Becker, Johannes; Fuest, Clemens

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Tax Enforcement and Tax Havens under Formula Apportionment*

Johannes Becker[1]
Clemens Fuest[2]

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[1] johannes.becker@uni-koeln.de
[2] clemens.fuest@uni-koeln.de

Finanzwissenschaftliches Forschungsinstitut
an der Universität zu Köln

A Member of CPE -
Cologne Center for Public Economics
P.O. Box 420520, D-50899 KÖLN
Zülpicher Str. 182, D-50937 KÖLN
T. +49-221-426979
F. +49-221-422352
http://fifo-koeln.de
http://cpe.uni-koeln.de

Abstract

In this paper, we consider optimal tax enforcement policy in the presence of profit shifting towards tax havens. We show that, under separate accounting, tax enforcement levels may be too high due to negative fiscal externalities. In contrast, under formula apportionment, tax enforcement is likely to be too low due to positive externalities of tax enforcement. Our results challenge recent contributions arguing that, under formula apportionment, there is a tendency towards inefficiently high levels of (effective) tax rates.

JEL Codes: H25, F23

Keywords: Corporate Taxation, Foreign Direct Investment

1 Introduction

Policy-makers and economists agree that profit shifting activities by multinational enterprises substantially reduce the tax revenue of high-tax countries. Accordingly, there is political pressure to implement effective measures to limit the size and the importance of tax havens. The European Commission has therefore proposed to replace the current system of separate accounting (SA) by a system with an EU-wide consolidated tax base. This tax base would be allocated to the member states according to some formula ('formula apportionment', henceforth FA). Each member state would apply the national statutory tax rate to its part of the tax base.

Under an FA regime, avoiding taxes by standard profit-shifting devices like transfer prices or debt financing is ruled out. But profit shifting to non-union tax havens is still possible. In this paper, we analyze enforcement behavior by national (i.e. decentralized) fiscal authorities before and after the introduction of an FA system.

The EU member states currently debate over the question of whether or not tax administration should be centralized or coordinated. An EU working group states: "*The basic principle expressed in the Commission Services' papers was that harmonising the rules for calculating the corporate tax base does not require an overall harmonisation of the tax administration and procedural rules*" (EU-Commission (2006b)). However, there is growing attention to this question as a recent survey under the EU member states shows: "*[I]t seems that there are two orientations: some Member States are more favourable to a centralised management of the common tax base (a single tax return, a single audit mechanism, a single interpretation forum etc.), while some other Member States would prefer that (...) each Member State audits the entities which are residents within their jurisdictions*" (EU-Commission (2006b)). The member states which demand a centralized tax administration vis-a-vis the common consolidated tax base are concerned by a "*scope for tax planning by choosing an administration with the most generous procedural rules*" and support a "*common approach to some elements of the audit procedure, for example, a common maximum length of the audit or common statute of limitation*" (EU-Commission (2006a)).

Apparently, these member states are aware that a decentralized enforcement system could yield inefficient results because the incentives for tax enforcement are distorted. The analysis in this paper supports this view. We show that, under SA, the level of enforcement vis-a-vis profit-shifting within the union is inefficiently high. The reason is that enforcement of tax payments reduces the tax revenue of the tax haven within the union. This negative fiscal externality is not taken into account by the fiscal authority in the non-haven country. In contrast, under FA, enforcement of taxes shifted to non-union tax havens is inefficiently low in our model. If the tax base is consolidated, then the enforcement return in terms of additional tax revenue has to be shared with other member states. This positive fiscal externality yields enforcement levels which are too low compared to the optimal level for the union as a whole. Thus, the idea that introducing FA is an effective way to solve the problem of income shifting has to be qualified. Shifting within the union will disappear but the problem of shifting to third countries becomes more severe. Our results also challenge recent contributions arguing that, under FA, there is a tendency towards inefficiently high levels of tax rates. If statutory tax rates increase and enforcement decreases, it is a priori undetermined whether the effective tax rate on business profits rises or falls.

The importance of international income shifting is documented by a growing empirical literature, see e.g. Hines and Rice (1994) as well as the recent contribution by Huizinga and Laeven (2005). As a consequence, corporate taxes give rise to a positive fiscal externality, i.e. increasing tax rates in one country lead to rising tax revenues in the other country. Implementing an FA system can abolish this fiscal externality, see McLure (1980), Mintz (1999) and Devereux (2004). Empirical estimations of how an FA system would affect the tax revenues of EU member countries is provided by Fuest, Hemmelgarn and Ramb (2007) and by Devereux and Loretz (2007). In both studies, the authors find that the FA system would lead to a substantial redistribution of tax revenues among the member states.

Next to these empirical approaches, there is a growing body of theoretical literature on the incentive effects imposed by an FA system. The literature can be classified according to its time perspective. McLure (1980), Mintz (1999), Mintz and Smart (2004) and Nielsen, Raimondos-Møller and Schjelderup (2003) consider profit shifting in models where capital stocks are fixed. This can be referred to as

short-run perspective. In contrast, Gordon and Wilson (1986), Pethig and Wagener (forthcoming) and Eggert and Schjelderup (2003) analyze the effects of FA when the size of capital stocks is endogenous, i.e. the long-run perspective. In this paper, we will analyze the incentive effects of SA and FA systems on enforcement activities by national fiscal authorities when capital stocks are endogenous, i.e. in the long run.

Our approach can be seen as part of a literature that examines external effects of national tax policies. With regard to the implementation of an FA system, similar approaches can be found in Nielsen, Raimondos-Møller and Schjelderup (2004), Sørensen (2004) and Riedel and Runkel (2007). The main argument in this literature goes as follows. In the presence of internationally mobile capital, national tax policies have external effects on the tax revenue and the tax policies of other countries. The introduction of an FA system may change the sign and the importance of these effects. For example, whereas tax competition leads to inefficiently low levels of corporate taxes under an SA system, the FA system may lead to inefficiently high levels of corporate taxation.

