Juranek, Steffen; Schindler, Dirk; Schjelderup, Guttorm

Conference Paper

Transfer Pricing Regulation and Taxation of Royalty Payments

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2017: Alternative Geld- und Finanzarchitekturen - Session: Taxation IV, No. D19-V2

Provided in Cooperation with:
Verein für Socialpolitik / German Economic Association

Transfer Pricing Regulation and Taxation of Royalty Payments*

Steffen Juranek†

Norwegian School of Economics and NoCeT

Dirk Schindler‡

Norwegian School of Economics, NoCeT and CESifo

Guttorm Schjelderup§

Norwegian School of Economics, NoCeT and CESifo

February 22, 2017

Abstract

The digital economy is characterized by the use of intellectual property such as software, patents and trademarks. The pricing of such intangibles is widely used to shift profits to low-tax countries. We analyze the implications of different OECD methods to regulate transfer pricing and the role of a source tax on royalty payments for abusive transfer pricing. First, we show that under the traditional transfer pricing methods mispricing of royalty payments does not affect investment behavior. In contrast, the Transactional Profit Split Method that is promoted by the OECD for evaluating firms in the digital economy, triggers higher investment in order to facilitate higher profit shifting. Second, royalty taxation is effective in reducing (such) abusive profit shifting, but always reduces investment. Third, a royalty tax rate below the corporate tax rate leads to overinvestment in a tax system with allowance for corporate equity (ACE).

Keywords: Royalty taxation, intellectual property, multinationals, profit shifting, transfer pricing methods

JEL classification: H25, H32, F23

---

*We are grateful to participants at the conference on Tax Citizenship and Income Shifting at Notre Dame Global Gateway London, Japanese-Norwegian Workshop on Public Economics in Bergen, Skatteforum (tax forum) of the Research Council of Norway in Halden, and Research Seminar at the Max Planck Institute for Innovation and Competition in Munich for valuable comments.

†Norwegian School of Economics, Department of Business Economics and Management Science, Helleveien 30, 5045 Bergen, Norway; email: Steffen.Juranek@nhh.no.

‡Norwegian School of Economics, Department of Accounting, Auditing and Law, Helleveien 30, 5045 Bergen, Norway; email: Dirk.Schindler@nhh.no; phone +47-55959628.

§Norwegian School of Economics, Department of Business Economics and Management Science, Helleveien 30, 5045 Bergen, Norway; email: Guttorm.Schjelderup@nhh.no.

1 Introduction

The rapid evolution of technology, especially digital and e-commerce arrangements, pose a significant challenge to countries' tax systems. Royalty payments are often linked to the digital economy as they represent remuneration of intellectual ideas in the form of intangible assets. Google, for example, charges its affiliates royalties for the use of its search engine. The income stream from these arrangements is paid to Bermuda, using a "Double Irish Sandwich". Other digital companies have been accused of using the same setup to shift profits to low-tax jurisdictions. The lack of market parallels for intangibles poses a problem for tax authorities because it is difficult to determine what the arm's length price is. Multinational companies therefore have substantial discretion in setting their royalty fees.

In particular, the OECD (2015a) is concerned that the traditional methods to evaluate transfer pricing, such as the Comparable Unrelated Price Method, will no longer be applicable, because observable comparable transactions are rapidly ceasing to exist. The reason for the latter is the digital economy with its integrated global value chains and its tendency to generate quasi-monopolies. Therefore, the OECD (2015a,b) wonders whether the Transactional Profit Split Method is a suitable (alternative) method to analyze global value chains where parties make unique and valuable contributions, e.g., in the form of intangible assets. This method is not well analyzed yet, and the OECD announced further research on its applicability until the end of 2017 (OECD, 2015a, p. 92).

The problem of establishing arm's length prices and suitable transfer pricing methods is exacerbated by empirical evidence suggesting that multinationals hold their intellectual property in low-tax jurisdictions as part of their global tax saving strategy.[1] The intellectual property has often been developed in a high-tax country, but is transferred to an affiliate offshore. The location of the patent provides multinationals with an incentive to shift profits to the tax haven affiliate by overinvoicing the transfer price on the intellectual property to high-tax affiliates.

An instrument to counter such profit shifting to tax havens is a source tax on royalty payments. It allows the tax authorities to capture some of the revenue loss due to abusive royalty rates. Unfortunately, such a tax has its downsides as well.[2] One such is that firms may be discouraged from investing in high-tax countries. Interestingly, the OECD (2015a,b) reports do not discuss source taxes on royalty payments. Nevertheless, many countries impose them as Table 1 documents with an overview of royalty and corporate tax rates for a selection of OECD countries.[3]

[1] See, e.g., Mutti and Grubert (2009), Dischinger and Riedel (2011), and Karkinsky and Riedel (2012).

[2] The disadvantages of source taxes on royalty payments are discussed in detail by the latest Norwegian Tax Committee. See their report NOU (2014), chapter 7.3.

[3] Royalty payments within the European Union are exempt from the source tax due to the EU Interest and Royalties Directive, and many bilateral tax treaties include a source tax reduction.

[Insert Table 1 about here]

In this paper, we take up the concerns by the OECD, provide an analysis of different transfer pricing methods, including the Transactional Profit Split Method, and their interaction with royalty taxation. First, we analyze the implications of different transfer pricing methods for intangible assets on profit shifting and investment incentives. In a second step of our analysis, we discuss the effects of royalty taxes on these margins, highlight how these effects depend on the chosen transfer pricing methods, and consider the effects of an allowance for corporate equity (ACE) tax system.

