Pricing the Transfer of Intellectual Property:
A Plea for Regulated and Internationally Coordinated Profit Splitting

by

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Abstract:

Taxing intellectual property effectively is a challenging task. With its BEPS initiative the OECD (2013) aims at taxing intangibles in accordance with value creation although difficulties in determining the jurisdiction in which value creation occurs are acknowledged. The European Commission promotes the introduction of a Common Consolidated Corporate Tax Base (CCCTB) to neutralize profit shifting. The drawback of this proposal is that incentives are created to relocate R&D activities to low-tax countries. This is the background against which the present paper pleads for a regulated and internationally coordinated split of the profits earned with licensed know-how.

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1. Introduction

Intellectual property ("IP") and intangibles are of increasing importance for multinational enterprises ("MNEs"). The value of patents, trademarks, copyrights, and other intangible assets as a percentage of the largest US companies' market value is estimated to have increased from 16.8% in 1975 to almost 80% in 2005 (Parr, 2013, citing Ocean Tomo). As a result, the adequate pricing of IP in transactions between the affiliates of multinationals has become a pressing issue for corporate management and even more for tax authorities. It is a characteristic of IP that the application of the standard methods for the determination of arm's length transfer prices – the comparable uncontrolled-price method, the cost-plus method, and the resale-minus method – is not free of arbitrariness.

Companies, particularly those of the digital economy, take advantage of this situation to shift profits to low-tax jurisdictions with the objective to minimize their overall tax payments (Commission Expert Group on Taxation of the Digital Economy, 2014). As a result, the link between taxation and real economic activity is suspected to get more and more lost. Although profit shifting is by its nature difficult to measure, there is evidence that IP plays a key role. According to estimates of Heckemeyer and Overesch (2013), 72% of profit shifting is attributed to the pricing of IP in intra-firm transactions and to the strategic location of ownership rights.

The challenges related to the taxation of MNEs have prompted the OECD (2013) to identify fifteen fields of action against base erosion and profit shifting ("BEPS"). With the BEPS initiative the OECD aims at taxing the returns to R&D in accordance with value creation although difficulties in determining the jurisdiction in which value creation occurs are frankly acknowledged. The problem is that no obvious answer exists to the key question whether value is created by the development of know-how or by its use. One therefore has to wait and see whether the aim of the initiative will be effectively reached. Skepticism is warranted.

The tax gain from shifting profit to low-tax jurisdictions would vanish if the profits earned by the affiliates of a company were consolidated before being taxed. This is the idea of the Common Consolidated Corporate Tax Base (CCCTB) whose introduction in the European Union was originally proposed by the European Commission in 2011. In June 2015 the Commission has confirmed the proposal though with a slight twist. While MNEs should be free to opt in to the CCCTB according to the original proposal, MNEs should be obliged to use CCCTB in tax reporting according to the relaunched proposal. The Commission fears that

otherwise MNEs would be unlikely to opt in to the CCCTB. The clear advantage of the CCCTB is that it takes the MNEs the incentive to minimize taxes by means of profit shifting. There is however an equally clear disadvantage. As the share of the common base which is apportioned to a participating country for the purpose of taxation depends on local activity a strong incentive is given to shift R&D activities to low-tax jurisdictions. Skepticism is therefore warranted as to whether high-tax countries with strong R&D activities would ever be prepared to join a CCCTB regime.

In order to limit the scope for MNEs to opportunistically reallocate taxable income across jurisdictions, Desai and Dharmapala (2011) recommend the adoption of a transfer-pricing norm which they call performance-related principle. The principle requires transfer prices reported by MNEs to tax authorities to be consistent with the transfer prices used internally. We prefer to speak of a one-book system as this labeling better reveals the essence of the proposal. Desai et al. point out that the requirement to keep a single book sustains global production efficiency in a simple model. As is shown in this paper, the efficiency result critically relies on the assumption of uncontrolled pricing. This is the drawback of the proposal. It is not very realistic to assume that MNEs abstain from controlling transfer prices when the tax bill is affected. As already noted by Nielsen (2014), a one-book system does not remove the ability to manipulate tax payments, only moderates it. Above all, it sets incentives for centralizing the management of transfer pricing.

This is the background against which the present paper pleads for a regulated and internationally coordinated split of the profits earned with licensed know-how. There is evidence that transactional profit-based methods are accepted by an increasing number of countries (OECD, 2008; Miller et al., 2009, para 14.17). This development has even brought the OECD to change its stance on profit-based methods. While these are rated as methods of last resort by the Transfer Pricing Guidelines of 1995, the revision of 2010 describes them as “the most appropriate method” in particular cases (OECD, 2010, p. 93). However, the identification of those particular cases is the subject of an ongoing discussion (OECD, 2014). That may explain why the application of the profit split method is still the subject of strong limitations in many countries.

This paper argues that an internationally coordinated policy of regulated profit splitting features some appealing properties. First, it enforces rules which are in line with practice. The change from optional to compulsory profit splitting is certainly less radical than the switching from a two-book to a one-book system and even less far-reaching than the introduction of

CCCTB. Secondly, regulated profit splitting does not distort the choice between centralized and decentralized management. It is management neutral. Finally, as will be shown in this paper, profit splitting allows one to balance various policy trade-offs. One trade-off can occur between the efficiency in the development of know-how and the tax revenue collected by the country hosting R&D activities. Another trade-off arises from maximizing tax revenue when it is not clear to what extent jurisdictions can effectively tax the returns to know-how the costs of which have been deducted from taxable income.

Such results are shown to hold in a highly stylized model of a MNE and corporate taxation. Another simplifying assumption is the focus on the profit-split method. According to this method, profits resulting from a transaction are shared between the legal entities involved in a fixed proportion. Popular examples are the Goldscheider rule requiring the licensee to pay 25% of its expected profits for the product that incorporates the intellectual property at issue to the grantor of the license (Goldscheider, Jarosz, and Mulhern, 2005)[1] and the Knoppe formula allocating 25% – 33% of the expected profit to the licenser (Knoppe, 1972). For other sharing rules based on hypothetical negotiations between independent parties see Boos (2003, p. 204).