To the best of our knowledge, we are the first to discuss the problem of optimal tax enforcement in a setting with formula apportionment. Enforcement issues in general are discussed in Cowell (2004) and Slemrod (2004). Optimal enforcement of corporate taxes is considered in Peralta, Wauthy and Ypersele (2006) as well as in Hong and Smart (2007). Both contributions claim that it may be optimal to reduce enforcement of taxes on multinational enterprises. Slemrod and Wilson (2006) show in a different framework that it is always optimal to shut down some tax havens. Bucovetsky and Haufler (forthcoming) hint at potential distortions which may arise from loopholes for multinational firms. If firms decide on their organizational form, i.e. whether being a multinational or a national company, these loopholes may lead to an excessive number of multinational firms and efficiency losses. Cremer and Gahvari (2000) as well as Stöwhase and Traxler (2005) discuss enforcement issues in a tax competition framework. None of these papers consider enforcement policies in a setting with a consolidated corporate tax base, though.

Our paper is most closely related to the recent contribution by Riedel and Runkel (2007). These authors analyze the effects of introducing an FA system

when there are tax havens which are not subject to the FA regime. They find that there may be inefficient overtaxation due to a negative externality of corporate taxation. Our argument is diametrically opposed. Since tax enforcement has a positive externality on the tax revenue of other countries, tax enforcement may be inefficiently low, which may lead to effective tax rates that are too low from an efficiency point of view.

The remainder of the paper is organized as follows. In section 2, we analyze tax policy and enforcement strategies under separate entity accounting. Section 3 introduces formula apportionment. In section 4, an extension of the model is discussed where profit shifting opportunities depend on real investment levels. Section 5 concludes.

2 A model with separate entity accounting

In this section, we analyse a model where profits of multinational firms are taxed according to the separate entity accounting principle (SA). We provide an analysis of optimal tax issues and derive welfare effects of coordinating enforcement policies.

2.1 The model setup

Consider two small countries, called the home country and the foreign country, which form a union. The union is small in the the sense that it faces a perfectly elastic supply of capital from the rest of the world with an exogenously given rental price of r. Moreover, there is a tax haven outside the union which offers possibilities of income shifting to firms operating in the union.

The assumption that capital demand from the union does not affect r is made because it allows us to focus on fiscal externalities transmitted through profit shifting and enforcement directed against this shifting. If the union had market power in the international capital market, additional fiscal externalities would arise and be transmitted through the interest rate channel. For instance, individual member states would neglect that a reduction in their tax rate would drive up the interest rate and reduce real investment in other member states of the union. These fiscal externalities have been studied extensively in the literature. Including

them in our model is possible but makes the analysis more complicated without adding additional insights.

2.1.1 Private households

The home country and the foreign country are populated by many identical and immobile households. For notational simplicity, the number of households per country is normalized to unity. The representative domestic household derives utility from private consumption C and publicly provided goods G. The utility function is $U(C, G)$ and has the usual neoclassical properties. The household is endowed with savings S and owns a share $0 \leq \gamma \leq 1$ of the multinational firm. There are no residence based taxes on capital income. Private consumption is given by

$$C = rS + \gamma \pi^{sa} \tag{1}$$

where π^{sa} denotes the profit of the multinational firm under SA. The foreign household is modelled equivalently. The firm may be partially or entirely owned by households residing outside the union, i.e. $0 \leq \gamma + \gamma^* \leq 1$, where γ^* is the foreign household's ownership share in the multinational firm. Henceforth, the * denotes the location in the foreign country.

2.1.2 Firms

There is a representative multinational firm operating in the union. The firm invests K in the domestic country and K^* in the foreign country. It produces an output of $F(K)$ and $F^*(K^*)$ in the domestic and the foreign country, respectively. Capital is the only factor of production. The production functions $F(K)$ and $F^*(K^*)$ have decreasing returns to scale, i.e. $F_{KK} < 0 < F_K$ and $F^*_{K^*K^*} < 0 < F^*_{K^*}$. Profits π of the multinational firm before taxes are

$$\pi = F(K) + F^*(K^*) - r(K + K^*) \tag{2}$$

In this paper, we compare two systems for the taxation of multinational firms: separate entity accounting and formula apportionment. Under both tax systems, firms react to taxation i) by adjusting their real investment decisions and ii) by

shifting book profits from high to low tax countries.

Under SA, taxable profits are determined and taxed separately for each country. "True" taxable profits generated in the home country are given by $F(K)$. The financing costs rK are not deductible, i.e. we assume investment to be financed by equity.

Firms may manipulate their book profits by employing transfer pricing and other profit shifting methods. We model income shifting as follows. Firstly, firms may shift income s within the union, from the home country to the foreign country and vice versa. Shifted income s is a function of two variables. Firstly, it depends on government enforcement α, which will be explained in greater detail below. Secondly, it depends on expenditures of the firm denoted by a (a^*), which can be interpreted as expenditure on e.g. tax advisor services, effort etc. Shifting is thus given by $s = s(a, \alpha)$ with $s_{aa} < 0 < s_a$.[1] In the following, will focus on equilibria where $\tau \geq \tau^*$, which implies that the direction of income shifting is from the home country to the foreign country, and $a^* = s^* = 0$.

Secondly, firms may shift income to a tax haven outside the union. For notational simplicity, we assume that the tax rate of the tax haven outside the union is equal to zero. Income e (e^*) shifted from the home (foreign) country to the haven outside the union depends on resources the firm spends on shifting activity b, and government enforcement expenditure directed against this specific type of shifting denoted by β, i.e. $e = e(b, \beta)$ with $e_{bb} < 0 < e_b$. Income from both the domestic and the foreign location will be shifted to the tax haven.