For this purpose, we set up a model in which two affiliates of a multinational firm trade an intangible asset. In particular, affiliate B, located in a low-tax country, charges affiliate A, located in a high-tax country, a royalty fee. This fee potentially includes a surcharge above the arm's length price. Affiliate A uses the intangible as a fixed input, combines it with capital investment, and produces a final good. To counter profit shifting and protect its corporate tax base, the residence country of affiliate A applies one of the transfer pricing methods proposed by the OECD and additionally levies a source tax on royalty payments.

A main finding of our paper is that the different methods of transfer pricing regulation affect investment behavior of multinational firms differently, driven by different incentives for abusive transfer pricing. Under all methods, the *arm's length component* of the royalty fee increases multinationals' capital investment, whenever the royalty tax rate is lower than the corporate tax rate. Deducting parts of the arm's length transfer price of the intellectual property through royalty taxation reduces the marginal net tax burden on multinationals' operations in the high-tax country.[4] With respect to the *abusive component*, however, the more traditional approaches Comparable Uncontrolled Price Method, Cost Plus Method, and Transactional Net Margin Method all have the same property that abusive royalty payments in intangibles do not affect the level of capital investment, whereas such an investment link exists for the Transactional Profit Split Method. The reason for the former finding is that the multinational incurs concealment costs for its abusive transfer pricing activities. In the profit-maximizing optimum, the marginal tax savings and marginal concealment costs cancel out. Hence, abusive transfer pricing is lump sum in nature under these methods. The finding under the Transactional Profit Split Method, in contrast, results from tax authorities evaluating the related entities' sharing of the total transactional profits, and multinationals manipulating this evaluation by their investment behavior. Higher capital investment increases total transactional profits, and by this, reduces concealment costs of transfer pricing. Thus, profit shifting will always be higher under the Transactional Profit Split Method, all else equal.

In our second step we find that under a conventional OECD-type corporate tax,

[4] This result lends support to Desai et al. (2006) who argue that when multinationals invest in tax havens, investments may rise in non-haven countries.

royalty taxes are effective in reducing abusive profit shifting, but also reduce investment. These findings hold for any transfer pricing method, but the effects on both margins are stronger, all else equal, under the Transactional Profit Split Method than under the more traditional methods, because the investment link of the former method implies a higher sensitivity to marginal tax savings. The effects are also present under an ACE system, but the investment-reducing effect might be beneficial. We show, that under all considered transfer pricing methods, an ACE tax leads to overinvestment in capital if the tax on royalty payments is lower than the corporate tax rate.

The related literature is scant. With respect to a detailed analysis of specific transfer pricing methods, existing literature focuses on material intermediate factors and neglects royalty taxation. Instead, this literature restricts, e.g., to the implications of the Resale Price Method vs. the Cost Plus Method for resource allocation in a multinational firm (Halperin and Srinidhi, 1987), vertical integration and relationship-specific investment (Sansing, 1999), or strategic interaction under imperfect competition (Gresik and Osmundsen, 2008).

With respect to royalty taxes, Fuest et al. (2013, section 5) propose withholding taxes on royalty payments that are creditable in the residence country as one policy option to reduce base erosion and profit shifting (BEPS). In a brief statement, the authors verbally discuss the scope of such a measure. In 2014, a Norwegian government committee on capital taxation in a small open economy discussed practical options for royalty taxation, but voiced mixed opinions (NOU, 2014, chapter 7.3). In an empirical analysis, Finke et al. (2014) estimate the revenue effects of various kinds of withholding taxes to curb profit shifting. They show that most countries would benefit from a withholding tax on royalty payments, whereas the U.S. that receives the largest royalty income worldwide would lose a significant share of its revenue. A comprehensive analysis of the effects of royalty taxation on firms' investment and profit shifting behavior is, however, missing in the literature.

The sections of the paper are organized as follows. In section 2, we describe the model. We analyze firm behavior under different methods to regulate transfer pricing in section 3 and continue with deriving the implications of royalty and corporate taxation under each of these regulatory approaches in section 4. Section 5 concludes.

2 The Model

Consider a multinational company (henceforth MNC) with affiliates A and B located in countries A and B. Country A is a high-tax country with a corporate tax rate $1 > t > 0$, whereas country B is a "tax-haven" country that imposes no taxes on income remitted there.[5] In line with empirical findings, we assume that the "haven" affiliate owns an intangible good that can be thought of as a patent or a trademark that is used by affiliate A as a fixed factor $\bar{X}$ in production. Affiliate A pays a royalty R to affiliate B for the use of the intellectual property. A difference in international tax rates implies that the MNC generally has an incentive to shift profits to the haven affiliate by setting a high R.

Affiliate A employs a standard neo-classical production function $f(K;\bar{X})$, which uses K units of capital to produce $y = f\left(K;\bar{X}\right)$ units of output, and sells the good at price $p\left(y\right)$ in market A.[6] $\bar{X}$ can be interpreted as a necessary production technology or trademark, and we normalize it to unity, $\bar{X} = 1$, and will suppress it without loss of generality.