In practice, particular splitting parameters are proposed by the MNE. It is then up to the tax authorities to accept the proposed parameters. One may rightly assume that extreme proposals by the former are hardly accepted by the latter. In fact, the ultimate choice can be a contentious issue between firms and tax authorities.

The present paper deviates from this practice by assuming that there is no leeway in choosing the splitting parameter. The idea is that there is a unique parameter set by law and exogenous to the MNE under consideration. One may think of a kind of internationally harmonized policy requiring the profit earned with licensed know-how to be split in fixed proportion. In what follows, such a policy regime is meant whenever we speak of *regulated profit splitting*. Under this regime, the profit that the affiliate of a MNE earns by exploiting provided IP is shared in a fixed proportion with the supplying affiliate. By assumption, the licensee has not contributed to the development of the know-how for which the license is paid. Hence, the splitting parameter cannot be justified by the individual contributions to R&D. The parameter is totally exogenous for the related parties. This has to be stressed for two reasons.

[1] It has to be noted that the Goldscheider rule has not been undisputed in transfer-pricing practice and that it has even been rejected by the US Federal Circuit in 2011 (‘Uniloc vs. Microsoft’).

The first is a certain terminological ambiguity in the literature. There is a strand assuming that the splitting parameter can be derived from individual contributions. An example is Miller et al. (2009, Sec. 14.19, p. 318). See also the literature on CCCTB and formula apportionment. The present paper deviates from this literature. In our view, it is a key characteristic of IP that individual contributions of related parties cannot necessarily be identified. This assumption is also the basis for the second reason and the question of whether the application of the profit split method can be brought in line with the OECD Guidelines (2010) if the licensee has not contributed to R&D. According to those Guidelines (OECD, 2010, p. 93), a profit split is only rated as the most appropriate method if both parties make "unique and valuable contributions". The term unique and valuable is however not defined and the discussion in OECD (2014, p. 6) shows that establishing close relationships with new customers by a sales company (including but not limited to the provision of on-site services, a maintenance program and advice to customers) might be considered a valuable contribution.

This paper's objective is to highlight the merit of regulated profit splitting from a policy perspective. The paper does not aim at characterizing any particular splitting parameter as being the optimal one. It is however shown that any fixed choice larger than zero and smaller than one hundred percent has certain advantages.

The paper is structured as follows: Section 2 shortly surveys related literature. Section 3 sets up the model of a MNE. The paper studies the effects that competing transfer-pricing regimes have on the allocational efficiency of R&D activity and on the distribution of tax revenue across jurisdictions. Section 4 studies the effects of the governing tax law with two sets of books. Section 5 derives the effects of a one-book system. Section 6 looks at formula apportionment. Section 7 analyzes regulated profit splitting. Section 8 compares the reform options. Section 9 summarizes and concludes.

2. Related literature

There is a growing body of literature trying to estimate the extent of base erosion and profit shifting in corporate taxation. The estimates are subject to large uncertainty and have to be interpreted with great caution. Surveying the literature, Riedel (2014) estimates that MNEs transfer 5% to 30% of their earned income from high-tax to low-tax jurisdictions. For other recent surveys see Dharmapala (2014) and the European Commission (2015). By its very nature, profit shifting is difficult to measure because there is not just one channel. Profit is not

only shifted via strategic mispricing of intra-firm trade but also via corporate restructuring, the unbundling and migration of ownership rights and the use of intra-firm debt. Synthesizing the evidence from 25 studies Heckemeyer and Overesch (2013) conclude that transfer pricing and licensing are the dominant profit-shifting channel accounting for 72% of the overall pre-tax profits response to a change in the shifting incentives. The recent literature therefore focuses increasingly on tax planning with IP (Grubert, 2003; Mutti et al., 2009; Dischinger et al., 2011; Karkinsky et al., 2012; Griffith et al., 2014; Evers et al., 2014; Beer et al., 2015; Evers et al., 2015; Bräutigam et al., 2015; Alstadsaeter et al., 2015; Dudar et al., 2015).

The effect of taxation on profit-shifting activity is to be documented by this kind of research. The normative question of policy design is not in the focus. It is mooted by Fuest and co-authors (2013). These researchers raise the question of how they would like international corporate taxation to work and they discuss the pros and cons of four policy options: (i) enforcing residence taxation for which they however see little chances internationally, (ii) extending source taxation which they deem to be more promising, (iii) reforming corporate taxation fundamentally by introducing the CCCTB or by switching to a destination-based cash-flow tax which they consider to be interesting options only for the longer perspective, and (iv) enforcing stricter reporting and transparency requirements of which they do not expect much improvement. In the short run, Fuest et al. (2013) recommend to extend source taxation and to impose withholding taxes on interest and royalty payments.

Starting with Gordon and Wilson (1986) a sizable literature has developed around the idea to consolidate tax bases and to apply formula apportionment. The European Commission (2011) has taken up this idea and proposed an optional CCCTB for Europe. In the relaunched version of 2015 the Commission (2015) advances the view that MNEs should be taxed on the basis of a compulsory CCCTB. For a discussion of CCCTB see Devereux (2004) and Fuest (2008).

Desai et al. (2011) propose to limit the scope for MNEs to opportunistically reallocate taxable income across jurisdictions by reforming the determination of transfer prices. More precisely, they propose to base the determination on what they call the performance related principle. As mentioned, this principle amounts to switching from a two-book to a one-book system. The potential merits of decoupling, i.e., the use of different transfer prices for internal and external statements, is investigated in a number of papers. An example is Johnson (2006), who sets up a sequential model in which two related legal entities (profit centers) trade IP. One firm invests in R&D leading to a certain output of IP which can be sold to the other firm in a second step. Johnson shows that decoupling can boost the overall group profit. Johnson's

sequential setting is picked up by Hiemann and Reichelstein (2012). These authors confirm the merits of decoupling. It allows MNEs to make better investments and also to earn higher after-tax profits. The effects of decoupling are also analyzed by Nielsen (2014). He presents a model with a MNE delegating its quantity-setting power to a subsidiary which is engaged in Cournot–Nash competition with an uncontrolled second supplier. In this framework he works out the trade-offs that a ban on decoupling and other constraints on the choice of transfer prices have for corporate behavior. An unambiguous assessment is not obtained.