Thus, the after-tax profits of the multinational firm are given by

$$\begin{aligned} \pi^{sa} &= F(K)(1-\tau) + F^*(K^*)(1-\tau^*) - r(K+K^*) \\ &\quad + (\tau - \tau^*)s - a + \tau e - b + \tau^* e^* - b^* \end{aligned} \tag{3}$$

In the literature, it is often argued that income shifting and investment interact, e.g. that income shifting is easier if the capital stock is higher etc. In section 4 we analyze income shifting which depends on capital stocks K and K^*.

[1] The precise properties of the shifting function will be explained further below.

2.1.3 Governments

The corporate income tax is the only source of revenue. In order to increase tax revenues governments may increase taxes or take measures against income shifting by spending resources on enforcement activities. As mentioned in the preceding section, enforcement expenditure per unit of capital directed against intra union shifting is denoted by α (α^*) and enforcement expenditure per unit of capital directed against shifting to the tax haven outside the union is denoted by β (β^*).

Thus, the budget constraint of the home country government is given by

$$G = \tau \left(F(K) - s - e \right) - \alpha - \beta \tag{4}$$

Note that we continue to assume that the home country tax rate is at least as high as the tax rate of the foreign country, so that no income shifting occurs from the foreign country to the home country. The budget constraint of the foreign government is

$$G^* = \tau^* \left(F^*(K^*) + s - e^* \right) - \beta^* \tag{5}$$

Increasing α drives down the income shifted $s\left(a, \alpha\right)$ by the multinational firm: $s_\alpha < 0 < s_{\alpha\alpha}$. Similar effects result from increasing β on $e\left(b, \beta\right)$: $e_\beta < 0 < e_{\beta\beta}$.[2]

2.2 Equilibrium investment and shifting behavior

The sequence of decisions is as follows. At the first stage, the governments simultaneously set their tax rates τ, τ^* and their enforcement expenditures α, β, β^*. At the second stage, the firm chooses the levels of real investment K, K^* and avoidance activities a, b, b^* to maximize profits. Optimal investment is implied by

$$F_K = \frac{r}{1-\tau} \quad \text{and} \quad F^*_{K^*} = \frac{r}{1-\tau^*} \tag{6}$$

[2] Furthermore, we assume that $s(a, \alpha) \geq 0$, $s(0, a) = 0$, $s_a(0, \alpha) = \infty$, $s_\alpha(a, 0) = -\infty$ as well as $e(b, \beta) \geq 0$, $e(0, \beta) = 0$, $e_b(0, \beta) = \infty$, $e_\beta(b, 0) = -\infty$. The shifting function $e^*(b^*, \beta^*)$ has the same properties.

With respect to income shifting acitivities, optimality is given by

$$s_a = \frac{1}{\tau - \tau^*}, \quad e_b = \frac{1}{\tau} \quad \text{and} \quad e^*_{b^*} = \frac{1}{\tau^*} \tag{7}$$

The firm's shifting behavior is therefore described by the functions $a = a(\tau, \alpha)$, $b = b(\tau, \beta)$, and $b^* = b^*(\tau^*, \beta^*)$. Note that an increase in enforcement expenditures may trigger more or less avoidance expenditure by firms. It follows from (7) that $\frac{da}{d\alpha} = -\frac{s_{\alpha\alpha}}{s_{a\alpha}}$. Since $s_{aa} < 0$, the sign of $\frac{da}{d\alpha}$ is equal to the sign of $s_{a\alpha}$, which depends on the functional form of $s\,(a, \alpha)$.

In the following, we make the following

Assumption 1 $s_{a\alpha}$, $e_{b\beta}$, $e^*_{b^*\beta^*} < 0$.

Assumption 1 implies that an increase in enforcement α,β will also succeed in reducing the amount of income shifting inputs a,b.

2.3 Tax and enforcement policies under separate entity accounting

Governments of both countries are assumed to maximize their residents' utility, given by $U(C, G)$, subject to the public and private sector budget constraints in (1) and (4). Consider first the home country. The first order condition for the tax rate can be expressed as

$$(U_G - \gamma U_C)\,[F(K) - s - e] + U_G\,[F_K K_\tau - s_a a_\tau - e_b b_\tau] = 0 \tag{8}$$

The first term on the left hand side of (8) reflects that a higher tax rate shifts income from the private to the public sector. If the degree of foreign firm ownership is high, i.e. γ is small, the cost of the tax increase in terms of private consumption is weighted less because it is borne by foreigners. The second term reflects that higher taxes affect real domestic investment and income shifting activities and, hence, the corporate tax base.

Optimal taxes are therefore given by

$$\tau^{opt} = -\frac{\left(1-\gamma\frac{U_C}{U_G}\right)\left[F(K)-s-e\right]}{F_K K_\tau - s_a a_\tau - e_b b_\tau} \tag{9}$$

The optimal tax rate rises in the degree of foreign firm ownership (decreasing γ), the relative valuation of public goods relative to private goods and the size of the tax base. It is lower the more elastic the capital stock and the avoidance activities react to a marginal increase in τ.

The first order condition for enforcement directed against tax havens inside the union (α) is given by

$$-\left[\tau U_G - (\tau-\tau^*)\,\gamma U_C\right] s_\alpha - U_G\left[\tau s_a a_\alpha + 1\right] = 0 \tag{10}$$

More enforcement reduces private benefits from profit shifting and increases tax revenue by reducing income shifting, as the first term on the left hand side of (10) shows. The second term stands for the behavioral effects of increasing α on the shifting choice a and the direct cost of enforcement.

Optimal enforcement of intra-union income shifting is therefore given by

$$\alpha = -\left[\left(1-(\tau-\tau^*)\,\gamma\frac{U_C}{U_G}\right)\varepsilon_{s,\alpha} + \varepsilon_{s,a}\varepsilon_{a,\alpha}\right]\tau s \tag{11}$$

Henceforth, $\varepsilon_{x,y}$ denotes the elasticity of x with respect to small changes in y: $\varepsilon_{x,y} = \frac{\partial x}{\partial y}\frac{y}{x}$. The optimal choice of α increases in the amount of tax revenue the government loses due to income shifting, τs, and in the magnitude of the behavioral elasticities.