The MNC finances its capital investments in country A either by borrowing in the financial market or by using equity. For simplicity, we assume that equity is free of risk so that the financing costs of both (external) debt and equity are given by the world interest rate r. Following most OECD corporate tax codes, costs of equity cannot be deducted from the corporate tax base. Interest expenses on debt are tax deductible, but using debt causes agency costs $C^E(b)$ that are convex and U-shaped in leverage b of the affiliate and proportional in capital invested.[7] We define b as the share of debt to capital, that is, $b = D/K$, denote the leverage ratio that minimizes agency costs by b^* (i.e., $b^* = \text{argmin } C^E(b)$), normalize the minimal agency costs to zero (i.e., $C^E(b^*) = 0$), and assume that marginal agency costs of full debt financing are prohibitive, that is, $C_b^E \to \infty$ if $b \to 1$.

We denote the true (or arm's length) value of the royalty payment by $R^\beta(K)$, whereas $R^\alpha(K)$ is the surcharge above arm's length that may depend on K. In the continuation, we interchangeably refer to $R^\alpha(K)$ as the abusive rate or the surcharge. It should be noted that $R^\beta(K)$ can be interpreted as the transfer payment that independent parties would charge and that the tax authorities apply in their tax audits (e.g., the comparable uncontrolled royalty payment). The royalty payment that affiliate A pays affiliate B is the sum of the abusive rate and the arm's length price,

$$R(K) \equiv R^\alpha(K) + R^\beta(K).$$

The empirical literature finds that royalty payments are mostly a combination of a fixed royalty payment plus proportional royalty rates per unit of sales y or per sales revenue py,

[5]None of our qualitative results would change if the tax haven levied some positive, but lower corporate tax rate than country A. In case of source taxes on royalty payments, any change in the corporate tax rate of the tax haven will also be nullified as long as the haven's tax rate is lower than the royalty tax rate in the high-tax country and a tax-credit system is in place for royalty taxes. If the haven's tax rate increases above the royalty tax rate, it will have the same effect on MNCs' behavior as an increase in the royalty tax rate.

[6]We invoke the standard conditions $f_K > 0$, $f_{KK} < 0$.

[7]Our assumptions are in line with what is often referred to as the trade-off literature, see, e.g., Hovakimian et al. (2004) and Huizinga et al. (2008).

or a payment proportional to either sales or sales revenue only.[8] In our model, we apply a general royalty-payment function $R(K)$ that also allows for non-linear, non-convex payment structures, but preserves the empirically identified feature that (arm's length) royalty payments are non-decreasing in sales/revenues, and therefore capital investment, i.e., $R_K^\beta \geq 0$ and $R_{KK}^\beta \leq 0$. Note also that $R^\alpha(K)$ is a choice variable in the model so that the optimal $R^\alpha(K)$ may not depend on K.

Because we are interested in the implications of transfer pricing in the final good market and MNCs' decisions in the productive affiliates are independent of the costs for developing intellectual property (after the R&D investment is made), we neglect the dynamics of inventions and innovations and treat the costs of the intellectual property as fixed. Thus, profits in affiliate B consist of royalty payments from affiliate A minus a fixed cost F for maintaining, protecting, and potentially developing[9] or acquiring the intangible asset,

$$\pi^B = R(K) - F.$$

Country A levies a tax τ on the royalty payments. Hence, after-tax profits in affiliate A are given by

$$\pi^A = (1-t)\left[p(y)f(K) - R(K)\right] - C^R - \left[r\left(1-bt\right) + (1-t)C^E(b)\right]K - \tau R(K),$$

where rK are the financing costs of capital, btK is the debt tax shield, and $C^E(b)$ are the agency costs so that total capital costs after-tax are given by $\left[r\left(1-bt\right) + (1-t)C^E(b)\right]K$.

The term C^R in equation (2) represents concealment costs that affiliate A incurs. These costs can be interpreted as the use of lawyers and accountants to disguise the abusive part of the royalty payment, or as non-tax deductible fines related to abusive pricing.[10] The exact functional form of the concealment costs depends on the method of regulation – in particular on the audit characteristic ξ – that the tax authority chooses to determine the arm's length royalty rate. The OECD uses five methods to establish the correct transfer price: The Comparable Uncontrolled Price Method, the Transactional Net Margin Method, the Cost Plus Method, the Transactional Profit Split Method, and the Resale Price Method. With respect to intangibles and royalty payments, the first four methods are of interest.[11]

[8] See San Martin and Saracho (2010) for a brief overview of the business models of royalty fees.

[9] The capitalization (and distribution on future periods) of research and development costs has been a controversial issue. Whereas the International Accounting Standards in IAS 38 allows in principle capitalization of the development costs, US GAAP takes a stricter approach and demands that all costs are expensed in the period they occur.

[10] See, e.g., Kant (1988) and Haufler and Schjelderup (2000). Notice that if the concealment costs were tax deductible, our model would imply more profit shifting, but our qualitative insights would not be affected.

[11] For further details about these rules, see OECD (2010, 2015b) and Gresik and Osmundsen (2008, section 2). The Resale Price Method is based on the gross margin or difference between the price at which a product is purchased and the price at which it is sold-on to a third party. The resale price less

The *Comparable Unrelated Price Method* (or CUP) compares the price charged for an intra-firm transaction with the price charged in a comparable transaction undertaken between independent parties, and is the most direct way of ascertaining an arm's length price of a controlled transaction (OECD 2015b, p. 113). It implies that the tax authorities base audits on the actual royalty payment and compares it to a comparable uncontrolled royalty payment, which is $R^{\beta}(K)$ in our setting. The audit characteristic, therefore, is $\xi = R(K) - R^{\beta}(K) = R^{\alpha}(K)$. In practice, many potential comparable unrelated prices are rejected because they cannot match one or more of the comparability criteria. Consequently, the tax authority cannot easily identify $R^{\alpha}(K)$ and $R^{\beta}(K)$ so that the MNC has some leeway in setting its abusive royalty payment. However, a higher $R^{\alpha}(K)$ implies a higher detection probability and a higher fine. Following previous literature, we let the concealment costs under the CUP be convex in the surcharge R^{α} and proportional in the amount of the intermediate factor $\bar{X}$. Taken together, this implies a functional form $C^R = C^R(R^{\alpha}(K))\bar{X} = C^R(R^{\alpha}(K))$ that is convex in $R^{\alpha}(K)$.

