



Corporate income taxation of multinationals in a general equilibrium model[☆]

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ABSTRACT

This paper contributes to the discussion on Separate Accounting versus Formula Apportionment in the corporate income taxation of multinational enterprises. The innovation is that we consider a general equilibrium tax competition model with an endogenous interest rate. In contrast to previous studies, we show that tax rates are inefficiently low not only under Separate Accounting, but also under Formula Apportionment. Moreover, we identify a wide range of empirically relevant cases where Formula Apportionment is superior to Separate Accounting, independent of the magnitude of the concealment cost of profit shifting. The reason for the change in results is that one country's tax rate affects other countries additionally via changes in the interest rate.

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1. Introduction

There are basically two alternative principles in the taxation of multinational enterprises (MNEs). Under Separate Accounting, corporate income of a MNE is taxed by the tax code of the country in which the MNE the income declares. Under Formula Apportionment, in contrast, the tax bases of all subsidiaries of the MNE are first consolidated and then apportioned to the taxing countries according to a predetermined formula. While Separate Accounting is in operation at the international level, some countries like the U.S., Canada, Germany and Switzerland apply Formula Apportionment at the national level. Moreover, the European Commission (2001) presented first plans to replace the current system of Separate Accounting by Formula Apportionment within the European Union. In 2007 the so-called Common Consolidated Corporate Tax Base (CCCTB) Working Group of the commission presented a detailed proposal for the

corporate tax reform (European Commission, 2007a,b). These activities in the European Union brought in its wake a heated debate about the pros and cons of the two taxation principles both among politicians and among economists.

Our paper contributes to this discussion. Using a multi-country tax competition model, we investigate the efficiency properties of the two tax principles by identifying fiscal externalities, that is the effect of one country's tax rate on the tax revenue or welfare in other countries. The innovation of the paper is that it uses a *general* equilibrium model which explicitly takes into account the capital market where the interest rate is endogenously determined. Such an approach has been used in the traditional tax competition literature since the seminal papers of Wilson (1985, 1986) and Zodrow and Mieszkowski (1986), but it has largely been ignored so far in the discussion of the relative merits of Separate Accounting and Formula Apportionment. The advantage of the general equilibrium approach is that it allows to consider *large* countries which are aware of their effects on the price of capital. And even for *small* countries, each of which takes as given the interest rate, aggregate policy changes of all countries have an impact on the interest rate when it is endogenous. Hence, regardless of whether countries are large or small, taxation under Separate Accounting and Formula Apportionment will have effects on the interest rate which should be taken into account when evaluating the two taxation principles in terms of efficiency.

This is particularly true since we point out that endogenizing the interest rate changes the nature of fiscal externalities known from the previous literature in a substantial way. The basic reason is that one country's tax rate impacts the other countries additionally by changes

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in the interest rate. Under Separate Accounting, it turns out that the cross country effect of one country's corporate tax rate consists of a profit shifting externality and a true tax base externality. The former states that a tax rate increase in one country induces the MNE to shift more profit to other countries, thereby improving the tax base and tax revenue in other countries. This externality is positive. The true tax base externality reflects the effect of one country's tax rate on the 'true' tax base (sales less tax deductible capital and labor costs) in other countries. It is constituted by three effects that build on each other. First, if one country increases its tax rate, capital demand in this country and, thus, the interest rate decrease. Second, the decrease in the interest rate raises capital input in other countries. Third, by complementarity the increase in capital raises labor demand and thereby the wage rate in other countries. While the first two effects improve the tax base in other countries, the third effect goes into the opposite direction, so the sign of the true tax base externality is ambiguous. But we show that the sum of profit shifting and true tax base externalities is positive, implying inefficiently low tax rates under Separate Accounting.

Under Formula Apportionment the cross country effect of tax rates can be decomposed into a formula externality and a consolidated tax base externality. The rationale of the formula externality is as follows. If one country raises its tax rate the MNE reallocates capital and labor from this country to other countries. In doing so, it reduces its tax burden by lowering the share of the consolidated tax base assigned to the tax-increasing country and by increasing the share of the consolidated tax base assigned to the other countries. As consequence, the tax revenue in the other countries goes up and the formula externality is positive. The consolidated tax base externality is the counterpart of the true tax base externality under Separate Accounting. It also reflects the impact of one country's tax rate on the other countries' tax base and tax revenue via changes in quantities and prices of production inputs. However, it is now the consolidated tax base that determines tax revenue of the countries. Hence, the effects via investments and wages cancel out. Only the reduction in the interest rate matters. It reduces capital cost and increases the consolidated tax base and tax revenue in other countries. Hence, the consolidated tax base externality is positive. Combined with the positive formula externality, it follows that tax rates under Formula Apportionment fall short of their efficient levels, as under Separate Accounting.