The first order condition for enforcement directed against tax havens outside the union is given by

$$-\left(U_G - \gamma U_C\right)\tau e_\beta - U_G\left[\tau e_b b_\beta + 1\right] = 0 \tag{12}$$

The interpretation of this first order condition is analogous to the condition for

α. Optimal enforcement of income shifting to non-union tax havens is given by

$$\beta = -\left[\left(1 - \gamma\frac{U_C}{U_G}\right)\varepsilon_{e,\beta} + \varepsilon_{e,b}\varepsilon_{b,\beta}\right]\tau e \tag{13}$$

Again, the optimal choice of β rises in the government's loss of tax revenue, τe, and the behavioral elasticities. The tax policy of the foreign country faces similar trade-offs. The main difference is that the foreign country benefits from income shifting within the union and does nothing against this type of shifting.

2.4 Welfare implications of uncoordinated tax and enforcement policies

In this section, we ask whether the decentrally implemented enforcement policies are efficient for the union as a whole. If this is the case, there would be no reason for coordination of enforcement policies. But as we will show below, national enforcement policies give rise to fiscal externalities, which make policy coordination welfare enhancing.

We analyse this issue by considering small changes in enforcement expenditures, departing from the equilibrium without policy coordination. We start by considering the effect of a small increase in the domestic corporate tax rate τ holding constant enforcement expenditures. With τ optimally chosen from the domestic point of view, it follows that $U_\tau = 0$. The effect on the welfare of the foreign country is

$$\frac{dU^*}{d\tau} = -\gamma^* U^*_{C^*}\left[F\left(K\right) - s - e\right] + U^*_{G^*}\tau^*[s_a a_\tau] \lessgtr 0 \tag{14}$$

The first term reflects the externality of domestic taxation on the foreign household's consumption opportunities which is given for $\gamma^* > 0$. This foreign firm ownership externality has first been derived by Huizinga and Nielsen (1997). The second term is the well-known positive fiscal externality of domestic taxation on foreign tax revenue, resulting from an increased income shifting as a response to higher domestic taxes. In sum, the effect of τ on U^* has an ambiguous sign.

Now consider the effects of home country enforcement. A small change in

home country enforcement against intra union income shifting, departing from the equilibrium without coordination, has no effect on home country welfare because the equilibrium without coordination is characterized by $U_\alpha = 0$, according to eq. (10).

The effect on the welfare of the foreign country is

$$\frac{dU^*}{d\alpha} = \gamma^* U^*_{C^*}(\tau - \tau^*)s_\alpha + U^*_{G^*}\tau^*[(s_\alpha + s_a a_\alpha)] < 0 \tag{15}$$

An increase in enforcement expenditure α gives rise to two negative fiscal externalities. Firstly, it reduces the after tax profits of the multinational firm. If the foreign household owns part of the firm, $\gamma^* > 0$, this gives rise to a negative fiscal externality. The second negative externality arises because income shifting from the home country to the foreign country declines. When determining its enforcement policy, the home country does not take into account these negative effects on the foreign country's tax revenue.

How do enforcement expenditures of the home country directed against tax havens outside the union affect the foreign household's utility? The effect of a marginal change in enforcement expenditure β on the welfare of the foreign country is given by

$$\frac{dU^*}{d\beta} = \gamma^* U^*_{C^*}\tau e_\beta < 0 \tag{16}$$

Again, there is the negative effect on after tax profits accruing to the firm owners residing in the foreign country. If, however, there is no foreign firm ownership, $\gamma^* = 0$, then there is no external effect on foreign welfare.

Whereas the foreign country has no need to enforce intra-union shifting (i.e. $\alpha^* = 0$), the external effect of enforcement in the case of non-union tax haven shifting is symmetric, i.e. $\frac{dU}{d\beta^*} = U_C \gamma \tau^* K^* e^*_{\beta^*} < 0$.

These results may be summarized as

Proposition 1 *Under SA, given that $\gamma, \gamma^* > 0$, and assuming that $\tau > \tau^*$, expenditure on tax enforcement directed against both intra union income shifting (α) and income shifting to countries outside the union (β, β^*) is inefficiently high.*

It thus turns out that, in a tax regime where corporate taxation is based on SA and where countries set their enforcement policies independently, there is a

general tendency towards too much tax enforcement. This does not only apply to enforcement directed against intra union shifting but also to enforcement directed against shifting to third countries. Put differently, the union would gain from a coordinated reduction in tax enforcement.[3]

However, note that excessive enforcement does not necessarily lead to an overprovision of public goods. It follows from equation (8) that, if $\gamma = 1$, $U_G > U_C$. Otherwise, the optimal tax rate is zero. If $\tau = 0$, though, there is no tax avoidance and no enforcement. Therefore, underprovision of public goods and excessive enforcement coexist.[4]

3 Introducing Formula Apportionment

We now assume that the profits of the representative multinational firm generated within the union are taxed on the basis of formula apportionment: Taxable profits will first be determined on a national basis and then consolidated (i.e. here: summed up) for all member countries of the union. The common consolidated tax base is then allocated to the individual member states according to some formula.

The factors entering the formula usually include indicators of real economic activity such as the payroll, property or sales. In the following, we assume that the share allocated to each country depends on the capital stock invested in the two countries. The share of the tax base allocated to the home country is denoted by $\theta(K, K^*)$, with $\theta_K > 0$ and $\theta_{K^*} < 0$. Accordingly, the share allocated to the foreign country is given by $1 - \theta$. Each state applies the national tax rate to its part of the tax base.