The *Transactional Net Margin Method* tests the net profit margin earned in a controlled transaction with the net profit margin earned by the related party on the same transaction with a third party or the net margin earned by a third party on a comparable transaction with another third party. Its purpose is to evaluate how much profit is shifted by a transaction. Applying the Transactional Net Margin Method to our model implies audits that focus on the difference in royalty payments between an MNC's affiliate and a comparable independent firm. Accordingly, the audit characteristic becomes $\xi = R(K)\bar{X} - R^{\beta}(K)\bar{X} = R^{\alpha}(K)\bar{X} = R^{\alpha}(K)$, and the corresponding concealment cost function reads $C^R = C^R(R^{\alpha}(K)\bar{X}) = C^R(R^{\alpha}(K))$. As long as $\bar{X}$ is a fixed factor whose quantity cannot be chosen by the MNC, both the Comparable Unrelated Price Method and the Transactional Net Margin Method are qualitatively equivalent, and we can normalize $\bar{X} = 1$ without loss of generality.

The *Cost Plus Method* seeks to determine an arm's length range of prices for a transaction by identifying the costs incurred by a seller in a controlled transaction and then adding an arm's length mark-up to that cost base. In our model, the cost mark-up is given by the arm's length payment R^{β} relative to the fixed costs F in affiliate B. Thus, the audit characteristic for the concealment cost function is $\xi = [R(K) - R^{\beta}(K)]/F = R^{\alpha}(K)/F$. We assume that total concealment costs are proportional in F, that is, $C^R = C^R(R^{\alpha}(K)/F)F$. As long as the costs F to generate and maintain the intellectual property in the upstream affiliate (B) are independent of output y and investment K in the productive affiliate (A), the Cost Plus Method qualitatively mimics the Comparable Unrelated Price Method.

the arm's length gross margin is considered to be the arm's length transfer price for the goods. This method does not appear relevant for royalties because it is hardly possible to establish an arm's length resale price for intellectual properties and the approach comes close to the controlled unrelated price method if the original selling price is used as a basis.

To summarize the auditing methods of transfer pricing in intangibles, discussed so far, the three methods rely on comparable transactions and trigger concealment costs that can be formalized by the function

$$C^R = C^R(\xi)\Phi = C^R(R^\alpha(K)), \tag{1}$$

where $\xi = R^\alpha(K)/\Phi$ with $\Phi = 1$, and $C^R_\xi > 0$ and $C^R_{\xi\xi} > 0$, no matter whether the Comparable Unrelated Price, Transactional Net Margin or Cost Plus Method is used.[12] Furthermore, concealment costs are zero for undercharging, that is, $C^R(\xi) = C^R_\xi = 0$ for $R^\alpha \leq 0$.

The *Transactional Profit Split Method* seeks to determine how a profit arising from a particular transaction would have been split between independent entities (OECD, 2015b, p. 101)[13]. Under the Transactional Profit Split Method, the tax authorities evaluate royalty payments on the basis of how the profits of the transaction are split between the two affiliates. Following the OECD guidelines (OECD, 2010, Chapter II, Section C.3.3.2), the best candidate for gross transactional profits in our context is operating profits, i.e., EBIT(DA) before royalty payments and any costs related to transfer pricing. Therefore, we define transactional profits as $\hat{\Pi} = p(y)f(K) - F$. Thus, tax audits will evaluate the deviation from the arm's length profit distribution on affiliates and focus on $R/\hat{\Pi}$. Any deviation from the arm's length ratio $R^\beta/\hat{\Pi}$ will trigger convex concealment costs and these concealment costs will be weighted by transactional profits. Consequently, the relevant characteristic becomes $\xi = R^\alpha(K)/\Phi$ with $\Phi = \hat{\Pi}$, and total concealment costs under the Transactional Profit Split Method are given by

$$C^R = C^R(\xi)\Phi = C^R\left(\frac{R^\alpha(K)}{\hat{\Pi}(K)}\right)\hat{\Pi}(K). \tag{2}$$

where $\xi = R^\alpha(K)/\Phi$ with $\Phi = \hat{\Pi}(K)$, $C^R_\xi > 0$ and $C^R_{\xi\xi} > 0$, and zero (marginal) concealment costs for undercharging, that is, $C^R(\xi) = C^R_\xi = 0$ for $R^\alpha \leq 0$.

Despite the fact that the OECD proposes the use of five different transfer pricing methods, it is clear that they also favor the Comparable Unrelated Price Method, and if this one cannot be invoked, the Transactional Profit Split Method is their second choice.[14] The former method is applicable, whenever a reliable comparable uncontrolled transaction can be identified. The latter one is considered as the alternative to evaluate

[12]To save notation, we implicitly normalize the fixed costs in affiliate B to one here. This does not affect any of our results in a qualitative way as long as Φ is independent of K, b and $R^\alpha(K)$.

