

Cross-border loss offset and formulary apportionment:

How do they affect

multijurisdictional firm investment spending

and interjurisdictional tax competition ?

[Note for the referee : this is a revision – both a simplification and generalisation – of our same title paper presented at IIPF 2003, Prague, which circulates as *Cesifo* WP 1004; especially the plan of the exposition is the same]

Marcel Gérard* and Joann Martens Weiner**

Summary

Motivated by the EU Commission's suggested company tax reforms, this paper investigates how cross-border loss offset and formulary apportionment of a consolidated tax base affect the investment and transfer pricing behaviour of a multijurisdictional firm, and how they affect the behaviour of governments potentially engaged in tax competition. The paper shows that cross-border loss offset mitigates both the reactions of a multijurisdictional firm to tax changes and the amount of tax competition engaged in by governments. However, formulary apportionment (with a consolidated tax base) boosts the sensitivity of firms to tax changes and increases the scope for interjurisdictional tax competition as well. For governments, formulary apportionment operates like a risk-sharing or partial equalisation mechanism.

Keywords : cross border loss offset, multinational firms, tax competition

JEL : H32, H73, H87

* Catholic Universities of Mons (Fucam), Mons, Belgium, and of Louvain-la-Neuve (Ucl), and Cesifo, Munich; e-mail: gerard@fucam.ac.be. Mailing address : Fucam, chaussée de Binche 151, B-7000 Mons, Belgium.

** Saint-Louis University (Fusl), Brussels, Belgium ; e-mail : weiner5@attglobal.net. Authors are indebted to Louis Eeckhoudt, Harry Grubert, Nicolas Marceau, Michael Smart, Peter Birch Sorensen, Andreas Wagener and John Wilson for valuable comments and suggestions. However any errors remain ours.

Earlier versions of that paper have been selected for presentation at various conferences in 2003, including PET03 in Durham, the IIPF congress in Prague and the NTA meeting in Chicago. One such version circulates as *CESifo* WP 1004.

1. Introduction

In late 2001, the EU Commission proposed a new approach for taxing multinational companies operating within the European Union.¹ That approach has two main characteristics. First, each multinational company should be able to compute a single consolidated tax base under a single set of tax rules for its EU-wide operations. Second, that consolidated tax base should then be apportioned among the various EU member states according to an agreed mechanism for taxation at local rates.² In presenting this new approach, the Commission explained that allowing EU-wide consolidation with an agreed cross-country distribution of profits would help remove the existing tax obstacles to the conduct of EU-wide activities.

The suggested reform has several advantages: tax-based distinctions between branches and subsidiaries would disappear; cross-border mergers would not incur adverse tax consequences; to a great extent, arm's length transfer pricing and cost allocation between members of the group located in different member states would no longer be necessary for tax purposes; and, most importantly, cross-border loss offset would occur.³ This latter option appears to be particularly attractive to some EU businesses.⁴ Thus, in many respects, consolidated base taxation with formula apportionment may be an EU multinational taxpayer's dream come true, as it *appears* to solve all of these issues at once.

The propositions of the EU Commission have been analysed on various respects by several authors. See, for example, the collection of papers presented in *CESIfo Forum, European Taxation*, and *Ifo-Studiën*.⁵ Weiner (2001b, 2002a) and Gérard (2002, 2003) have separately examined these proposals, which are described in section 2. This joint paper builds on their earlier work to investigate the impact of cross border loss offset within a formulary

¹ See European Commission (2001, 2002)

² A formula would not be required if all of the revenue collected from the corporate income tax accrued to the European Union, an option that is not under serious consideration. In all other cases, the consolidated tax base would be distributed to the member states for taxation at the local rate using a formula. While the details of the four options vary, apart from the exception just noted, all of the options use a formula to apportion the tax base to the member states.

³ The extent to which these advantages arise depends on the definition of the EU taxable corporate group and the treatment of income and activities outside of the EU.

⁴ The Commission's Study (2002, p. 327) presents an example provided by UNICE, the federation of European employers, where one of its companies would have saved ECU 320 million if it had been able to use its losses of ECU 880 million in some member states to offset profits of ECU 870 million in other member states. For additional details, see Union of Industrial and Employers' Confederations of Europe (2000).

⁵ *CESIfo Forum*, 2001, vol. 1, *European Taxation*, 2002, vol. 42 (8), *Ifo-Studiën*, 2002, vol. 48 (4),

apportionment system. The Commission, in presenting its analysis, noted that it had not analyzed these features in depth. Moreover, while Gérard (2002) recognised that cross-border loss offsetting could make consolidation with apportionment superior to taxation under the separate-entity approach, he did not address this issue analytically.

In section 3, we consider the impact of cross-border loss offsetting in the framework of corporate tax systems operated under a separate-entity approach. We first examine the impact on the value of a multijurisdictional firm under the source and residence principles for international taxation, then on the sensitivity of the distribution of investment among jurisdictions to changes in corporate tax rates, and finally on the level of the corporate tax rates determined by governments, and thus on tax competition.

In section 4, we substitute the separate-entity approach with a consolidated tax base and a formulary apportionment mechanism. Then we repeat the analysis of the previous section in that new framework.

Finally, section 5 suggests some conclusions.

From a methodological point of view, we nest the issue of cross-border loss offset in a setting where the multinational company faces an uncertain return on investment. More precisely we consider that such a firm distributes its investment between two jurisdictions, and that two states of the nature may occur in either jurisdiction, a good state where profit is positive and a bad state where a loss occurs. This loss may, or may not, be totally or only partially offset against any profit earned in the other jurisdiction. We will examine, in particular, if the move from no loss offset to a partial or total loss offset system changes the strategy of the firm in terms of the location of plants.

We will also investigate the impact of cross-border loss offsetting and formulary apportionment on interjurisdictional tax competition.