This paper departs from the literature by arguing in favor of pricing the transfer of IP by splitting the licensee's profit before royalty payments in fixed and internationally agreed proportion. To the best of our knowledge, such a policy of regulated profit splitting has not received serious consideration in the theoretical literature. One of the rare contributions analyzing profit splitting is from Wellisch (2003). He shows that the parameter of split must be exogenously fixed if the effect of splitting on decisions made by the MNE's management is to be neutralized.

3. The model of a multinational enterprise

Know-how K is assumed to be the sole variable input of production. Such know-how is the result of R&D. The country in which know-how is developed is called the *home country* and the country only sharing the know-how is called the *host country*. In what follows, we use know-how and R&D as interchangeable notions. We however differentiate between know-how and intellectual property for two reasons. The first one is that we like to allow for the case that the know-how is only patentable to a certain extent. R&D activities produce spillover effects on which property rights cannot be acquired. Third parties cannot be foreclosed from their use. The second reason for differentiating between know-how and intellectual property is that we also like to study the case of unbundled ownership rights. Contracted research often has the effect that the country in which patents are held deviates from the country in which R&D is undertaken. Let $C(K)$ capture the cost caused by the development of know-how assumed to be increasing and weakly convex, $C' > 0$, $C'' \geq 0$.

Consider a MNE with two divisions producing output $F = F(K)$ and $f = f(K)$ for third-party customers at a price normalized to one. Marginal productivities F', f' are positive and decreasing. Know-how is a non-rival production input which explains why F and f are both stated as functions of K. F is the production function of the division located in the home

country. As know-how is developed in the home country, we call this division the *developing division*. The division located in the host country and modelled by f is called the *sharing division* as the host country is assumed to share the developed know-how. We start by looking at the scenario with unbundled property rights. This means that the developing division is considered to be the licenser of intellectual property and the sharing division is considered to be the licensee.

The quantity K_i^* is called *internally (production) efficient* if the sum of marginal productivities equals marginal cost, $F' + f' = C'$. This is Samuelson's rule. We differentiate between internal and external efficiency. Internal efficiency refers to the inside of the MNE. As mentioned, the production of know-how is assumed to generate non-patentable *spillover effects* $E(K)$ which are external to the MNE. It is plausible to assume that all such external benefits $E(K)$ exclusively accrue to the country in which R&D is undertaken. The quantity K_e^* is called *externally efficient* if $F' + f' + E' = C'$.

One could argue that intellectual property is an asset which can rarely be increased incrementally. The present model is flexible enough to cope with a zero-one innovation. One only has to set $F(K) \equiv p(K)\Phi, f(K) \equiv p(K)\varphi$ and to interpret $p(K)$ as the probability that R&D results in a product innovation. Requiring $p' > 0$ then amounts to assuming that the probability of success increases in the amount of resources devoted to R&D.

Corporate income is taxed at rate T in the home country and at rate t in the host country. T may exceed t but need not do so. By assumption, costs of know-how are tax deductible. When know-how produced by the developing division is shared with another division, a royalty payment has to be specified. We allow for *decoupling* which means that the payment used *internally* for financial statements may differ from the payment used *externally* for tax reporting ("*two books*"). Let $R_i(K)$ be the royalty which the sharing division has to pay internally and let $R_e(K)$ be the royalty payment used for tax reporting. According to the Model Tax Convention of the OECD royalties shall be taxable in the country where the payments are received. This provision does not necessarily exclude the case that a withholding tax is levied by the country from which payments are made. An exception is the European Union. It has adopted a directive designed to eliminate withholding taxes on interest and royalty payments. This does not keep Fuest et al. (2013) from proposing the (re-) introduction of a creditable withholding tax. In the following analysis w denotes such a tax.

As a result of all these assumptions, the sharing division's profit after tax is

$$\pi \equiv (1-t)f(K) - R_i(K) + (t-w)R_e(K) \quad (1)$$

and the developing division's profit after tax is

$$\Pi \equiv (1-T)[F(K) - C(K)] + R_i(K) - (T-w)R_e(K) \quad (2)$$

4. The governing tax law with two sets of books

Equations (1) and (2) capture main features of international corporate taxation. Profits are taxed at source and exempted from taxation in the parent's country of residence. If the latter country should apply a system of crediting, special provisions typically allow the MNE to postpone the taxation of repatriated profits so that the difference to effective exemption can be ignored. MNEs are free to maintain two separate sets of books and it is only fair to assume that they use external reporting for minimizing their tax bill. Hence, let us assume that our model MNE maximizes the divisions' joint profit

$$\pi + \Pi = (1-t)f + (1-T)[F - C] + (t-T)\,R_e \quad (3)$$

in $R_e \in [\underline{R}_e, \bar{R}_e]$ where $\underline{R}_e, \bar{R}_e$ denote the bounds of feasible transfer prices. The choice of $R_i(K)$ is not relevant for tax planning. The term cancels out when summing equations (1) and (2) as does the withholding tax. The latter only redistributes tax revenue between tax jurisdictions. A fully creditable withholding tax does not affect the MNE's dispositions. The objective to minimize tax payments will induce the MNE's headquarter to set $R_e = \underline{R}_e$ if $T > t$ and to set $R_e = \bar{R}_e$ if $T < t$. Such an optimizing behavior raises the question of how to model the boundaries of feasible transfer prices.