[13]Note that this method differs from the Transactional Net Margin Method by taking into account both parties of the transaction and does not only look at the profit effects in the high-tax affiliate.

[14]The OECD promotes the Comparable Unrelated Price and the Transactional Profit Split Method as the dominant choices being *"most likely to prove useful in matters involving transfers of one or more intangibles"* (OECD, 2015b, p. 100).

the value of the contributions by the transacting parties in those circumstances in which comparable transactions cannot be observed (OECD, 2015b, p. 101). The other methods seem to be applicable only under specific, limited circumstances (see OECD, 2015b, pp. 98-100). However, as our discussion of audit characteristics above and equation (1) show, the implications of the Transactional Net Margin and the Cost Plus Method qualitatively mimic the Comparable Unrelated Price Method. Therefore, we label all three methods as "standard regulation" when comparable transactions are observable. In the next section, we derive optimal MNC behavior, analyze how these standard methods of regulation affect profit-shifting and investment decisions, and contrast these findings to how the Transactional Profit Split Method affects firm behavior.

3 Firm Behavior

The MNC maximizes global profits after tax, $\Pi = \pi^A + \pi^B$, by choosing the function of tax-efficient surcharges on royalty payments $R^\alpha(K)$, leverage b, as well as the optimal use of capital K. The profit-maximization problem of the MNC can be simplified as

$$\max_{R^\alpha(K),b,K} \Pi = (1-t)p(y)f(K) - C^R(\xi)\,\Phi + (t-\tau)R(K) - \left[(1-bt)r + (1-t)C^E(b)\right]K - F.$$

where the argument $\xi = R^\alpha(K)/\Phi$ of the concealment cost function depends on the chosen transfer pricing method as defined in equations (1) and (2). In order to preserve a well-behaved decision problem under all market structures, we assume that the MNC has positive net costs, i.e., the tax benefits from profit shifting do not outweigh the financing costs.

The MNC's first-order condition for a tax-efficient royalty structure is given by

$$t - \tau - C^R_\xi \frac{\partial \xi}{\partial R^\alpha(K)} \Phi = 0 \quad \Rightarrow \quad t - \tau = C^R_\xi, \tag{3}$$

for any transfer pricing method. In the optimum, the abusive part of the royalty payment function $R^\alpha(K)$ is chosen such that marginal tax savings $(t-\tau)$ equal marginal expected concealment costs. Condition (3) shows that it is not profitable to shift profits to affiliate B if $\tau > t$. In this case the MNC sets $R = 0$, which implies $R^\alpha = -R^\beta$ and $C^R(\xi) = C^R_\xi = 0$. If $\tau = t$, then $R^\alpha \in (-R^\beta, 0)$, implying $C^R_\xi = 0$. Therefore, we restrict our analysis to the case of $\tau \leq t$.[15] This also implies that in optimum $R^\alpha(K) \geq 0$.

Optimal leverage is determined by

$$\left[tr - (1-t)C^E_b\right]K = 0 \quad \Leftrightarrow \quad \frac{tr}{1-t} = C^E_b, \tag{4}$$

[15] We assume that a negative tax base does not lead to a tax credit (i.e., tax payments are truncated at zero and cannot become negative).

where C_b^E represents the partial derivative of the agency cost function with respect to b. Hence, the firm sets its leverage such that the benefit of the marginal debt tax shield equals the marginal agency costs related to debt. This finding simply reproduces the standard trade-off theory in corporate finance that dates back to Kraus and Litzenberger (1973), and optimal leverage is not affected by the choice of transfer pricing methods either.

Optimal capital investment K follows from

$$(1-t)\left[p_y f(K)+p(y)\right] f_K+\left[C_\xi^R \xi-C^R(\xi)\right] \frac{\partial \Phi}{\partial K}-C_\xi^R R_K^\alpha+(t-\tau)\left(R_K^\alpha+R_K^\beta\right) = (1-bt)r+(1-t)C^E(b). \quad (5)$$

In general, abusive transfer pricing in intangibles can have an effect on the intensive investment margin, depending on the audit characteristic ξ and the derivative $\partial\Phi/\partial K$, and unambiguous conclusions are impossible. In the following two subsections, therefore, we impose some more structure on concealment costs by using equations (1) and (2), and evaluate investment incentives under different transfer pricing methods that are proposed by the OECD.

3.1 Standard Regulation based on Comparable Transactions

Assuming that comparable unrelated transactions can be observed (i.e., comparables exist) and that the tax authority applies one of the traditional approaches, the Comparable Unrelated Price, the Cost Plus, or the Transactional Net Margin Method, the concealment cost function will take the form $C^R(\xi)\Phi = C^R(R^\alpha(K))$ with $\xi = R^\alpha(K)$ and $\Phi = 1$, see equation (1).

When we insert equation (3) into equation (5) and also apply $\partial\Phi/\partial K = 0$, the first-order condition for optimal capital investment K simplifies to

$$(1-t)\left[p_y f(K)+p(y)\right] f_K+(t-\tau)R_K^\beta = (1-bt)r+(1-t)C^E(b). \quad (6)$$

The first-order condition states that after tax marginal costs of capital (the RHS) should equal the marginal after-tax benefits of investing in capital (the LHS). The first term on the left hand side shows the marginal after-tax productivity of capital, whereas the second term shows the marginal net after-tax benefit of shifting income at arm's length to the tax-haven affiliate. Because $R_K^\beta > 0$, the latter term on the left hand side is positive if $t > \tau$, inducing the affiliate to invest more capital. Because the equation is independent of R^α, we can state:

Proposition 1 *Abusive royalty payments (R^α) in intangibles do not affect the level of capital investment (K) if the tax authorities base their audits on one of the OECD trans-*

fer pricing methods that rely on comparable transactions, that is, on the Comparable Unrelated Price, Transactional Net Margin, or Cost Plus Method.