Tax enforcement continues to be decentralized. Tax enforcement affects the determination of taxable profits at the national level, before they are consolidated

[3] One should note that this result is derived under the assumption that the supply of capital to the union as a whole is completely elastic. If the union has some market power in the international capital market, a coordinated reduction of enforcement expenditures would lead to an increase in the interest rate. This would give rise to a negative fiscal externality, so that the overall welfare effect of a coordinated reduction in enforcement becomes ambiguous.

[4] Another question is whether the effective tax rate (i.e. the combined tax burden resulting from tax rates and enforcement) is higher or lower in the case of coordination. It is obvious that this question cannot be answered using general production, shifting and utility function as we do in our model. We leave this question to further research.

and allocated at the union level. Profits generated in the rest of the world are still allocated on the basis of SA.

3.1 Changes in the model setup

Households are not or only indirectly affected by the introduction of the FA system. Firms and governments, however, face a substantial change in their incentive schemes.

3.1.1 Firms

The consolidation of the tax base implies that shifting income via transfer prices from one country within the union to the other does not affect tax payments, i.e. the incentive for intra union income shifting vanishes. Income shifting to tax havens outside the union, in contrast, still allows firms to reduce their tax burden.

After tax profits of the multinational firm under FA are given by

$$\pi^{fa} = (F(K) + F^*(K^*))\,(1-t) - r(K+K^*) + t\,(e+e^*) - b - b^* \tag{17}$$

where $t \equiv \tau\theta + \tau^*(1-\theta)$ is the weighted combination of the two national tax rates, with $\theta = \theta(K, K^*)$, which determines the effective statutory tax burden on the firm's income.

3.1.2 Government

Under FA, the budget constraint of the home country government is given by

$$G = \tau\theta[F(K) + F^*(K^*) - e - e^*] - \beta \tag{18}$$

Accordingly, the budget constraint of the foreign country is

$$G^* = \tau^*(1-\theta)[F(K) + F^*(K^*) - e - e^*] - \beta^* \tag{19}$$

The difference to the SA case is twofold. Firstly, the corporate tax of both countries is now grounded on the unionwide tax base. This implies that income shifting from the foreign country to tax havens outside the union c.p. reduces

domestic tax revenue and vice versa. Secondly, the share of the unionwide tax base allocated to each country depends on the distribution of investment across the two countries. This is reflected by the weight $\theta(K, K^*)$. In the next subsection, we derive the optimal tax and enforcement policies.

3.2 Equilibrium investment and shifting behavior

The sequence of decisions is the same as in the SA case. At the first stage, the governments simultaneously set their tax rates (τ, τ^*) and their enforcement expenditures (β, β^*). At the second stage, the firm chooses the levels of real investment (K, K^*) and avoidance activities (b, b^*) to maximize profits.

Optimal investment is given by

$$F_K = \frac{r + (\tau - \tau^*)\left[F(K) + F^*(K^*) - e - e^*\right]\theta_K}{1 - t} \tag{20}$$

$$F^*_{K^*} = \frac{r + (\tau - \tau^*)\left[F(K) + F^*(K^*) - e - e^*\right]\theta_{K^*}}{1 - t} \tag{21}$$

This means that the firm's investment behavior is described by the functions $K = K(\tau, \beta, \tau^*, \beta^*)$ and $K^* = K^*(\tau, \beta, \tau^*, \beta^*)$. Optimal income shifting to non-union tax havens implies

$$e_b = \frac{1}{t} \quad \text{and} \quad e^*_{b^*} = \frac{1}{t} \tag{22}$$

Therefore the firm's shifting behavior is given by the functions $b = b(\tau, \beta, \tau^*, \beta^*)$ and $b^* = b^*(\tau, \beta, \tau^*, \beta^*)$.

Under FA, the effects of taxes and enforcement activity on investment and income shifting become far more complex than in the SA case. In general, the effects of changes in tax rates and tax enforcement on shifting and investment behavior are ambiguous. But for the symmetric case, we show in the appendix that $\frac{dK}{d\tau}, \frac{dK^*}{d\tau^*} < 0$, $\frac{dK}{d\beta} = \frac{dK}{d\beta^*} = \frac{dK^*}{d\beta} = \frac{dK^*}{d\beta^*} = 0$. The sign of $\frac{dK}{d\tau^*}$ (and $\frac{dK^*}{d\tau}$) is ambiguous.

3.3 Tax and enforcement policies under formula apportionment

As in the SA case, the governments of both countries are assumed to maximize the utility of their residents and take the policy of the other country as given. Consider first the home country. The f.o.c. for the tax rate is

$$\begin{aligned} 0 &= (U_G - \gamma U_C)\,\theta T - U_G \tau \theta \left(e_b b_\tau + e^*_{b^*} b^*_\tau\right) \\ &\quad + U_G \tau \left[\left(\theta F_K + \theta_K T\right) K_\tau + \left(\theta F^*_{K^*} + \theta_{K^*} T\right) K^*_\tau\right] \end{aligned} \tag{23}$$

where $T = F(K) + F^*(K^*) - e - e^*$ is the consolidated tax base. The first term on the r.h.s. captures the welfare gain of a redistribution of income between the private and the public sphere. The other terms represent the effects on firm behavior: Increasing the tax rate leads to more income shifting and reduces the capital stocks K and K^*. The optimal tax rate is given by

$$\tau = \frac{\left(1 - \gamma \frac{U_C}{U_G}\right) T}{e_b b_\tau + e^*_{b^*} b^*_\tau - \left(F_K + \frac{\theta_K}{\theta} T\right) K_\tau - \left(F^*_{K^*} + \frac{\theta_{K^*}}{\theta} T\right) K^*_\tau} \tag{24}$$

As before, the optimal τ rises in the degree of foreign firm ownership (decreasing γ), the relative valuation of public goods relative to private goods and the size of the tax base T. It is lower the more elastic the domestic capital stock and the more avoidance activities react to a marginal increase in τ. The third term in the denominator is ambiguous, though. Increasing τ may affect the optimal choice of K^* but the effect has no clear sign.