An upper bound can be derived from the requirement that transfer prices do not imply losses. We call this the *no-loss constraint* of transfer pricing. In the present framework with no uncertainty, a loss can only result when a tax refund is part of strategic planning. For this very reason, tax authorities can be expected to reject royalty payments implying losses and to enforce the no-loss constraint. In the model, a loss results from setting $R_e > f$. Neither will the host country be prepared to refund $t(R_e - f) > 0$, nor will the home country refund $(t-T)(R_e - f) > 0$ which it would have to do if $t > T$ and if a cross-border loss offset were

institutionalized.[2] Hence there is good reason to set $\bar{R}_e \equiv f$. Assuming $T < t$ and maximizing joint profit (3) subject to $R_e \leq f$ yields $R_e = f$ and $F' + f' = C'$. This outcome is unfavorable for the host country but good for efficiency. The host country does not collect positive corporate tax revenue yet the production of know-how is internally efficient.

If $T > t$, joint profit decreases in royalty payments. It then pays for the MNE to set R_e as low as possible. This is without drawback as external transfer prices have no managerial function. The only negative effect is on the tax revenue of the high-tax country. This will give its tax authorities reason to negotiate the choice of specific prices. In practice, their position is, however, weak because information about the productivity of know-how is typically not available. The informational asymmetry gives the MNE's headquarter a lot of leeway in setting R_e. Just for the sake of simplicity, let us assume that the choice of R_e is only constrained to be nonnegative. Negative transfer prices would certainly be challenged by tax authorities. The MNE's optimal choice then requires setting $R_e = \underline{R_e} \equiv 0$. This is as if a regime of source taxation were implemented for IP. The returns to know-how are taxed in the source country. Maximizing eq. (3) with $R_e \equiv 0$ yields

$$(1 - T)[F' + f' - C'] = -(T - t)f' < 0. \qquad (4)$$

The last term on the right-hand side of eq. (4) works like a subsidy to the development of know-how. Such a subsidy is internally inefficient but it may raise external efficiency. The development of know-how exceeds the internally efficient level when some returns are taxed at a lower rate than the rate at which costs are deducted. However, external efficiency cannot be guaranteed. As there is no connection between $(T - t)f'$ and E' the subsidy can well be too weak or too strong. The subsidy fails to target external efficiency.

Let us summarize the main findings. They can hardly claim to be novel. But stating them in the form of a proposition helps to structure the discussion.

Proposition 1: A two-book system sets incentives for profit shifting and strategic transfer pricing. If the boundaries of feasible transfer prices are as specified, a high-tax host country is unable to collect any corporate tax revenue while a low-tax host country collects revenue as if know-how were taxed at source. In the

[2] Cross-border loss compensation for MNEs has become a major policy issue in Europe. For a discussion of the implications for tax compensation see Haufler and Mardan (2013).

former case, tax-base erosion is internally efficient. In the latter case, the tax gap works like an untargeted subsidy to R&D.

The analysis underlying Proposition 1 assumes that the development of know-how and the holding of the derived ownership rights are bundled and allocated to the home country. This may not be a realistic scenario. Large multinationals can organize their activities in such a way that R&D may be located in a high-tax country while the ownership rights and the associated profits are shifted to a low-tax country (Evers et. al, 2015). The special appeal of such a strategy of unbundling is that it promises the MNE a "double dip" tax deduction. Not only are the costs of R&D tax deductible in the home country, the royalties which the home country has to pay to the host country for the right of sharing the know-how are equally deductible from the home's country tax base. To be more specific let us assume $T > t$ so that the home country takes the role of the high-tax country. If the international migration of ownership rights is not taxed effectively, the home country ends up collecting no corporate tax revenue. The MNE achieves this result by setting $R_e \equiv F - C$. As a result, the home country's tax base is zero and all profits are taxed in the host country. The home country only benefits from the external effects of R&D. Assuming this double-dip strategy and maximizing joint profit

$$\pi + \Pi = [(1-t)f - t(F-C)] + [F-C] = (1-t)[F + f - C] \qquad (5)$$

reveals that it has the advantage of sustaining internal efficiency.

Proposition 2: If unbundling is feasible, a two-book system sets incentives for locating R&D in the high-tax country and for holding ownership rights in the low-tax country. The high-tax country enjoys the external effects of R&D but it is unable to collect sizable corporate tax revenue from R&D. Still, tax-base erosion sustains internal efficiency in the development of know-how.

Propositions 1 and 2 allow deriving behavioral responses when the jurisdictions compete for the location of the MNE's activities. The countries just sharing know-how have a strong incentive to undercut corporate tax rates. A marginal decrease in the tax rate can trigger off a

first-order increase in taxable profits. This is so as the locational choice for the holding of IP is a zero-one decision. As a result, tax competition is at the extensive margin and not at the intensive one. Countries are led to compete by offering favorable tax provisions. A prominent provision is the so-called patent box which a growing number of developed economies have recently implemented (Evers et al., 2015; Alstadsaeter et al., 2015, Dudar et al., 2015). There is increasing evidence supporting the suspicion that those patent boxes are primarily designed to steal the revenue collected from taxing intangibles. Countries hosting R&D activities are incentivized to react by taxing the international migration of IP. It is however not clear to what extent the tax benefit from strategic migration can be skimmed off in practice. For a discussion see Russo (2007, 180-182) or Endres et al. (2015, §16.04).

For the sake of simplicity let us assume that the home country levies an exit tax based on the cost of R&D and not on the return. In a realistic scenario, the cost is realized and known while the profit is not realized and uncertain. Let us further assume that the exit tax is not levied just on cost C but on cost plus some mark-up captured by the factor m and that the host country allows the cost of acquisition to be deducted. The developing country then collects TmC and the host country loses tmC. In order to make sense, T must exceed t. Maximizing joint profit implies

$$(1-t)[F' + f' - C'] = (T-t)mC' > 0 \qquad (6)$$

As the right-hand side is positive, optimal know-how drops behind the internally efficient level. The exit tax is effectively a tax on R&D. If the host country does not allow mC to be deducted from taxable income, the effect of the exit tax on R&D is even more detrimental.

Proposition 3: An exit tax on the migration of IP protects high-tax countries against base erosion at the price of reduced internal efficiency.

5. One-book system

In order to limit the scope for MNEs to opportunistically reallocate taxable income across jurisdictions, Desai and Dharmapala (2011) recommend an international tax regime which requires transfer prices reported by MNEs to tax authorities to be consistent with the transfer

prices used internally. The authors call such a transfer-pricing norm the *performance related principle*. As already mentioned, we however prefer to speak of a *one-book system*.