Our contribution relates to the economic literature at the junction of public finance and uncertainty; that literature, as pointed out *among others* by Myles (1995) textbook, which includes Mossin (1968), Stiglitz (1969), Diamond and Stiglitz (1974), Sandmo (1977) and Fucam colleagues Eeckhoudt and Hansen (1982). More recently Eeckhoudt, Gollier and

Schlesinger (1997) specifically cope with the no loss offset provision and the attitude towards risk of a risk-neutral firm. However those works examine loss offset over time rather than at a given moment of time and not across affiliates of a same group, as we do in this paper.

In addition to tax considerations, the conclusions from our examination of cross-border loss offset can be generalised to situations where the risk associated with an activity in one jurisdiction can be matched against the return of another activity in another jurisdiction. This situation allows governments to achieve a certain risk-sharing potential for their revenue from corporate income taxation.

2. The EU Commission's proposed approaches

The EU Commission Study (2002) presents four approaches that may achieve its long-term goal: Home State Taxation (HST), Common (Consolidated) Base Taxation (CCBT), a European Union Corporate Income Tax (EUCIT) and a compulsory harmonized EU tax base. Except for a variation of EUCIT where the revenue from the company tax accrues to the Commission, each method also uses a formula to allocate the tax base to the member states.⁶ While all methods require adopting a formula to implement a comprehensive solution, the implications of adopting a formula have not been analysed in-depth for any of the methods. To a great extent, the debate has centred on which of the four proposals is more feasible in political terms, rather than on which proposal is more practical in economic terms. Following the company tax conference held in April 2002, the Commission has decided to restrict its analysis to the first two options.⁷ The Commission is now proceeding on a two-track approach. It is examining the potential use of Home State taxation for Small- and Medium-Sized Enterprises within a limited number of Member States and examining the potential of using International Accounting Standards as a potential starting point for the EU common consolidated tax base.⁸

⁶ For an analysis of the various approaches, see Westberg (2002).

⁷ For a review of this conference, see Weiner (2002b).

⁸ See Commission (2003).

Table 1 summarizes the approaches for obtaining consolidated taxation in the European Union.⁹ Table 2 summarizes the separate accounting and formula apportionment methods. Separate accounting and formula apportionment are two different ways to determine the amount of a company's income attributable to a jurisdiction.¹⁰

[Note for the referee : the tables thereafter can be skipped and replaced by a reference]

⁹ Source for descriptions: Part IV. Chapter 13 "Options for comprehensive approaches to EU company taxation," in *Company Taxation in the Internal Market*, European Commission (2002).

¹⁰ There is a wide body of literature analysing the strengths and weaknesses of both separate accounting and formula apportionment. See McDaniel (1994), Hellerstein (1993), Musgrave (2000), among others.

Table 1 – Alternative systems proposed by the EU Commission

Home state taxation Under Home State Taxation, companies would have the option of computing their income for their operations located in various Member States participating in the home state tax system according to the company income tax rules of the Member State where their headquarters are located (the “home” state). The tax authorities of the home state would administer their particular home state tax system. All groups in the home State area would share their net profit according to the same formula, but the method for offsetting profits and losses would vary according to the rules in the home State. Post-apportionment profits would be taxed at local rates.
Common consolidated base taxation Under Common Consolidated Base Taxation, all or a group of Member States would agree on a set of common rules for establishing the taxable base. Companies would then have the option of calculating their income according to the rules for the new common EU tax base. This EU tax base would operate in parallel with existing national rules. The Member State where the company was headquartered would administer the common EU tax base. All groups choosing this method would share their net profit according to the same formula, and the method for offsetting profits and losses would be identical. Post-apportionment profits would be taxed at local rates.
European Union company income tax Under a European Union Company Income Tax, a new EU tax base would be developed and would operate in parallel with existing national rules. It would be optional for companies. In one form, it would be administered by a new tax authority, with a single EU tax rate, with revenues funding EU institutions and activities and any excess allocated to the Member States according to an agreed formula. In another form, individual Member States could administer the EU company income tax and apply its own tax rate to its allocated share of the tax base.
Compulsory harmonised tax base Under this approach, a single EU tax base and tax code would replace national company tax systems. This EU tax system would apply to all enterprises in all Member States. Member States would administer the tax so there would be no need to create a centralized tax authority. Consolidated profits would be apportioned to the Member States according to the terms of an agreed mechanism, where they would be taxed at local rates.

Table 2 – Separate accounting vs formula apportionment

Separate accounting

Under this system, companies apply traditional accounting methods to calculate the income earned by the legally separate entities located in different jurisdictions, treating transactions with affiliated entities as if they had occurred with independent entities. For tax purposes, corporate entities are required to price internal transactions with their related entities at the level that would have prevailed had these transactions occurred with unrelated parties. These market-based, or arm's length prices, are those that approximate the prices that independent entities would use when selling goods and services to each other in a market relationship. When operations are located in different countries, this process identifies the amount of profit attributable to each country where the multinational company does business.

Formula apportionment

Under formula apportionment, companies do not attempt to separate the income of an affiliated corporate group along geographic lines. Instead, under apportionment, a corporate group first calculates its net income for the entire group and then apportions that income to each location where it does business using a formula. Formula apportionment as traditionally used does not necessarily attempt to identify the geographic source of a company's profits. Instead, apportionment provides a rough approximation of the amount of income generated from the company's activity in each location where it does business. The formula used to apportion a multistate company's income typically includes factors that relate to that activity, e.g., property, payroll, and gross receipts (sales). The U.S. states have used the apportionment system for nearly a century, and the Canadian provinces have used the system for more than a half a century. Under the U.S. state apportionment method, a company doing business in several states would use federal taxable income as its total income and, after making certain adjustments, apportion that income to each state using a formula based on location of its business activity in the various states.¹¹ Under the Canadian method, the federal government calculates the tax liability for each province that participates in certain federal collection agreements. The federal government then allocates each province its share of federal income according to a two-factor payroll and sales formula. The three provinces that do not participate in the collection agreements use the same formula and generally the same tax base.