The first order condition for enforcement directed against tax havens outside the union is given by

$$0 = \gamma U_C t e_\beta - U_G \tau \theta [e_\beta + e_b b_\beta + e^*_{b^*} b^*_\beta] - U_G \tag{25}$$

The interpretation of this first order condition is as follows. The first term on the right hand side of (25) stands for the decline in after tax profits accruing to the domestic household caused by an increase in β. The second term represents the effect of more domestic enforcement on profit shifting to the tax haven outside the

union. The third term reflects the change in the budgetary costs of enforcement.

Optimal enforcement activity is therefore given by

$$\beta = -\left[\left(1 - \frac{t}{\tau\theta}\gamma\frac{U_C}{U_G}\right)\varepsilon_{e,\beta} + \varepsilon_{e,b}\varepsilon_{b,\beta} + \frac{e^*}{e}\varepsilon_{e^*,b^*}\varepsilon_{b^*,\beta}\right]\theta\tau e \tag{26}$$

where $\varepsilon_{e,\beta}, \varepsilon_{b,\beta} < 0$ and $\varepsilon_{e,b} > 0$ are elasticities (see above). In comparison to equation (13), this shows that the design of optimal enforcement policies under FA is more complex that under SA. The main reason is that the two countries share a common tax base and allocate the right to tax this base using a factor which is itself influenced by tax policy. This suggests that fiscal externalities caused by enforcement policies are also more complex. We will analyse this issue in the next subsection.

3.4 Welfare implications of uncoordinated policies under FA

As in the SA case, we ask whether the enforcement policies implemented by the individual countries under FA are efficient for the union as a whole. We analyse this issue by considering small changes in tax rates and enforcement expenditures, departing from the equilibrium without policy coordination. If we allow for asymmetries, the welfare effects or coordination are in general ambiguous. We therefore focus on the case of symmetry.

Starting with the tax rate, a small increase in τ , departing from a symmetric equilibrium, and holding constant enforcement expenditure, has no effect on domestic welfare since τ has already been chosen optimally. Its effect on foreign welfare is given by

$$\begin{aligned}\frac{dU^*}{d\tau} &= -U^*_{C^*}\gamma^*\theta T - U^*_{G^*}\tau^*(1-\theta)\left(e_b b_\tau + e^*_{b^*}b^*_\tau\right) \\ &\quad + U^*_{G^*}\tau^*\left[(1-\theta)F_K - \theta_K T\right]K_\tau + U^*_{G^*}\tau^*\left[(1-\theta)F^*_{K^*} - \theta_{K^*}T\right]K^*_\tau\end{aligned} \tag{27}$$

The first term on the r.h.s. is the effect resulting from foreign firm ownership: An increase in τ reduces the after-tax income from holding shares in the multinational firm. The second term reflects the effect of a tax rate increase on income

shifting. Since income shifting increases, the foreign country suffers a tax revenue loss. The third term and the fourth term include the effects of the induced changes in K and K^* on the size of the common tax base and the share allocated to the foreign country. These terms have an ambiguous sign because the expressions in brackets may be positive or negative. The overall effect of an increase in the domestic tax rate on foreign welfare is thus ambiguous. This is in line with results derived in the literature for models without endogenous enforcement policies, see e.g. Nielsen et al. (2004).

Next, we focus on the welfare effect of a small change in home country enforcement β, departing from the equilibrium without coordination and holding constant the tax rate. The change in β has no effect on home country welfare because the equilibrium without coordination is characterized by $U_\beta(C, G) = 0$, see eq. (25). The effect on the welfare of the foreign country is

$$\frac{dU^*}{d\beta} = U^*_{C^*}\gamma^* t e_\beta - U^*_{G^*}\tau^*(1-\theta)[e_\beta + e_b b_\beta] \tag{28}$$

Firstly, more domestic enforcement reduces after tax profits of the multinational firm and thus reduces the income of the foreign household. This negative externality also occurs in the SA case. Secondly, more domestic enforcement increases the tax base shared by the two countries, given the behavior of the firm. This gives rise to a positive fiscal externality. Using the first order condition for the optimal enforcement policy of the foreign country under symmetry in (25), we can express the above equation as

$$\frac{dU^*}{d\beta} = U^*_{G^*} > 0 \tag{29}$$

Thus, in an uncoordinated symmetric equilibrium, enforcement expenditures are inefficiently low. This may stated as

Proposition 2 *Under FA, and assuming a symmetric uncoordinated equilibrium, expenditure on tax enforcement directed against income shifting to countries outside the union (β, β^*) is inefficiently low.*

For the case of symmetric countries, it thus turns out that the result on the

efficiency of tax enforcement directed against tax havens outside the union is diametrically opposed to the result derived under SA. Under SA, the overenforcement result emerges because countries do not take into account that their tax enforcement directed against third country tax havens reduces the profits accruing to residents of the other union country. Given that all benefits accrue to the country determining the enforcement, the emerging enforcement level is unambiguously too high. Under FA, it is also true that more enforcement in one country reduces the profit income of households residing in other countries. But, some additional fiscal externalities arise. In particular, national enforcement activities affect the common tax base and the division of the tax base between the national fiscal authorities. This is intuitive in so far as the budgetary costs of enforcement are fully borne by the country deciding on the enforcement level whereas the benefits in the form of a larger tax base spread over the entire union.

4 Extension: Enforcement policy when investment and income shifting interact

In this section, we briefly discuss whether our results are robust when income shifting depends on the distribution of investment across the two member countries of the union. In the literature it is often argued that investment and income shifting should not be modelled as being separable. It is rather assumed that they interact, i.e. that the larger the stock of capital K the easier it is for the firm to shift income to the tax haven.

We therefore change the above presented model as follows. Income shifting is now modelled as a fraction of a capital unit K. Firms spend aK and bK (b^*K^*) in order to shift sK and eK (e^*K^*) to the intra-union and non-union tax havens, respectively.