The merits of a one-book system are easily demonstrated when analyzing a perfectly decentralized organization of management characterized by uncontrolled pricing and decentralized profit maximization. Decentralization means that each MNE's division maximizes its own profit after tax. The decentralization is called *perfect* if the divisions take the transfer price functions R_i and R_e as given and if the royalties are not paid lump-sum. A synonym is *uncontrolled pricing*. When taxation is absent, the divisions supply and demand know-how as functions of R_i'. If royalties are not paid lump-sum, a price $P_i = R_i'$ exists equating supply and demand. In practice, one can think of a headquarter fixing the price. Most patent licensing agreements observed empirically rely on such marginal pricing by including per-unit or ad valorem royalties (San Martín and Saracho, 2010).[3] Maximizing eq. (1) in K yields

$$f' = \frac{R_i' - (t-w)R_e'}{1-t} \tag{7}$$

and maximizing eq. (2) in K yields

$$F' + \frac{R_i' - (T-w)R_e'}{1-T} = C'. \tag{8}$$

The term $\frac{R_i' - (T-w)R_e'}{1-T}$ can be interpreted as the developing division's effective price fetched for supplied know-how, K^s. Similarly, $\frac{R_i' - (t-w)R_e'}{1-t}$ is the sharing division's effective cost of demanded know-how, K^d. The development of know-how is internally efficient if the sum of marginal productivities equals marginal cost. Obviously, such efficiency requires the equality of the effective price and cost of know-how, $\frac{R_i' - (T-w)R_e'}{1-T} = \frac{R_i' - (t-w)R_e'}{1-t}$, at $K^s = K^d$. At unequal tax rates such an equality is ensured only if a one-book system is installed, $P \equiv R_i' = R_e'$, and if no withholding tax is levied, $w = 0$. If this is the case, know-how supplied is paid its marginal product at the internally efficient level, $P = f'(K_i^*)$.

[3] These authors treat the two pricing strategies as alternatives. In the present model the difference can be viewed as one between ex ante and ex post. Just assume $f(K) \equiv p(K)\varphi$ where $p(K)$ denotes the probability that R&D results in a product innovation. When taxation is absent, maximizing the profit of the sharing division yields $p'\varphi = P_i$. What appears as a per-unit royalty ex ante, $P_i K$, then equals a linear payment in sales ex post, $p'K \cdot \varphi$.

Proposition 4: When the MNE's management is perfectly decentralized, internal efficiency in the development of know-how is ensured if a one-book system is installed and if withholding taxes on royalty payments are not levied. The royalties paid equal the marginal product of know-how.

Proposition 3 replicates a key result of Desai and Dharmapala (2011). The replication clarifies the assumptions needed to sustain efficiency. Two of them require far-reaching steps of international policy coordination. The mentioned ban on withholding taxes within the European Union would have to be extended to the rest of the world. And MNEs would have to be obliged to stick to a one-book system. Still, governments could consider agreeing on such measures. Governments cannot however enforce uncontrolled pricing. Such a judgment suggests taking a closer look at a one-book system when transfer pricing is assumed to be controlled.

The control of prices is by its very nature a centralized function. Hence, let us assume that the MNE's headquarter chooses royalty payments $R(K)$ out of some feasible interval, $[\underline{R}(K), \bar{R}(K)]$. After substituting $R(K)$ for $R_e(K), R_i$(K) in equations (1) and (2), the divisions' profits are seen to add up to

$$\pi + \Pi = (1-t)f(K) + (1-T)[F(K) - C(K)] + (t-T)\,R(K). \qquad (3')$$

This maximization on the basis of a one-book system is perfectly equivalent to the maximization with a two-book system. The choice of $R_e(K)$ is only replaced with the choice of $R(K)$. Therefore, the solutions to the maximizations could only differ if the modeled boundaries of feasible royalty payments differed. That raises the question of why the boundaries should differ. It is difficult to find reasons in tax authorities' considerations. The asymmetry of information between tax authorities and MNEs is not directly affected when switching from a two-book system to a one-book system. If changes in the optimizations are to be justified, possible reasons would primarily have to be attributed to managerial considerations. Such managerial considerations are not however modelled explicitly. As it stands, the model is too simple to capture any possible tension between internal and external reporting. Such a tension could well have its origin in informational asymmetries between the MNE's headquarter and the divisions. In practice, centralization can be assumed to raise particular managerial costs which are not, however, modelled. This may be considered a

weakness of the present modeling. On the other hand, the model allows one to confirm an observation made before by Nielsen (2014) in a slightly different framework. The switch from a two-book system to a one-book system does not remove the ability to manipulate tax payments, only moderates it. In particular, the switch is not *managerially neutral*. The promise of tax savings sets incentives for centralization.

Proposition 5: The introduction of a one-book system can only be expected to have a moderating effect on tax planning to the extent that distorted internal prices of IP cause a cost to the MNE. Most importantly, a one-book system sets incentives for centralized management.

6. Formula apportionment

The European Commission (2011, 2015) favors the introduction of a Common Consolidated Corporate Tax Base (CCCTB) which should be compulsory for MNEs. The Commission views the CCCTB as "an extremely effective tool for meeting the objectives of fairer and more efficient taxation" and for "tackling profit shifting and corporate tax abuse in the EU." (European Commission, 2015, p. 7)

The consolidated tax base is defined as sales minus costs. In the simple model of the present paper, this is

$$B \equiv F(K) + f(K) - C(K).$$

This base has to be split between the jurisdictions so that each of them can apply its own tax rate to its apportioned share. According to the Commission's proposal of 2011 the apportioned shares are to be determined as an equally weighted average of the shares in labor, capital (assets), and sales. This is *formula apportionment*. As the present model does not differentiate between labor and capital it is suggestive to illustrate CCCTB by assigning a weight of 2/3 to costs and a weight of 1/3 to sales. The share of B apportioned to the home country then takes the simple form of

$$\lambda \equiv \frac{2}{3} + \frac{1}{3}\frac{F}{F+f}. \qquad (9)$$

The remaining share, $(1-\lambda)B$, is apportioned to the host country. The first summand of 2/3 on the right-hand side of eq. (9) results from assuming that know-how is exclusively developed in the home country.