3. Cross border loss offset under separate accounting taxation

As in Gérard (2002b), we assume a multijurisdictional firm which consists of a parent and two affiliated entities, such as factories. These entities are either separately incorporated – they are then subsidiaries of the parent – or they are not – they are then branches of the

¹¹ These adjustments include eliminating income that states are constitutionally prohibited from taxing and adjusting for differences between state and federal tax law.

parent.¹² The affiliated entities are located in two different jurisdictions denoted by i and j while the parent is located in a jurisdiction denoted as r , a jurisdiction which can be either i or j . Without loss of generality the parent can be either a company or an individual (i.e., a “person”), although in the logic of the analysis of cross-border loss offsetting, it has to be a company. The company is deemed to have continuity of life.

In terms of the model specifications, the multijurisdictional firm has invested one unit of money in production tools which are distributed among the affiliates. A fraction a has been invested in the entity located in jurisdiction i and a fraction $1-a$ in the entity located in jurisdiction j . Together the two entities produce and sell one unit of good per period. Entity i produces a fraction a and entity j produces $1-a$.

Adopting an intertemporal perspective¹³ we define p as the discounted flows of unit retail price net of production cost; that variable is exogenously determined. To allow us to analyse loss offsetting in a tractable way, we assume that dividends are the only means to channel funds from the affiliates to the parent entity¹⁴.

We suppose that entity i sells its output a with probability w , then obtaining a flow of profit pa . Alternatively, it can experiment a loss¹⁵ e_i with probability $1-w$, with $p \geq e_i \geq pa$. Similarly, we have $p \geq e_j \geq p(1-a)$. The same probabilities hold for the entity located in jurisdiction j . The restrictions on the values of e_i and e_j are central for the sequel of the paper. Indeed they allow the multijurisdictional firm, when cross border loss offsetting will be permitted, to match excess losses $e_i - pa > 0$ or $e_j - p(1-a) > 0$ against the tax base in the other jurisdiction while keeping the tax base positive in that jurisdiction.

¹² The distinction between operating as a subsidiary or as a branch generally has no economic substance. However, as a subsidiary has a separate legal personality while a branch has no such separate identity, multijurisdictional companies may often prefer to organize a new operation as a branch, in which case loss offsetting automatically occurs, and then convert the branch to a separate entity once it become profitable. Providing cross-border loss-offsetting would eliminate the need for companies to undertake such actions simply for the purpose of using the losses. Some firms, such as those in financial services, operate in branch form for legal reasons.

¹³ We keep intertemporality as simple as possible in this paper to avoid technical difficulties that could distract from the core issue; on the intertemporality issue see Myles (1995) and typical intertemporal approaches, such as Auerbach (1979) and Bradford (1981).

¹⁴ The firm is equity funded, meaning we can abstract from the issue of debt finance. See Gerard (2002b) for an alternative specification.

¹⁵ To keep the exposition as simple as possible we have introduced an additive risk; a multiplicative risk increases the complexity of the presentation.

It turns out that the value of the project before tax can obey four different expressions depending on which state of the nature occurs. These four possible outcomes, for jurisdiction i and j , respectively, are shown below:

- (i) good – good, probability w^2

$$V^{gg} = p \quad (1)$$

- (ii) good – bad, probability $w(1-w)$

$$V^{gb} = pa - e_j \quad (2)$$

- (iii) bad – good, probability $(1-w)w$

$$V^{bg} = p(1-a) - e_i \quad (3)$$

- (iv) bad – bad, probability $(1-w)^2$

$$V^{bb} = -(e_i + e_j) \quad (4)$$

Then, the expected value of the firm, again before tax, is

$$E(V^{BT}) = wp - (1-w)(e_i + e_j) \quad (5)$$

assumed to be positive, otherwise the firm will not participate. We immediately see that this expression is independent of a so that, in the absence of tax, there is no incentive to locate in either jurisdiction.

3.1. Taxation under pure source vs. pure residence taxation with no loss offset

Let us now introduce taxation. Consider first the case of *no cross border loss offset* and that *tax is levied at the level of the active entities (pure source taxation) rather than at the parent level (residence taxation)*; the tax base is also characterised by depreciation allowances: one unit of investment in jurisdiction i creates a flow of a_i of tax shield. The corporate tax rate in i is denoted t_i . Symmetric design applies for the other jurisdiction.

Then the expected tax liability for the entire multinational enterprise is then,

$$E(T^{NLO}) = wt_i(p - a_i)a + wt_j(p - a_j)(1 - a) \quad (6)$$

and the expected after-tax value of the firm under *source taxation* and with no loss offsetting,

$$E(V^{NLO}) = E(V^{BT}) - E(T^{NLO}) \quad (7)$$

now depends on the distribution of investment, a , between the active entities. *Capital export tax neutrality* exists in such a setting only if the distribution of investment between the two entities is irrelevant. A sufficient condition to reach capital export neutrality, therefore, is that tax rates and tax bases are harmonized, i.e., that $t_i = t_j$ and $a_i = a_j$.

If, by contrast, the tax is levied at the level of the parent entity (*pure residence taxation*), then the tax system would be capital export neutral. In a system of pure residence taxation, the location of the parent is important, unless tax rates and tax bases are independent of that location. This condition, again, implies that both tax rates and tax bases are harmonized.

To see this case, note that equation (6) would become

$$E(T^{NLO}) = wt_r [p - a_r] \quad (8)$$

so that its value depends on the location of the parent company except when $t_r, a_r = t, a \forall r$. However, *although the location of the parent is not independent of local taxes, with pure residence taxation the location of the parent is now independent of the distribution of the investment.*

In the sequel of the paper, however, we ignore the tax shields since they play no role in the argument.