The MNC chooses the abusive royalty payment structure by equating marginal tax savings to marginal cost of the fine. Therefore, a change in the abusive rate R^α does not affect any of the margins that determine optimal investment in capital. Hence, if an MNC operates an affiliate or decides to open an affiliate, the amount of capital investment in this affiliate (i.e., the intensive investment margin) does not depend on royalty payments and tax savings from abusive profit shifting.

Note that Proposition 1 does not depend on the degree of market power of the MNC. This result is related to San Martin and Saracho (2010) who show that the royalty structure matters for the outcome of competition. We show that market structure does not matter for the abusive part of the royalty rate structure in the sense that MNCs with a low level of market power are not more likely to use abusive transfer pricing to gain a competitive advantage than MNCs with more market power.

3.2 No Comparable Transactions: Transactional Profit Split Method

If comparable unrelated transactions cannot be observed and the tax authorities apply the Transactional Profit Split Method, the concealment cost function takes the form $C^R = C^R(\xi)\hat{\Pi}$, where $\xi = R^\alpha(K)/\Phi$ and $\Phi = \hat{\Pi}$, see equation (2), and transactional profits are given by consolidated operating profits $\hat{\Pi} = p(y)f(K) - F$.

Applying equation (3) in equation (5) once more, the first-order condition for optimal capital investment K now turns into

$$(1-t)\left[p_y f(K) + p(y)\right] f_K + (t-\tau)R_K^\beta + \left[(t-\tau)\xi - C^R(\xi)\right]\frac{\partial\hat{\Pi}}{\partial K} \\ = (1-bt)r + (1-t)C^E(b). \qquad (7)$$

Different from the standard regulation methods described under Proposition 1, abusive transfer pricing will affect capital investment under the transaction profit split method. Comparing equation (7) to the investment condition (6) in the previous subsection, we see that capital investment triggers an additional marginal payoff $\left[(t-\tau)\xi - C^R(\xi)\right]\frac{\partial\hat{\Pi}}{\partial K} > 0$, while all other terms remain the same. The additional term is always positive, because $C^R(\xi)$ is strictly convex in $\xi = R^\alpha/\hat{\Pi}$ for any $\xi \geq 0$ so that $(t-\tau)\xi = C_\xi^R \xi > C^R(\xi)$, and $\partial\hat{\Pi}/\partial K = [p_y f(K) + p(y)]f_K > 0$.[16] Consequently, the Transactional Profit Split Method triggers higher investment than the standard methods, all else equal.

[16]For price-taking MNCs, the latter condition is trivial and boils down to $\partial\hat{\Pi}/\partial K = f_K > 0$. For MNCs with market power, facing $p_y < 0$, the assumptions of a non-convex arm's length royalty component and positive net costs are sufficient to ensure $\partial\hat{\Pi}/\partial K > 0$.

The positive investment effect works via the marginal change in transactional profit and concealment costs of transfer pricing. Higher capital investment increases transactional profits. Because $C^R(\xi)$ is strictly convex in $\xi = R^\alpha/\hat{\Pi} \geq 0$, higher transactional profits reduce total concealment costs of transfer pricing $C^R = C^R(\xi)\hat{\Pi}$. Put together, by increasing its investment, the MNC can manipulate the audit characteristic under the Transactional Profit Split Method and ease its concealment costs in order to shift more profits via abusive royalty payments.

We summarize as

Proposition 2 *If tax authorities apply the transactional profit split method, abusive royalty payments R^α trigger a positive incentive effect on capital investment. Capital investment is used to increase transactional profits, and by this, manipulate the audit characteristic and reduce total concealment costs of profit shifting.*

From Propositions 1 and 2 follows that the Transactional Profit Split Method counters the standard corporate tax distortion on capital investment, but also allows for higher profit shifting. In the next section, we analyze the implications of the different regulation methods for attempts to reduce profit shifting via royalty taxation.

4 The Impact of Royalty Taxes

In the continuation, we restrict our analysis without loss of generality to a price-taking firm, $p(y) = p$, and a price normalized to one, $p = 1$. First, we focus on the case in which comparable transactions can be observed so that the tax authorities can apply the standard transfer pricing methods and Proposition 1 holds. Then, we analyze the Transactional Profit Split Method.