An advantage of formula apportionment is that it is management neutral whenever royalties are not paid lump-sum. Divisions may maximize their own profits,

$$\Pi = F(K) - C(K) + R_i(K) - T\lambda B \text{ and } \pi = f(K) - R_i(K) - t(1-\lambda)B\ ,$$

taking $R_i(K)$ as given. Or the MNE's headquarter may maximize $\Pi + \pi$. In both cases, optimal know-how results from solving

$$(1-\tau)[F' + f' - C'] = (T-t)\frac{d\lambda}{dK}B \qquad (10)$$

where $\tau \equiv \lambda T + (1-\lambda)t$ denotes the weighted average tax rate.

Eq. (10) reveals that formula apportionment sustains internal efficiency if the sharing parameter λ does not vary with *K*. The right-hand side of eq. (10) vanishes in this case and $F' + f' = C'$ is implied. Constancy of λ is not an irrelevant case. In the present model, it holds when setting $F = p(K)\Phi, f = p(K)\varphi$ so that $\lambda = \frac{\phi+2\varphi/3}{\phi+\varphi}$ which equals 5/6 when $\phi = \varphi$. Constancy should however not be expected in the general case. Quite to the contrary, it is a distinct feature of formula apportionment that the sharing parameter λ varies with varied factor costs and sales. MNEs will react to such variations by relocating factor costs to a low-tax country thereby reducing the effective tax. This incentive has been extensively discussed in the literature. (Gordon and Wilson, 1986; Eggert and Schjelderup, 2003) The present analysis allows one to highlight the specific effect that formula apportionment has for R&D activities. MNEs will be prompted to react less by some marginal shifting of R&D activities. They will rather choose to relocate complete R&D activities. In eq. (9) the effect is that λ drops by 2/3.

Proposition 6: The positive side of formula apportionment is management neutrality. The negative side is that it sets incentives to relocate complete R&D activities to low-tax countries.

7. Regulated profit splitting

The last regime analyzed in some detail sticks to separate accounting. The characteristic feature is that it assumes international coordination in the allocation of profits earned from licensed IP. Under this regime, some fixed share σ of the licensee's profit determined before royalty payments is allocated to the licenser in matters of taxation. We speak of *regulated profit splitting* to stress the fact that σ is to be considered by the MNE to be an exogenous parameter. The term profit splitting is meant to imply that σ is larger than zero and smaller than one. We speak of *source taxation* if $\sigma = 0$ and we speak of *residence taxation* if $\sigma = 1$. The return to know-how is taxed at source in the former case and it is taxed in the country in which the licenser is resident in the latter case.

Our analysis of regulated profit splitting starts with the scenario in which the development of know-how and the holding of IP are bundled. In this case the sharing division's profit after tax is

$$\pi \equiv (1-t)f(K) - R_i(K) + t\sigma f(K) \tag{11}$$

and the developing division's profit after tax is

$$\Pi \equiv (1-T)[F(K) - C(K)] + R_i(K) - T\sigma f(K). \tag{12}$$

As already noted by Wellisch (2003), regulated profit splitting sustains management neutrality. Divisions may maximize their own profits taking the non-lump-sum payment R_i as given or the MNE may maximize joint profits. In both cases, the optimal choice of know-how denoted by $\bar{K}_\sigma^b$ is a solution of the same first-order condition:

$$(1-T)\sigma f' = -(1-t)(1-\sigma)f' \tag{13}$$

Implicit differentiation reveals that optimal know-how decreases in σ if, and only if, $T > t$. For $\sigma = 1$ eq. (13) implies $F' + f' = C'$. Residence taxation sustains internal efficiency as all returns to R&D are taxed at the same rate as the costs are deducted. Regulated profit splitting does not sustain internal efficiency. Optimal know-how exceeds the internally efficient level, $\bar{K}_\sigma^b > K_i^*$, if $T > t$ and it falls short of the internally efficient level if $T < t$. External efficiency requires a negative right-hand side which only holds when the home country is the high-tax country, $T > t$. The development of know-how is then effectively subsidized. As there is no connection between $(1-t)(1-\sigma)f'$ and $(1-T)E'$ the subsidy can well be too

weak or too strong in terms of external efficiency. For later reference, we note that the home country's tax base $F - C + \sigma f$ increases in σ for all values of σ when $T > t$ and for values of σ close to one if $T < t$. See Appendix.

Proposition 7: Regulated profit splitting is management neutral and it eliminates profit shifting by construction. Internal efficiency is however failed. If the host country is a low-tax country, the tax gap works like an untargeted subsidy for R&D. The home country's tax base increases in σ. If the host country is a high-tax country, know-how is inefficiently low. The home country's tax base still increases in σ for sufficiently large values of σ.

If it is possible to unbundle the development of R&D and the holding of IP, the MNE will be incentivized to locate R&D in the high-tax country and to shift the holding of IP to the low-tax country. The effect is that the returns to R&D are taxed more leniently. The divisions' joint profit then is

$$\pi + \Pi = [(1-t)f - t\sigma(F-C)] + [F - C - T(1-\sigma)(F-C)]. \quad (14)$$

Let $\overline{K}_\sigma^u$ be the optimal know-how in the scenario with unbundling. It solves the first-order condition,

$$(1-\tau)[F' + f' - C'] = -(T-t)(1-\sigma)f' \quad (15)$$

where $\tau \equiv \sigma t + (1-\sigma)T$ is the weighted average tax rate and where $T > t$ holds by assumption. Other than in the case without unbundling, $\overline{K}_\sigma^u$ increases in σ. This is easily shown by implicit differentiation of eq. (15). See Appendix. The reason is that τ decreases in σ. As $\sigma = 1$ implies internal efficiency, the increase in σ is efficiency enhancing. For later reference, we note that the home country's tax base $(1-\sigma)(F-C)$ decreases in σ for σ close to one. See Appendix.