3.2. Cross border loss offset

Let us now introduce *cross border loss offset*. To do so, we set a dummy variable k which equals zero if cross border loss offset is not permitted, and which equals one if such loss offsetting is allowed.¹⁶ With cross-border loss offsetting, the expected value of the firm, $E(V)$, as shown earlier in equation (7) without loss offsetting becomes, under taxation at source,

¹⁶ Alternatively k can be viewed as a value between zero and one, a value other than zero or one corresponding to a *partial loss offset*. Also we assume that the tax base in one jurisdiction is large enough to absorb losses in the

$$E(V^{LO}) = w(1-t_i)pa + w(1-t_j)p(1-a) - (1-w)(e_i + e_j) + kw(1-w)t_i[e_j - p(1-a)] + kw(1-w)t_j[e_i - pa] \quad (9)$$

so that, under the assumption that changing the rules regarding cross border loss offset does not alter the tax rates, expected tax liabilities are not larger when losses can be offset across borders. Then

$$E(V^{LO}) \geq E(V^{NLO}) \quad (10)$$

and the same sufficient conditions for capital export neutrality hold, i.e., tax rates and tax bases are identical.

Under taxation at residence, equation (9) becomes

$$E(V^{LO}) = w(1-t_r)p - (1-w)(e_i + e_j) + kw(1-w)t_r[e_j - p(1-a)] + kw(1-w)t_r[e_i - pa] \quad (11)$$

and again, capital export neutrality holds while capital import neutrality further requires tax rate and tax base harmonization.

Then we can state that,

Proposition 1 – *Under the assumption that changing the rules regarding cross border loss offset does not alter the tax rates, expected tax liabilities are not larger, and expected value of the firm is not smaller, when losses can be offset across borders. As a consequence, cross border loss offset makes the multijurisdictional firm better off.*

Notice that cross border offsetting makes the firm better off than carry forward offsetting in the same jurisdiction if, assuming that offsetting can effectively occur the year after,

$$t_j - \frac{t_i}{1+r} > 0$$

with r a discounting rate; if tax rates are equal, a sufficient condition for that inequality to hold is $r > 0$.

other jurisdiction; relaxing that assumption implies using a more complicated formalisation but does not change the lesson of the model.

To illustrate Proposition 1 graphically, on Figure 1, let us first rewrite equation (9) in a continuous way, and then suppose that tax rates are identical and that only jurisdiction i is risky, i.e.,

$$E(V^{LO}) = p + u - t \max[pa + u, 0] - t \max[p(1-a) + kd(pa + u), 0] \quad (12)$$

with

$$d = 1, \quad pa + u < 0 \\ = 0, \quad pa + u \geq 0$$

and u is a random variable such that $u \in [-p, 0]$. On the figure, we see that introducing cross border loss offsetting moves the far left portion of the value line upward such that it clearly improves the value of the firm when $u < -ap$, i.e. when the loss is large enough for the profit to become negative in the jurisdiction where it occurs.

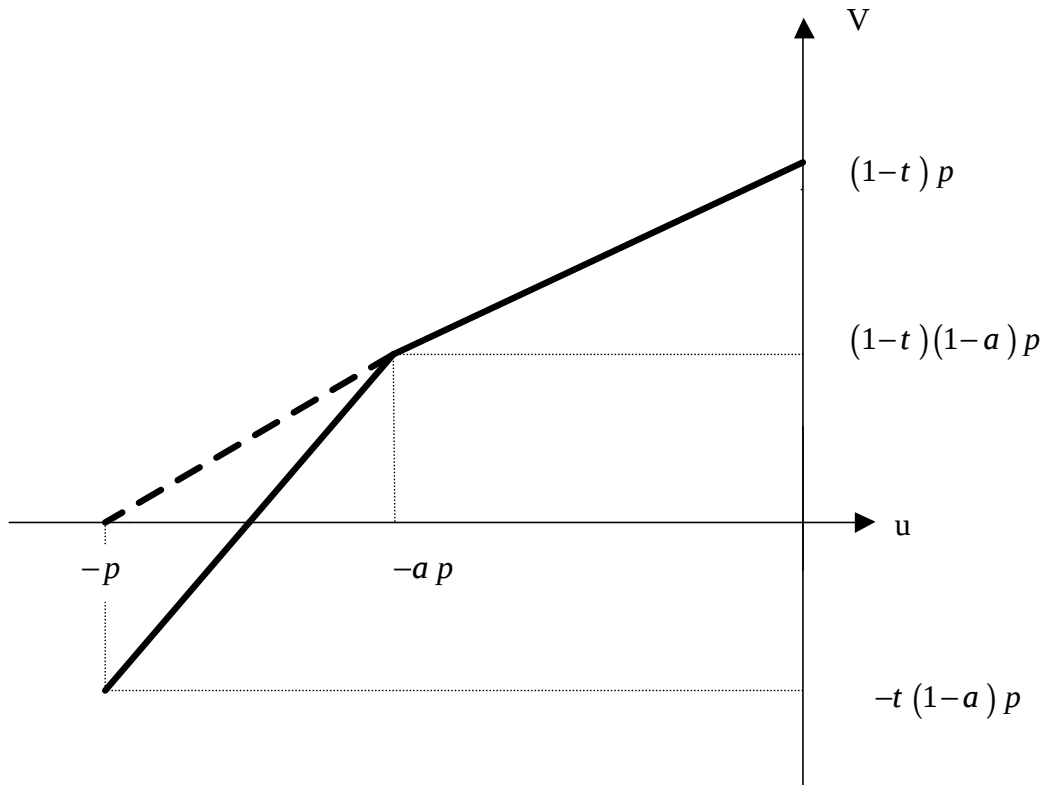


Figure 1 – Cross border loss offset makes the multijurisdictional firm better off

3.3. Effect of loss offsetting on company responses to changing tax rates

So far we have shown that cross border loss offsetting makes the multijurisdictional firm better off. In this subsection we will investigate the effect of that change in the tax system on the interjurisdictional distribution of investment expenditures. Therefore we first need to make endogenous the fraction a of investment invested in each jurisdiction. Then we examine the effect of changing the tax system on the value of a .