Thus, the modified multinational's profit function is given by

$$\begin{aligned} \pi^{sa} &= F(K)\,(1-\tau) + F^*(K^*)\,(1-\tau^*) - r(K+K^*) \\ &\quad + [(\tau-\tau^*)\,s - a]\,K + [\tau e - b]\,K + [\tau^* e^* - b^*]K^* \end{aligned} \tag{30}$$

Investment behavior is different now since it interacts with income shifting. Optimal investment is given by

$$F_K = \frac{r - (\tau e - b)}{1 - \tau} \equiv \rho \tag{31}$$

Optimal income shifting activities are given by $e_b = \frac{1}{\tau}$ and $e^*_{b^*} = \frac{1}{\tau^*}$ which are the same expressions as in the previous sections. Using this, it is straightforward to show that, given $\tau > 0$ and $\tau > \tau^*$, the cost of capital ρ is increasing in enforcement expenditures α and β. Moreover, the impact of a change in the domestic tax rate on the cost of capital (given optimal shifting behavior) is $\rho_\tau = \frac{\rho}{1-\tau} - \frac{\tau(s+e)}{1-\tau}$. In the following, we assume that tax effects are in the relevant range: $\rho_\tau > 0$.

Again, the government is supposed to maximize welfare $U = U(C, G)$ subject to

$$C = \gamma\pi^{sa} + rS \tag{32}$$

$$G = \tau[F(K) - (s + e)K] - (\alpha + \beta)K \tag{33}$$

The first order condition for enforcement directed against tax havens outside the union is given by

$$-(U_G - \gamma U_C)\,\tau K e_\beta + U_G\,[G_K K_\beta - \tau K e_b b_\beta - K] = 0 \tag{34}$$

The main difference between equations (34) and (12) is that enforcement now affects investment. It follows from (31) that $K_\beta < 0$.

The effect of a marginal change in enforcement expenditure β on the welfare of the foreign country is given by

$$\frac{dU^*}{d\beta} = \gamma^* U^*_{C^*} \tau K e_\beta < 0 \tag{35}$$

Again, there is a tendency towards overenforcement in the SA case. Similar results can be derived for the intra-union shifting.

Under FA, after tax profits of the multinational firm under formula apportion-

ment π^{fa} are given by

$$\pi^{fa} = (F(K) + F^*(K^*))(1-t) - r(K+K^*) + t(eK + e^*K^*) - bK - b^*K^* \quad (36)$$

Under FA, the budget constraint of the home country government is given by

$$G = \tau\theta[F(K) + F^*(K^*) - eK - e^*K^*] - \beta K \quad (37)$$

Optimal investment is given by

$$F_K = \frac{r - (te - b) - (\tau - \tau^*)\theta_K T}{1-t} \quad (38)$$

where T is the consolidated tax base. With respect to income shifting to non-union tax havens, optimality is implied by $e_b = \frac{1}{t}$ and $e^*_{b^*} = \frac{1}{t}$, as in the previous section. It is straight-forward to show that, in the symmetric case with $\tau = \tau^*$, $K_\beta < 0$ and $K_{\beta^*} = 0$ which will be used later on.

The first order condition for enforcement directed against tax havens outside the union is given by

$$\begin{aligned} 0 &= \gamma U_C t K e_\beta - U_G \tau\theta[(e_\beta + e_b b_\beta)K + e^*_{b^*} b^*_\beta K^*] - U_G(K + \beta K_\beta) \\ &\quad + U_G\tau\left[(\theta(F_K - e) + \theta_K T)K_\beta + (\theta(F^*_{K^*} - e^*) + \theta_{K^*}T)K^*_\beta\right] \end{aligned} \quad (39)$$

Next, we focus on the welfare effect of a small change small change in home country enforcement β, departing from the equilibrium without coordination. We directly focus on the symmetric case. The effect on the welfare of the foreign country is

$$\begin{aligned} \frac{dU^*}{d\beta} &= U^*_{C^*}\gamma^* t K e_\beta - U^*_{G^*}\tau^*(1-\theta)(e_\beta + e_b b_\beta)K \\ &\quad + U^*_{G^*}\tau^*[[(1-\theta)(F_K - e) - \theta_K T]K_\beta \end{aligned} \quad (40)$$

Using the foreign equivalent of (39) in the symmetry case, we can express (40) as

$$\frac{dU^*}{d\beta} = U^*_{G^*}(K^* + \beta^* K^*_{\beta^*}) = U^*_{G^*}(1 + \varepsilon_{K^*,\beta^*})K^* > 0 \quad \text{if } \varepsilon_{K^*,\beta^*} > -1 \quad (41)$$

where $\varepsilon_{K^*,\beta^*} = K^*_{\beta^*}\frac{\beta^*}{K^*}$ is the elasticity of the capital stock with respect to the enforcement level β^*. Assuming $\varepsilon_{K^*,\beta^*} > -1$ simply means that increasing the enforcement level effectively increases the expenditures for enforcement $\beta^* K^*$. Thus, in an uncoordinated symmetric equilibrium, enforcement expenditures are inefficiently low, i.e. the positive fiscal externalities dominate.

5 Conclusions

In this paper, we have shown that, under separate accounting, governments have the incentive to overspend on tax enforcement directed against income shifting to tax havens. In contrast, under formula apportionment, there may be underenforcement. The reason is that enforcement gives rise to various fiscal externalities which are not accounted for in decentralized policy making.

Interestingly, our results stand in contrast to recent contributions which analyze the incentive effects for tax rate setting. These studies show that under FA, tax rates may be set too high. This can be replicated in our model. Inefficiently high tax rates and inefficiently low enforcement may result in effective over- or undertaxation. Which of the two countervailing effects prevails crucially depends on the functional form of shifting cost functions, enforcement costs etc.