Proposition 8: If unbundling is possible, the MNE will be incentivized to locate R&D in the high-tax country and to shift the holding of IP to the low-tax country. When

negotiating over σ, a trade-off results between the objectives of efficiency and of tax-revenue maximization in the high-tax country. Increasing σ at large values increases efficiency but decreases the share of profit being taxed in the country developing know-how.

This paper tries to argue in favor of regulated profit splitting. We therefore like to indicate how the idea of profit splitting can be extended to scenarios which are not just as simple as the one which has been analyzed until now. E.g. assume that know-how is developed in n countries and that it generates profit of f in one further country. One could well invent a special splitting formula dealing with such a scenario. However, one could also agree to keep it simple and to allocate $1/n$ of σf to each country $i = 1, \dots, n$ supplying know-how. This is particularly suggestive when different parts of know-how are difficult to value in relative terms. And it is clearly more convincing than allocating σf to each supplying country. The latter rule would not only risk distributing profit exceeding the disposable amount. It would also give incentives for tax planning. By splitting the holding of IP and allocating the holding to n low-tax countries one could eliminate all taxable profit in a high-tax country using the IP.

Another scenario deserving to be shortly discussed is the one characterized by some cross-sharing of know-how. Assume that the home country develops K at cost $C(K)$ and the host country develops k at cost $c(k)$. It is suggestive to allocate

$$(1-\sigma)[F(K,k) - C(K)] + \sigma[f(k,K) - c(k)]$$

for taxation in the home country and the remaining profit for taxation in the host country. Such a scenario would not however survive tax planning and unbundling. One country would necessarily have to be the high-tax country. This country would attract all R&D activities and the other country the holding of IP.

A scenario deserving some more thoughts is the one where licensed know-how is not the sole source of profit. Just for the sake of being more specific, let us assume that output $f = f(l)$ is a natural resource which has to be extracted at increasing cost $w(l)$. If provided know-how K helps to reduce the cost $w(l) = w(l, K)$ of extraction, splitting the full profit $\pi(K) \equiv \max[f(l) - w(l,K)l]$ does not seem appropriate. The share of profit attributable to the licensed know-how is $\pi(K) - \pi(0)$ and not more. The remaining share of profit, $\pi(0)$, is attributable to the scarcity of the resource which is ideally determined by applying arm's

pricing methods. In practice, the separation may well raise problems. In theory, things are, however, clear. Only the profit which cannot be traced back to fixed local factors can rightly be attributed to know-how.

These remarks are to indicate that the implementation of regulated profit splitting raises problems for which theoretical considerations suggest appropriate solutions.

8. The options of reform in comparison

Let us compare the various tax regimes which have been discussed in this paper. By doing so we take the perspective of the high-tax countries' tax authorities. We do this as the top recipients of royalty payments – the United States and Japan – are high-tax countries and as their tax authorities should have the strongest interest to fight profit shifting by means of international tax coordination. (The top fifteen recipients of royalty payments in 2012 are listed in Dudar et al., 2015.) When comparing the tax regimes we stick to the assumptions made before: Centralization does not cause any appreciable cost to MNEs and transfer prices are only feasible if they are neither negative nor so high that they cause a loss ("no loss constraint").

Given these assumptions, high-tax countries have a problem under the governing two-book tax regime. They are the ideal host of R&D which secures them the spill-over effects generated by the development of know-how. However, they risk providing tax deduction for costs without being able to tax returns. The returns are taxed only to the extent that the countries succeed in fighting the unbundling and migration of ownership rights. If they succeed, they collect the revenue from taxing the home returns to own R&D activities. The returns earned in low-tax jurisdictions go, however, untaxed in the high-tax countries. If unbundling and migration cannot be stopped, high-tax countries do not even collect tax revenue from the return to own R&D activities. If anything, they can try to collect revenue from taxing the migration of know-how. In practice, this will mean that know-how is taxed on a cost-plus basis. Such an exit tax applied to a cost-plus basis may be effective in making double-dip strategies unattractive. It will however hardly allow taxing the full revenue potential of know-how.

A switch to a one-book system could only mean a relevant change if the MNEs would have to face appreciable costs of centralization. If such costs are not appreciable, a one-book system

does hardly stop base erosion and profit shifting in the field of IP. Profit shifting would be less of a problem if MNEs were taxed according to the CCCTB proposal. However, formula apportionment provides strong incentives to locate R&D activities in low-tax countries. It must therefore be conjectured that countries like the United States or Japan will hardly agree to adopt a world-wide CCCTB. They might collect more corporate tax revenue but they would risk losing the external benefits from R&D activities when the latter are shifted to low-tax countries.

Compared to these prospects regulated profit splitting has some notable advantages. Profit splitting seems to be increasingly adopted in practice. The change from optional to compulsory profit splitting is less radical than switching from a two-book to a one-book system and even less far-reaching than the introduction of CCCTB. Above all, regulated profit splitting promises the high-tax countries with strong R&D activities clear benefits. They would not risk the loss of R&D activities as under CCCTB. And they would broaden their corporate tax base. In the scenario characterized by banned unbundling, the tax base would increase from $F - C$ to $F - C + \sigma f$. The high-tax countries would be able to tax a positive share of the returns that own R&D earns abroad and this share increases in σ. In the scenario with unbundling the high-tax countries would be able to tax some share of the returns that own R&D earns at home and this share decreases in σ at large values of σ. Collected tax revenue would be $T(1 - \sigma)(F - C)$ rather than nothing in the governing two-book regime. (If an exit tax is levied on migrated ownership, the generated revenue comes on top in all scenarios of separate accounting.) In negotiating on the choice of σ high-tax countries would face a trade-off. A high σ is favorable for tax revenue when unbundling can be banned while a lower σ is favorable in the opposite case. There is also a potential trade-off between efficiency and tax collection. In the scenario characterized by banned unbundling, the increase in σ increases the high-tax country's tax revenue but decreases the development of know-how and *a fortiori* efficiency. In the scenario with unbundling the increase in σ decreases the high-tax country's tax revenue but increases efficiency.