Therefore we maximise the expected value of the firm with respect to the fraction of investment located in jurisdiction i . Prior to that however, we introduce a cost of moving function, thus of departing from an initial distribution of the investment.¹⁷ Let us then assume that $c(a)$ is such a function, with a_0 the initial value of a and $c(a_0)=0$. Further we suppose that

$$c'(a) \geq 0, a \geq a_0, c'(a) \leq 0, a \leq a_0 \text{ and } c''(a) > 0$$

Then, maximisation of the expected value of the firm with respect to the fraction of investment located in jurisdiction i implies the first order condition, given that departing from the initial position is costly

$$\frac{dE(V)}{da} = w(t_j - t_i)p - kw(1-w)(t_j - t_i)p - c'(a) = 0 \quad (13)$$

From equation (13) we can derive the responsiveness of investment located in jurisdiction i to changes in the tax rate in each jurisdiction, i.e.,

$$\frac{da}{dt_i} = \frac{wp[1-k(1-w)]}{-c''(a)} < 0 \quad (14)$$

and

$$\frac{da}{dt_j} = \frac{wp[1-k(1-w)]}{c''(a)} > 0 \quad (15)$$

Thus, *the introduction of cross border loss offset drives down (rev. up) investment in the low-tax (rev. high-tax) jurisdiction.*

¹⁷ This is a standard way of dealing with such topic since it is equivalent to the installation function usually introduced in investment model to guarantee an interior solution.

The intuition behind that conclusion is the following: assume that the corporate tax rate is lower in jurisdiction i than in jurisdiction j . In this case, the after-tax value of the firm increases with the fraction of the capital invested in the low-tax jurisdiction. The introduction of cross border loss offset mitigates, but does not reverse, that outcome; *indeed, preserving enough tax base in the higher-tax jurisdiction allows the firm to benefit from a larger tax deduction in case the bad state of nature occurs in the lower taxing jurisdiction*. In other terms, extra investment in the higher taxing jurisdiction is like an insurance premium to cover the risk of bad state of the nature in the lower taxing jurisdiction.

We can then conclude that,

Proposition 2 – *Regarding the location of active entities and the related distribution of tax bases, cross-border loss offsetting reduces the absolute value of company response to changing tax rates.*

3.4. Effect of cross border loss offset on interjurisdictional tax competition

To complete that investigation, let us examine the consequence of cross border loss offset on tax competition within the area in which cross-border loss offsetting is allowed. Therefore, let us consider a simple model of interjurisdictional tax competition. Governments are assumed to maximize the jurisdiction's welfare, which increases with the value of the firm hold by resident taxpayers and the amount of tax revenue available to finance public goods and services. Setting s_i as the fraction of multijurisdictional firm's value V hold by residents of jurisdiction i , g_i as the shadow cost of public funds and $E(B_i)$ as the expected tax base, the government of jurisdiction i maximizes,

$$W_i = s_i V + g_i t_i E(B_i) \quad (16)$$

with respect to the domestic corporate tax rate. The first order condition with respect to a change in the tax rate is

$$s_i \frac{dV}{dt_i} + g_i E(B_i) + g_i t_i \frac{dE(B_i)}{dt_i} = 0 \quad (17)$$

with

$$E(B_i) = wpa - kw(1-w)[e_j - p(1-a)] \quad (18)$$

As a consequence, and using the envelope theorem, the first order condition becomes,

$$(g_i - s_i)\{pa - k(1-w)[e_j - p(1-a)]\} + g_i t_i p[1 - k(1-w)] \frac{da}{dt_i} = 0 \quad (19)$$

with $\frac{da}{dt_i}$ given by equation (14).

From equations (14) and (19), and taking into account that the tax rate has to be comprised between 0 and 1, we can derive an expression for the value of the corporate tax rate in jurisdiction i , i.e.,

$$0 \leq t_i = \frac{g_i - s_i}{g_i} \frac{pa - k(1-w)[e_j - p(1-a)]}{p^2[1 - k(1-w)]^2} c''(a) \leq 1 \quad (20)$$

That expression set forth that the equilibrium value of the tax rate goes up with the cost of public funds or the social weight given to government revenue, but goes down with the degree of domestic ownership of the multijurisdictional firm or the social weight given to the best interest of that firm.¹⁸ Moreover, that equation allows us to compare the equilibrium values of the tax rate without and with cross border loss offset.

From equation (20), it turns out that, if $g_i - s_i > 0$,

$$t_i^{NLO} \propto \frac{a}{p}, t_i^{LO} \propto \frac{a}{pw} + \frac{(1-w)(p - e_j)}{p^2 w^2} \quad (21)$$

so that, given the value of a , permitting cross border loss offset increases (viz. decreases) the equilibrium level of the corporate tax rate when $g_i - s_i > 0$ (viz. $g_i - s_i < 0$). Therefore such a tax reform mitigates tax competition and we can set forth the following proposition,

Proposition 3 – *Cross border loss offsetting mitigates tax competition since such a tax reform increases the equilibrium value of the corporate tax rate when the cost of public funds or the social weight given to government revenue is larger than the degree of domestic ownership of the multijurisdictional firm or the social weight given to the best interest of that firm.*

¹⁸ The role of the ownership of the multijurisdictional firm has been investigated for some years now, see the references and developments in Huizinga and Nielsen (1997), Sorensen (2000) or Gérard (2002a).

and its corollary,

Corollary 1 – Cross border loss offsetting mitigates tax competition since such a tax reform decreases the equilibrium value of the corporate tax rate when the cost of public funds or the social weight given to government revenue is smaller than the degree of domestic ownership of the multijurisdictional firm or the social weight given to the best interest of that firm.