4.1 Effects under Standard Regulation based on Comparable Transactions

Let $\mu = (t - \tau)$ denote the net deductibility rate of the royalty payment in affiliate A, where $\mu \in [0, t]$. We can now restate the first-order conditions as

$$R^\alpha: \qquad \mu = C^R_\xi, \tag{8}$$

$$b: \qquad \frac{tr}{1-t} = C^E_b, \tag{9}$$

$$K: \qquad f_K(1-t) + \mu R^\beta_K = (1-bt)r + (1-t)C^E(b). \tag{10}$$

Note that this is a disjunct system and that the first-order conditions can be treated separately as long as Proposition 1 holds and abusive transfer pricing does not affect capital investment. Equation (10) can be rearranged to identify the corporate tax wedge (CTW) as

$$f_K - r = \frac{tr(1-b) + (1-t)C^E(b) - \mu R_K^\beta}{1-t} = CTW \gtrless 0. \tag{11}$$

We see that the sign of the corporate tax wedge depends on the level of deductibility of financing costs b and the net deductibility rate μ of the marginal arm's length royalty payments R_K^β. Effective capital costs are thus given by $r + CTW$. Notice that $CTW = 0$ if $R_K^\beta = 0$ and all financial costs are tax deductible. However, as noted in our set up of the model, most arm's length royalty rates are dependent on sales or sales revenue so that $R_K^\beta > 0$. It also implies that the tax wedge is not unambiguously negative, as is the case in standard models of corporate taxation.

One important insight directly follows from the corporate tax wedge in equation (11). A corporate tax system with allowance for corporate equity (ACE) that allows to deduct the normal rate of return on equity, besides interest deductibility of debt, leads to a negative tax wedge whenever there is some net deductibility of royalty payments $\mu > 0$ and the arm's length royalty payment is not a fixed payment, but depends on sales so that $R_K^\beta > 0$. It is straightforward to show that an ACE system implies equal tax treatment of equity and debt so that the MNC chooses its leverage to minimize agency costs. Consequently, $b = b^* = \text{argmin } C^E(b)$, $C^E(b^*) = 0$, and the corporate tax wedge becomes $CTW = -\frac{\mu R_K^\beta}{1-t} \leq 0$ as all capital costs are deductible, independent of leverage. Hence,

Proposition 3 *In the presence of sales-dependent arm's length royalty payments ($R_K^\beta > 0$), a corporate tax system with an allowance for corporate equity (ACE) is investment neutral if and only if royalty taxation ensures that the net deductibility of royalty expenses is zero ($\mu = 0$). Whenever the royalty tax rate is lower than the corporate tax rate ($\mu > 0$), an ACE system induces overinvestment in capital.*

While an ACE system shelters the normal rate of return from corporate taxation, the deductibility of royalty payments that are not fixed but depend on revenues or output still gives incentives to increase capital investment in order to lower the corporate tax burden. The resulting investment inefficiency can only be avoided by introducing a royalty tax rate at the same rate as the corporate tax rate.

We expect the findings in Proposition 3 to gain relevance for two reasons. First, MNCs in the digital economy such as Google and Apple are growing and make extensive use of royalty payments. Second, several EU countries have introduced ACE-like systems (e.g., Belgium and Italy) or partial ACE systems (e.g., Estonia) in recent years and the EU commission is evaluating the experience with and scope of such cash-flow taxation (European Commission, 2015). At the same time, the EU still bans royalty taxation for payments between states within the European Economic Area.

Turning to a conventional OECD corporate tax system and investigating the effects of taxes on capital investment therein, we totally differentiate the first-order condition (10) with respect to t and the net deductibility rate μ, and obtain[17]

$$\frac{dK}{dt} = \frac{f_K - br - C^E(b)}{\frac{d^2\Pi}{dK^2}} = \frac{(1-b)r - \mu R_K^\beta}{(1-t)^2 f_{KK} + (1-t)\,\mu R_{KK}^\beta} \gtrless 0, \tag{12}$$

$$\frac{dK}{d\mu} = -\frac{R_K^\beta}{\frac{d^2\Pi}{dK^2}} = -\frac{R_K^\beta}{(1-t)\,f_{KK} + \mu R_{KK}^\beta} \geq 0. \tag{13}$$

If equation (12) is negative, the standard corporate tax distortion from the non-deductibility of equity costs dominates. In contrast, if $dK/dt > 0$, the MNC overinvests in capital ($f_K < r$). This can happen if the subsidy on investment from the royalty fee ($\mu > 0$) is large and the MNC is financed mostly by debt (b is large) so most of the financing costs are tax deductible. In this case, the tax burden on marginal revenue f_K is lower than the tax savings from deducting additional capital costs $br + C^E(b)$.

Equation (13) states that when the deductibility rate of the royalty rate (μ) increases (so either t rises or τ falls), capital investment increases as long as the royalty payment is not a lump-sum fee, but depends on sales or revenues so that $R_K^\beta > 0$. This investment effect results because the MNC can deduct a larger share of the arm's length transfer price on intellectual property when production is expanded.

The effects of changes in t and μ on the absolute amount of abusive transfer pricing R^α follow as:

$$\frac{dR^\alpha}{dt} = 0, \qquad \frac{dR^\alpha}{d\mu} = \frac{1}{C_{\xi\xi}^R} > 0. \tag{14}$$

Total profit shifting is not affected by corporate taxation (as long as the deductibility rate μ is constant), but increases with tax deductibility of royalty payments. For a constant net deductibility rate μ, an increase in the corporate tax does not provide any incentive to change total profit shifting R^α. On the contrary, a higher deductibility rate μ (e.g., a lower royalty tax rate) sets incentives for larger profit shifting, increasing R^α.