This insight allows a straightforward comparison of the two tax principles. By comparing the magnitude of the fiscal externalities we show that there always exists an apportionment formula such that Formula Apportionment yields the higher tax rate and, thus, is superior to Separate Accounting, provided the substitution elasticity of capital and labor exceeds a threshold. The latter condition turns out to be satisfied for empirically relevant values of the substitution elasticity. This is a remarkable result since it yields a ranking of the tax principles that is independent of the profit shifting externality, which is mainly determined by concealment cost. It is difficult to gather information on concealment cost, so a comparison of the tax principles that relies on such information is hardly practicable from a policy point of view. Our comparison does not refer to the concealment cost because of the true tax base externality under Separate Accounting. This externality can be set against the externalities under Formula Apportionment. For sufficiently high substitution elasticity it overcompensates the formula and consolidated tax base externalities, so the magnitude of the profit shifting externality does no longer matter for the comparison of the tax principles.

There is by now a large number of studies investigating Separate Accounting versus Formula Apportionment. Examples are [McLure \(1980\)](#), [Mintz and Smart \(2004\)](#) and [Nielsen et al. \(2003\)](#). Our paper is closely related to [Gordon and Wilson \(1986\)](#), [Eggert and Schjelderup \(2003\)](#), [Wellisch \(2004\)](#), [Sørensen \(2004\)](#), [Riedel and Runkel \(2007\)](#), [Pethig and Wagener \(2007\)](#), [Pinto \(2007\)](#), [Eichner and Runkel \(2008\)](#)

and [Nielsen et al. \(2010\)](#). But in contrast to our approach, these papers use partial equilibrium models with a fixed interest rate.² Hence, the true tax base externality under Separate Accounting is missing since the increase in one country's tax rate reduces only the MNE's capital and labor demand in this country, but neither the interest rate nor the production inputs in other countries. For the same reason, the effects on the consolidated tax base via changes in the production inputs do not cancel out, so the sign of the consolidated tax base externality under Formula Apportionment becomes indeterminate. The previous literature therefore obtains undertaxation under Separate Accounting, but not necessarily under Formula Apportionment. Moreover, in the previous literature the comparison of the two tax principles depends on the concealment cost due to the absence of the true tax base externality, which in our analysis ensures that the comparison of the two principles is independent of the concealment cost.³

The paper is organized as follows. In [Section 2](#), we introduce the basic assumptions. [Sections 3 and 4](#) investigate the efficiency properties of tax rates and in [Section 5](#) we compare the two principles. [Section 6](#) considers extensions and [Section 7](#) concludes.

2. Basic assumptions

Consider an economy with $n \geq 2$ identical countries. We use $i, j, h = 1, \dots, n$ as country indices. There is one representative MNE which operates a plant in each country. In country i , the MNE produces a consumption good according to the production function $F(k_i, \ell_i)$ where k_i is capital and ℓ_i is labor input in country i . The production function has the usual properties $F_k, F_\ell > 0$ and $F_{kk}, F_{\ell\ell} < 0$. Capital and labor are supposed to be complements ($F_{\ell k} > 0$). Moreover, F is homogeneous of degree $\mu \in]0, 1[$, so $F(\kappa k_i, \kappa \ell_i) = \kappa^\mu F(k_i, \ell_i)$ for $\kappa > 0$. For $\mu \in]0, 1[$ we have decreasing returns to scale with a fixed production factor (say, entrepreneurial services) that generates economic rents. Decreasing returns to scale are typically assumed in the literature on Separate Accounting versus Formula Apportionment. In contrast, the traditional literature on capital tax competition usually supposes $\mu = 1$ and, thus, constant returns to scale. There is some empirical evidence supporting this latter assumption (e.g. [Duffy and Papageorgiou, 2000](#)). Nevertheless, to ensure comparability with both lines of literature, the largest part of our analysis considers the general case of $\mu \in]0, 1[$.

The MNE may use, for example, transfer pricing in order to shift profit between its subsidiaries. Profit shifting in country i is reflected by the variable s_i . If $s_i > 0$ ($s_i < 0$), then the tax base in country i goes up (down) since the MNE shifts profit to (from) country i . The shifting variables satisfy the condition

$$\sum_j s_j = 0, \quad (1)$$

which ensures that s_i represents shifting from or to country i without changing the overall profit of the MNE. Profit shifting comes at a concealment cost that reflects, for example, the expense for tax consultants and the MNE's risk of being detected by the tax authority when illegally shifting income (e.g. [Kant, 1988](#); [Haufler and Schjelderup, 2000](#)). The concealment cost accruing to the subsidiary

² [Gordon and Wilson \(1986, p. 1366\)](#) claim that their results also hold with an endogenous interest rate. But in their formal analysis they treat the interest rate as fixed (see [Gordon and Wilson, 1986, p. 1360 and 1366](#), for example). Moreover, they do not compare Formula Apportionment with Separate Accounting in the presence of profit shifting. Overall they therefore do not obtain our results.

³ Note that our result of undertaxation under both tax principles puts the analysis of Separate Accounting and Formula Apportionment more in line with the traditional capital tax competition literature (e.g. [Wilson, 1985, 1986](#); [Zodrow and Mieszkowski, 1986](#); [Combrugghe and Tulkens, 1990](#); [Hoyt, 1991](#)). This literature also treats the interest rate as endogenous and also proves undertaxation (but, in contrast to our analysis, focuses on a unit tax on capital instead of a corporate income tax and does not distinguish between Separate Accounting and Formula Apportionment).

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