Finally, notice that the slope of the reaction function

$$\frac{dt_i}{dt_j} = - \frac{(g_i - s_i) \frac{\partial a}{\partial t_j} + g_i t_i \frac{\partial^2 a}{\partial t_i \partial t_j}}{(2g_i - s_i) \frac{\partial a}{\partial t_i} + g_i t_i \frac{\partial^2 a}{\partial t_i^2}} > 0 \quad (22)$$

is positive and smaller than one, with

$$\frac{\partial^2 a}{\partial t_i^2} = - \frac{c'''(a)}{c''(a)} \left(\frac{\partial a}{\partial t_i} \right)^2, \quad \frac{\partial^2 a}{\partial t_i \partial t_j} = - \frac{c'''(a)}{c''(a)} \frac{\partial a}{\partial t_j} \frac{\partial a}{\partial t_i}$$

while the first order derivatives are given by equations (14) and (15) respectively. Then the non-cooperative equilibrium is stable. Under the assumption that $c'''(a) = 0$, which is the case a.o. if the cost function is quadratic, the reaction function reduces to, assuming $g_i - s_i > 0$,

$$\frac{dt_i}{dt_j} = \frac{g_i - s_i}{2g_i - s_i} > 0 \quad (23)$$

which is not affected by the move to cross border loss offset.

4. Apportionment of a consolidated tax base

So far, despite cross border loss offset in the computation of the tax bases, the tax bases are computed separately for each entity of the group, and each entity is required to pay its own tax liabilities. We now examine how company decisions are affected if the tax base is computed at the level of the group and then apportioned among the entities according to an agreed formula. In this case, each entity is responsible for paying its tax liabilities, but the tax base in each jurisdiction is determined according to the apportionment formula.

The fact that we jointly deal with consolidation and apportionment should not mask that those two features are *per se* independent. Indeed we can have apportionment without consolidation of losses, as in Canada, where consolidation is not allowed.¹⁹ This also can occur if the tax base is computed at the level of the group as simply the sum of entities' separately computed tax bases, even if it is done on the basis of a single set of rules.

We will not discuss here the *pros* and *cons* of various formulae that may be used in an apportionment system. Authors such as Gordon and Wilson (1986), Goolsbee and Maydew (2000), Gérard (2002b, 2003) or Pethig and Wagener (2003) examine this issue. In this paper we will consider the impact of the apportionment system using a single criterion, the distribution of capital investment.²⁰ Notice however that, since we have assumed that the price p is the sale price net of operation cost, the other two standard criteria – distribution of sales and of labour costs – are equivalent to that used in this paper.

Using equation (9), the expected consolidated tax base is,

$$E(B) = wp - kw(1-w)(e_i + e_j - p) \quad (24)$$

like under taxation at source above – see equation (11). Assuming that the consolidated base is apportioned according to the distribution of investment, expected tax liabilities in jurisdiction i are then $t_i a E(B)$, and similarly in the other jurisdiction. As a consequence, total expected tax liabilities of the group are,

$$E(T) = [at_i + (1-a)t_j][wp - kw(1-w)(e_i + e_j - p)] \quad (25)$$

and cross border loss offset reduces that amount – remember that $p \geq e_i \geq pa$ and similarly $p \geq e_j \geq p(1-a)$.

4.1. Effect on company decisions

Let us first re-examine the results obtained above and summarised by propositions 1 and 2.

The value of the multijurisdictional firm can now be written

¹⁹ In Canada, where consolidation is not permitted, Mintz and Smart (2003) observe that “since corporate groups are not required to consolidate income for tax purposes, a number of tax planning devices are essentially unrestricted for firms that incorporate separately in different provinces”.

$$E(V^{LOFA}) = wp - (1-w)(e_i + e_j) - [at_i + (1-a)t_j][wp - kw(1-w)(e_i + e_j - p)] \quad (26)$$

to be compared with equations (9) and (11). It turns out that *cross border loss offset also increases the value of the firm in a consolidation cum formulary apportionment setting* so that Proposition 1 holds in that framework too. Moreover equations (9), (11) and (26) are equivalent only if the tax rates are equal. *Then, capital export neutrality under consolidation cum formulary apportionment setting needs equal rates across jurisdictions.*

From the maximisation of equation (26) with respect to a , we can again derive the sensitivity of the distribution of investment to changes in tax rates, i.e.,

$$\frac{da}{dt_i} = -\frac{wp - kw(1-w)(e_i + e_j - p)}{c''(a)} < 0 \quad (27)$$

and

$$\frac{da}{dt_j} = \frac{wp - kw(1-w)(e_i + e_j - p)}{c''(a)} > 0 \quad (28)$$

so that, as in equations (14) and (15), introducing cross border loss offset mitigates the sensitivity of investment to changes in tax rates. Therefore, Proposition 2 also holds in the setting of this section.

However the comparisons with equations (14) and (15) reveals that the mitigation of the sensitivity is smaller under formulary apportionment than under separate taxation since $k(1-w)wp > kw(1-w)(e_i + e_j - p)$ for $e_i + e_j < 2p$. Thus, *per se, formulary apportionment boosts the sensitivity of investment to tax rates.*

The intuition behind that increased sensitivity is twofold. First, under apportionment, losses in the lower taxing jurisdiction, when offset across border, are not turned into a tax reduction at the rate applicable in the higher taxing jurisdiction, but at a rate which is an average between the rates prevailing in both jurisdictions. And, second, the overall profit of the multinational firm will be partially taxed at the rate of the lower taxing jurisdiction, even if the entity in that jurisdiction faces losses and even if there is no loss offset, which is a further argument in favour of locating in the lower taxing jurisdiction.

²⁰ For an alternative formulation of this analysis, see Eggert and Schjelderup (2003) and Nielsen, Raimondos-Moller and Schjelderup (2003).

To sum up,

Proposition 4 – *Under consolidation with formulary apportionment, permitting cross border loss offset makes the multijurisdictional firm better off and mitigates the sensitivity of the distribution of investment to changes in tax rates, so that Propositions 1 and 2 hold in that framework too. However that mitigation is smaller and, per se, formulary apportionment boosts that sensitivity. Moreover like in previous settings, capital export neutrality needs harmonisation of tax rates.*

4.2. Effect on interjurisdictional tax competition

In the social welfare function of jurisdiction i , the expression for government revenue is now no longer $t_i E(B_i)$ like in equation (16) but $t_i a E(B)$ with $E(B)$ provided by equation (24).