What are the policy implications of our analysis? One important implication is that introducing formula apportionment for the taxation of corporate profits in the EU will change the incentives of governments to act against profit shifting in a significant way. Under the current system, these incentives are strong, too strong according to our analysis. A switch to formula apportionment would lead to the opposite situation. If tax enforcement directed against income shifting is left to the discretion of the member states, underenforcement has to be expected. In so far, the concerns expressed by some member states quoted in the introduction are supported by our results.

Another important policy issue is the impact of formula apportionment on the effective tax burden faced by firms. Under the current SA system, there is a trend towards lower tax rates, broader tax bases and stricter tax enforcement. The German corporate tax reform 2008, which reduces tax rates but imposes severe restrictions on income shifting via debt or royalties is a good example.

Under formula apportionment, the pressure to reduce tax rates will be smaller, but incentives to stabilize the domestic tax base will be much weaker, so that national tax policies may return to higher tax rates and less rigid enforcement. It is even possible that lax enforcement becomes a key instrument in tax competition because the legal definition of the tax base would have to be harmonized before FA is introduced.

The likely trend towards underenforcement also suggests that the effective tax burden under FA will not necessarily be higher than under SA. Of course, an obvious solution to the problem of underenforcement would be to coordinate enforcement policies. But the implementation of EU-wide standards for tax enforcement is probably much more difficult in practice than the introduction of common rules for the determination of company profits or common tax rates.

6 Appendix

This appendix derives tax and enforcement effects on capital stocks and income shifting under FA, for the case of a symmetric equilibrium. Optimal firm choices are implied by

$$\begin{aligned}
\pi_K^{fa} &= F_K\left(1-\tau\theta-\tau^*\left(1-\theta\right)\right)-r-\left(\tau-\tau^*\right)\left[F(K)+F^*(K^*)-e-e^*\right]\theta_K=0\\
\pi_{K^*}^{fa} &= F_{K^*}^*\left(1-\tau\theta-\tau^*\left(1-\theta\right)\right)-r-\left(\tau-\tau^*\right)\left[F(K)+F^*(K^*)-e-e^*\right]\theta_{K^*}=0\\
\pi_b^{fa} &= e_b\left(1-\tau\theta-\tau^*\left(1-\theta\right)\right)-1=0\\
\pi_{b^*}^{fa} &= e_{b^*}^*\left(1-\tau\theta-\tau^*\left(1-\theta\right)\right)-1=0
\end{aligned}$$

Under symmetry, note that $\pi_{KK^*}^{fa}=\pi_{K^*K}^{fa}=\pi_{Kb}^{fa}=\pi_{Kb^*}^{fa}=\pi_{K^*b^*}^{fa}=\pi_{K^*b}^{fa}=0$. Given this, the effect of a marginal increase in τ on the capital stock K is given by $\frac{dK}{d\tau}=-\frac{\pi_{K\tau}^{fa}}{\pi_{KK}^{fa}}$. The second order conditions require $\pi_{KK}^{fa}<0$. Therefore $\frac{dK}{d\tau}$ has

the same sign as $\pi^{fa}_{K\tau}$, $\frac{dK}{d\tau^*}$ as $\pi^{fa}_{K\tau^*}$, and so on. We derive

$$\begin{aligned}
\pi^{fa}_{K\tau} &= -\theta F_K - T\theta_K < 0 \quad \Rightarrow \quad \frac{dK}{d\tau} < 0 \\
\pi^{fa}_{K\tau^*} &= -(1-\theta) F_K + T\theta_K \gtrless 0 \quad \Rightarrow \quad \frac{dK}{d\tau^*} \gtrless 0 \\
\pi^{fa}_{K^*\tau^*} &= -(1-\theta) F^*_{K^*} + T\theta_{K^*} < 0 \quad \Rightarrow \quad \frac{dK^*}{d\tau^*} < 0 \\
\pi^{fa}_{K^*\tau} &= -\theta F^*_{K^*} - T\theta_{K^*} \gtrless 0 \quad \Rightarrow \quad \frac{dK^*}{d\tau} \gtrless 0
\end{aligned}$$

where $T = F(K) + F^*(K^*) - e - e^*$ is the consolidated tax base. It follows from $\pi^{fa}_{Kb} = \pi^{fa}_{Kb^*} = \pi^{fa}_{K^*b^*} = \pi^{fa}_{K^*b} = 0$ that

$$\frac{dK}{d\beta} = \frac{dK}{d\beta^*} = \frac{dK^*}{d\beta} = \frac{dK^*}{d\beta^*} = 0$$

With respect to shifting, we derive the following effects:

$$\begin{aligned}
\pi^{fa}_{b\beta} &= e_{b\beta}(1 - \tau\theta - \tau^*(1-\theta)) < 0 \quad \Rightarrow \quad \frac{db}{d\beta} < 0 \\
\pi^{fa}_{b^*\beta^*} &= e^*_{b^*\beta^*}(1 - \tau\theta - \tau^*(1-\theta)) < 0 \quad \Rightarrow \quad \frac{db^*}{d\beta^*} < 0 \\
\pi^{fa}_{b\beta^*} &= \pi_{b^*\beta} = 0 \quad \Rightarrow \quad \frac{db^*}{d\beta} = \frac{db}{d\beta^*} = 0 \\
\pi^{fa}_{b\tau} &= e_b\theta > 0 \Rightarrow \quad \frac{db}{d\tau} > 0 \\
\pi^{fa}_{b^*\tau^*} &= e^*_{b^*}(1-\theta) > 0 \Rightarrow \quad \frac{db^*}{d\tau^*} > 0 \\
\pi^{fa}_{b\tau^*} &= e_b(1-\theta) > 0 \Rightarrow \quad \frac{db}{d\tau^*} > 0 \\
\pi^{fa}_{b^*\tau} &= e^*_{b^*}\theta > 0 \Rightarrow \quad \frac{db^*}{d\tau} > 0
\end{aligned}$$

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