Because of such trade-offs, one might be optimistic that policy negotiations on the choice of the splitting parameter σ are less contentious than other fundamental changes in the area of international taxation. There are good reasons to opt for an intermediate value of σ. Clearly, much depends on the relevance of unbundling. If the migration of unbundled ownership rights can be banned by means of an exit tax, high-tax countries with strong R&D activities favor a high value of σ. The higher σ is, the larger is the share of the returns of own R&D which are

earned abroad and taxed at home. If the migration of unbundled ownership rights cannot be stopped, the same countries will, however, opt for less high values of σ. A less high value promises them a larger share of the returns of own R&D which are earned and taxed at home although the property rights have been transferred to a foreign country. The low-tax countries with weak R&D activities would have just the opposed interest in both cases. They would favor a small value of σ if unbundling is effectively banned. And they would favor a less small value if unbundling is not costly for MNEs. Hence one has reason to hope that international negotiations on the splitting parameter might not be too antagonistic.

9. **Summary and concluding remarks**

Pricing the transfer of intellectual property is one of the challenging tasks in the field of international transfer pricing. The task is challenging because an ideal method of pricing does not seem to exist. Standard methods of transfer pricing are not applicable because sufficiently comparable third-party data are typically not available. By contrast, profit-based methods seem to lack any sound normative justification.

Considerations of equity seem to be mistaken, for legal entities can hardly be the object of equity from an economic point of view. And even if one is prepared to apply notions of equity to legal entities, one encounters the difficulty of doing justice to two entities one of which develops and uses know-how while the other only uses the provided know-how.

Considerations of efficiency support the view that external benefits of know-how should be exclusively assigned to the developer of the know-how. Such exclusive assignment ensures an efficient internalization of the external benefits generated by R&D. In view of internal efficiency, residence taxation dominates regulated profit splitting.

Regulated profit splitting gains appeal if the national interest of tax authorities and key features of the governing tax regime are foregrounded. The governing regime of international taxation relies on separate accounting, the taxation of profits in the source country, and the permission to keep different books for internal and external reporting. Taking these key features as given high-tax countries would only have reason to support residence taxation of know-how if they were successful in stopping the migration of unbundled ownership rights. If the migration is possible at low costs, MNEs are incentivized to transfer the holding of IP to low-tax countries so that high-tax countries risk collecting no appreciable corporate tax

revenue from own R&D activities. The enforcement of residence taxation would not change anything. On the contrary, a move away from residence taxation and the adoption of regulated profit splitting enables the high-tax countries to tax at least some share of the profit earned at home from own R&D activities. Hence high-tax countries with strong activities in R&D should have reason to support a world-wide regulation of profit splitting.

Regulated profit splitting is clearly no first-best solution to the problem of base erosion and profit shifting in the knowledge economy. It has, however, been argued that regulated profit splitting has further appealing features. One is that the profit split method is increasingly applied when the transfer of IP is priced in practice. The change from optional to compulsory profit splitting may therefore be considered to be less radical than the switching from a two-book to a one-book system and even less far-reaching than the introduction of CCCTB. Furthermore, regulated profit splitting is management neutral. It does not set incentives for centralizing management.

One cannot finish such an analysis without stressing the theoretical nature of the obtained results. They rely on a whole array of simplifying assumptions which clearly limit the applicability. The following simplifying assumptions deserve to be stressed more than others. First, potential imperfections in the management of MNEs which are fought by way of decentralization have been ignored. In the model, centralization only promises benefits and no costs. Future research will have to explore the implications of removing this simplification. Secondly, the costs of R&D have been assumed to be tax deductible. This need not be the case. It is clearly not the case when R&D is financed with equity. Even if R&D only requires labor, incomplete tax deductibility may be a problem. This is so for the following reason. Know-how has to be developed by humans who tend to be highly skilled employees and who need to be incentivized and compensated for the effort caused by R&D activities. Equity-based forms of compensation are more and more used so that the non-deductibility of costs of R&D becomes an issue (Griffith and Miller, 2014). Thirdly, taxes have been modeled to only differ internationally with respect to rates. Preferential tax provisions for R&D such as patent boxes and cost subsidies which are widely granted in practice have not been modeled. For details of the practice see Evers et al., 2015. Regulated profit splitting is clearly no ideal solution to the problem of taxing R&D activities. It however deserves a closer consideration than it has received before in the literature.

10. Appendix

Implicit differentiation of eq. (13) yields

$$\frac{d}{d\sigma}\overline{K}_{\sigma}^{b} = \frac{(T-t)f\prime}{(1-T)[F"-C"+\sigma f"]+(1-t)(1-\sigma)f"} = \frac{(T-t)f\prime}{(1-T)[F"-C"]+(1-\tau)f"} < 0 \Leftrightarrow T > t$$

where $\tau \equiv (1-\sigma)t + \sigma T < 1$. Hence,

$$\frac{d}{d\sigma}[F - C + \sigma f] = f + [F' - C' + \sigma f']\frac{d}{d\sigma}\overline{K}_{\sigma}^{b}. \qquad (16)$$

Eq. (13) implies that the bracketed expression on the right-hand side, $F' - C' + \sigma f'$, is negative for $\sigma < 1$. The right-hand side of eq. (16) is therefore positive for all values of σ when $T > t$. By contrast, the right-hand side of eq. (16) is only positive for values of σ close to one when $T < t$.

Implicit differentiation of eq. (15) yields

$$\frac{d}{d\sigma}\overline{K}_{\sigma}^{u} = -\frac{(T-t)[F'-C']}{(1-\tau)[F"-C"]+(1-t)f"} > 0 \Leftrightarrow T > t.$$

$$\frac{d}{d\sigma}(1-\sigma)(F-C) = -(F-C) + (1-\sigma)(F'-C')\frac{d}{d\sigma}\overline{K}_{\sigma}^{u} < 0 \text{ at } \sigma = 1.$$

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