Then, from the first order condition of the maximisation of that function w.r.t. t_i we obtain, using (27),

$$0 \leq t_i^{FA} = a \frac{g_i - s_i}{g_i} \frac{c''(a)}{w p - k w (1-w)(e_i + e_j - p)} \leq 1 \quad (29)$$

to be compared with the corresponding value under separate taxation, provided by equation (20). *Again, the equilibrium value of the tax rates goes up when cross border loss offset is introduced, but that value is pushed down when formulary apportionment is further introduced.*

The proof of that result is as following. Suppose that $g_i - s_i > 0$. Then, from equation (19), the equilibrium value of the corporate tax rate under separate taxation can be written

$$t_i^{ST} = \frac{g_i - s_i}{g_i} \frac{p a - k(1-w)[e_j - p(1-a)]}{p[1 - k(1-w)]} \frac{1}{\left| \frac{da}{dt_i} \right|_{ST}}$$

while its counterpart under formulary apportionment is

$$t_i^{FA} = a \frac{g_i - s_i}{g_i} \frac{1}{\left| \frac{da}{dt_i} \right|_{FA}}$$

an equation used to compute (29). Then, the fact that

$$\left| \frac{da}{dt_i} \right|_{FA} > \left| \frac{da}{dt_i} \right|_{ST}$$

combined with the observation that

$$a < \frac{pa - k(1-w)[e_j - p(1-a)]}{p[1-k(1-w)]}$$

since

$$a < a + \frac{k(1-w)(p-e_j)}{p[1-k(1-w)]}$$

$p-e_j$ being positive, implies that

$$t_i^{FA} < t_i^{ST} \quad (30)$$

As a consequence,

Proposition 4 – *Though cross border loss offsetting mitigates tax competition, further introduction of formulary apportionment acts in the opposite direction, so that, per se, formulary apportionment boosts tax competition.*

The intuition behind that result includes that *under apportionment, jurisdictions compete not only to have investments because they increase tax revenue of the government if the activity of the firm in the jurisdiction generates profits, but also because the jurisdiction receives revenue even if the activity in the jurisdiction is not profitable, provided that the multinational firm is profitable overall. In some sense, apportionment provides the government of a jurisdiction with an insurance or risk-sharing mechanism against revenue losses in case of a bad state of nature (i.e., losses) on its territory.*²¹ As a consequence, *apportionment can make a risk averse government better off.*

5. Conclusion

This paper has investigated the effect of the introduction of cross border loss offset and apportionment of the tax base, on both the behaviour of a multijurisdictional firm and on that governments engaged in interjurisdictional competition. Though motivated by the reforms

²¹ As pointed out by Michael Smart, formulary apportionment can also be regarded as a redistribution or equalisation device among jurisdictions.

suggested by the European Commission in 2001 and 2002, the lessons of the paper also apply to other situations where additional possibilities of risk sharing among geographically distributed entities of a given firm are introduced. In reference to the EU Commission proposed approaches, we have compared the impact of cross-border loss offset under two tax systems, separate entity taxation and formulary apportionment of a consolidated tax base.

We have shown that cross border loss offset increases the value of multijurisdictional firms , making them better off, mitigates the reaction of the firms in terms of investment location and transfer pricing policy, and affects the level of the corporate income tax rates determined by government, and thus the outcome of tax competition.

Regarding firms, the intuition behind that result is the following: assume that the corporate tax rate is lower in jurisdiction i than in jurisdiction j , and, for simplicity, that there is no tax shield. Then, the after-tax value of the firm increases with the fraction of the capital invested in the low-tax jurisdiction. However, the introduction of cross border loss offset mitigates, but does not reverse, that situation. Indeed, preserving enough investment in the other jurisdiction, that with the higher tax rate, allows the firm to benefit from a larger deductibility against the corporate tax base in that jurisdiction, in case losses occur in the lower taxing jurisdiction. In other terms, extra investment in the higher taxing jurisdiction is like an insurance premium to cover the risk of bad state of the nature in the lower taxing jurisdiction.

For governments, the intuition can be similar: if the government of jurisdiction j reduces its corporate income tax rate, there will be an outflow of investment from jurisdiction i to jurisdiction j . However, that outflow will be refrained by the willingness of the multinational firm to keep enough tax base in jurisdiction i in order to be able to match the possible loss in the other jurisdiction against that tax base. Knowing that, governments will moderate their own tax cuts in situations where tax competition drives down the tax rates. erritory reduces the tax base in that jurisdiction.

Furthermore, we show that apportionment, per se, boosts the sensitivity of firms' behaviour to changes in tax rates, and thus, possibly, boosts tax competition.

The intuition behind that increased sensitivity and behind the boosting of tax competition, is twofold. First, under apportionment, losses in the lower taxing jurisdiction, when offset

across border, are not turned into a tax reduction at the rate at work in the higher taxing jurisdiction, but at a rate which is an average between those prevailing in both jurisdictions. And second, the overall profit of the multinational firm will be partially taxed at the rate of the lower taxing jurisdiction, even if the entity in that jurisdiction faces losses and even if there is no loss offset, which is a further argument to locate in the lower taxing jurisdiction.

In addition, under apportionment, jurisdictions compete not only for company tax revenue if the firm's activity in the jurisdiction is profitable, but also because the multijurisdictional firm generates revenue even if the activity in the jurisdiction is not profitable, provided the firm is profitable over all the other jurisdictions of the apportionment area. In this sense, apportionment provides the government of a jurisdiction with a insurance or risk-sharing mechanism against revenue losses in case of a bad state of the nature on its territory.

.Let us add that, from a policy point of view, one can find in the paper arguments in favour of implementing cross border loss offset, even if a mechanism of formulary apportionment is not introduced simultaneously.

September 2003

References

- Auerbach, A., 1979, "Wealth maximization and the cost of capital", *Quarterly Journal of Economics*, 93, 433–446.
- Bradford, D., 1981, "The incidence and allocation effects of a tax on corporate distributions", *Journal of Public Economics*, 15, 1–22.
- Diamond, P. and J. Stiglitz, 1974, "Increases in risk and in risk aversion", *Journal of Economic Theory*, 8, 337–360.
- Eeckhoudt, L. and P. Hansen, 1982, "Uncertainty and partial loss offset provision", *Economics Letters*, 9, 31–35.

Eeckhoudt, L., C. Gollier and H. Schlesinger, 1997, "The no-loss offset provision and the attitude towards risk of a risk-neutral firm", *Journal of Public Economics*, 65, 207-217.

Eggert, W. and G. Schjelderup, 2003, "Symmetric tax competition under formula apportionment", *Journal of Public Economic Theory*, 5 (2), 437-444.

European Commission, 2001, *Towards an Internal Market without tax obstacles*, COM (2001) 582 final, 23 October 2001.

European Commission, 2002, *Company taxation in the internal market*, Commission staff working paper, Office of Official Publications for the European Communities: Luxembourg (Originally published as SEC(2001) 1681, 23 October 2001).

European Commission, 2003, 'The application of International Accounting Standards (IAS) in 2005 and the implications for the introduction of a consolidated tax base for companies' EU-wide activities," Consultation Document, February 2003.

European Taxation, 2002, *Special Issue. Company Tax Reform in the European Union: Targeted Measures and Comprehensive Proposals*, Official Journal of the Confédération Fiscale Européenne, 42 (8).

Gérard, M., 2002a, "Tax competition, the distribution of MNE's ownership and the wage formation process", *CESifo WP* 631.

Gérard, M., 2002b, "Neutralities and Non-Neutralities in International Corporate Taxation: An Evaluation of Possible and Recent Moves", *Ifo-Studiën*, 48 (4), 533-554.

Gérard, M., 2003, "L'imposition des entreprises multinationales en Europe, à propos d'un rapport de la Commission européenne", *Revue Economique*, 58 (4), 489-498.

Gordon, R. and J. Wilson (1986), "An examination of multijurisdictional corporate income taxation under formula apportionment", *Econometrica*, 54 (6), 1357-1373.

Goolsbee, A. and E. Maydew (2000), "Coveting thy neighbor's manufacturing: the dilemma of state income apportionment", *Journal of Public Economics*, 75, 125-143.

Hellerstein, J., 1993, "Federal Income Taxation of Multinationals: Replacement of Separate Accounting with Formulary Apportionment", *Tax Notes* 60 (10), 1131-1145.

Huizinga, H. and S. B. Nielsen, 1997, "Capital income and profit taxation with foreign ownership of firms", *Journal of International Economics*, 42(1-2), pp. 149-165.

McDaniel, P.R., 1994, "Formulary Taxation in the North American Free Trade Zone", *Tax Law Review*, 49 (4), 691-744.

Mintz, J. and M. Smart, 2003, "Income shifting, investment, and tax competition: Theory and evidence from provincial taxation in Canada", *Journal of Public Economics*, forthcoming.

Mossin, J., 1968, "Taxation and risk-taking: an expected utility approach", *Economica*, 35, 74-82.

Musgrave, P.B., 2000, "Interjurisdictional Equity in Company Taxation: Principles and Applications to the European Union", in: S. Cnossen (ed.), *Taxing Capital Income in the European Union. Issues and Options for Reform*, Oxford: Oxford University Press, 46-77.

Myles, G., 1995, *Public Economics*, Cambridge: Cambridge University Press.

Nielsen, S., P. Raimondos-Moller and G. Schjelderup, 2003a, "Tax spillovers under separate accounting and formula apportionment", Economic Policy Research Unit paper 01-07, Copenhagen Business School.

Nielsen, S., P. Raimondos-Moller and G. Schjelderup, 2003b, "Formula apportionment and transfer pricing under oligopolistic competition", *Journal of Public Economic Theory*, 5 (2), 419-437.

Pethig, R. and A. Wagener, 2003, "Profit Tax Competition and Formula Apportionment", *CESifo WP* 1011.

Sandmo, A., 1977, "Portfolio theory, asset demand and taxation: comparative statics with many assets", *Review of Economic Studies*, 44, 369-379.

Sorensen, P. B., 2000, "The case for international tax co-ordination reconsidered", *Economic Policy*, 31, pp. 429-461.

Stiglitz, J., 1969, "The effects of income, wealth, and capital gains taxation on risk-taking", *Quarterly Journal of Economics*, 83, 262-283.

Union of Industrial and Employers' Confederations of Europe (UNICE), 2000, *Memorandum on cross-border company taxation obstacles in the single market*, 3 April 2000.

Weiner, J. 1999, "Using the Experience in the U.S. States to Evaluate Issues in Implementing Formula Apportionment at the International Level," OTA Paper 83, Office of Tax Analysis, U.S. Department of the Treasury: Washington, D.C.

Weiner, J., 2001a, "The European Union and Formula Apportionment: Caveat Emptor", *European Taxation*, 41 (10), 380-388.

Weiner, J., 2001b, "EU Commission Proposes Strategy for Consolidating Corporate Tax Bases," *Tax Notes International* 24 (5), 515-519.

Weiner, J., 2002a, "Would Introducing Formula Apportionment in the European Union Be a Dream Come True or the EU's Worst Nightmare?", *Ifo-Studiën*, 48 (4), 519-532.

Weiner, J., 2002b, "EU Commission, Member States Commit to EU-Wide Company Taxation, Formula Apportionment," *Tax Notes International* 25, (5) (6 May 2002), 515-520

Westberg, B., 2002, "Consolidated Corporate Tax Bases for EU-Wide Activities: Evaluation of Four Proposals Presented by the European Commission," *European Taxation* 42 (8), 322-330.