With respect to the financial structure, a higher corporate tax increases the debt tax shield and gives an incentive to leverage up the MNC, whereas the deductibility rate of royalty payments does not affect the trade-off between the debt tax shield and the

[17] Note that the full effect of a change in the corporate tax rate is given by

$$\frac{dK}{dt} = \frac{\partial K}{dt}_{\big|\triangle\mu=0} + \frac{\partial K}{\partial\mu}\underbrace{\frac{\partial\mu}{\partial t}}_{=1}.$$

marginal agency costs of debt:

$$\frac{db}{dt} = \frac{r}{(1-t)^2 C^E_{bb}} = \frac{r + C^E_b}{(1-t) C^E_{bb}} > 0, \qquad \frac{db}{d\mu} = 0. \tag{15}$$

To summarize the effects of royalty taxation under a conventional OECD corporate tax system with a standard arm's length regulation according to Proposition 1, a higher royalty tax rate will reduce profit shifting in intellectual property rights and immaterial goods and will not affect the financial structure of MNCs, but it will reduce capital investment whenever the royalty tax falls on a positive arm's length royalty payment that depends on the level of production or sales revenues.

4.2 Implications of the Transactional Profit Split Method

Compared to the standard methods discussed in the previous subsection, the effects of taxation on capital investment and abusive royalty payments become more complex under the Transactional Profit Split Method, because the level of capital investment becomes a profit-shifting device as investment affects transactional profits which constitute a key determinant for concealment costs of profit shifting.

The first-order condition for capital investment turns into

$$(1-t) f_K + \left[\mu\xi - C^R(\xi)\right] \frac{\partial \hat{\Pi}}{\partial K} + \mu R^\beta_K - \left[(1-bt)r + (1-t)C^E(b)\right] = 0, \tag{16}$$

where $\hat{\Pi} = f(K) - F$ and $\partial\hat{\Pi}/\partial K = f_K > 0$, now. The corresponding corporate tax wedge under the transactional profit split method is given by

$$f_K - r = \frac{tr(1-b) + (1-t)C^E(b) - [\mu\xi - C^R(\xi)] - \mu R^\beta_K}{(1-t) + [\mu\xi - C^R(\xi)]} = CTW^{TPS} \gtrless 0. \tag{17}$$

Also for the Transactional Profit Split Method, the sign of the corporate tax wedge is ambiguous. As long as the costs related to non-deductibility of the return on equity are substantial, we will have a positive tax wedge and the traditional corporate tax distortion, leading to underinvestment, $f_K > r$, emerges. For MNCs with high leverage ratios b and low agency costs of debt $C^E(b)$, however, the marginal tax savings from abusive transfer pricing, $\mu\xi - C^R(\xi)$, plus the tax gain from the marginal arm's length royalty payment, μR^β_K, can dominate, and the corporate tax wedge becomes negative. In the latter case, the MNC will overinvest, $f_K < r$, because the corporate tax turns into an investment subsidy.

Comparing the tax wedge in equation (17) to the tax wedge under standard regulation, equation (11), we see that the additional effect in the numerator reduces the tax wedge (and makes overinvestment more likely) under the Transactional Profit Split Method, while the effect in the denominator buffers the tax wedge in (17) around zero. In sum, we have in principle $CTW > CTW^{TPS}$, all else equal. The reason is the additional tax savings generated from fostering transactional profits via higher capital investment, see the discussion before Proposition 2.

Once more, the effect of an ACE tax system is unambiguous and directly carries over from the previous subsection. ACE taxation implies a wedge $CTW^{TPS} = -\frac{[\mu\xi - C^R(\xi)] + \mu R_K^\beta}{1-t+[\mu\xi - C^R(\xi)]} < 0$ so that Proposition 3 also holds under the Transactional Profit Split Method.

Turning to the comparative statics, the effect of corporate taxation on the MNC's financial structure is identical to the case derived in equation (15) for standard methods, and we find[18]

$$\frac{db}{dt} = \frac{r}{(1-t)^2 C_{bb}^E} = \frac{r + C_b^E}{(1-t) C_{bb}^E} > 0, \qquad \frac{db}{d\mu} = 0. \tag{18}$$

In contrast, we observe an additional effect on the impact of the deductibility rate μ on the investment decision, which results as

$$\frac{dK}{d\mu} = -\frac{R_K^\beta + \xi \frac{\partial \hat{\Pi}}{\partial K}}{D_K} > 0, \tag{19}$$

where $D_K = \big(1 - t + [\mu\xi - C^R(\xi)]\big) f_{KK} + \mu R_{KK}^\beta < 0$ follows from the second-order conditions of firms' optimization. It implies that the function of arm's length royalty payments $R^\beta(K)$ must not be too convex.[19]

Just as under the standard methods, the positive direct effect works via higher tax savings from increased arm's length royalty payments ($R_K^\beta > 0$). In addition, this effect is fostered by an indirect effect stemming from the increase in transactional profits $\partial\hat{\Pi}/\partial K > 0$. Higher transactional profits reduce concealment costs and allow for more profit shifting, all else equal. Therefore, a higher deductibility rate μ unambiguously triggers higher capital investment, because an increase in μ renders profit shifting more profitable.

In contrast, higher corporate taxation (for a constant deductibility rate μ) has an ambiguous effect:

$$\frac{dK}{dt} = \frac{f_K - [br + C^E(b)]}{D_K} \gtrless 0. \tag{20}$$

This effect is equivalent to the impact of corporate taxation under the standard methods analyzed in section 4.1 and is not triggered by the use of transactional profits to determine arm's length pricing. As long as taxable marginal revenue is higher than the tax-deductible part $br + C^E(b)$ of total capital costs, the MNC will reduce investment in

[18] A formal derivation of all comparative static effects under the Transactional Profit Split Method is provided in Appendix A.

[19] Note that standard royalty payments are proportional to sales or revenues (see San Martin and Saracho, 2010), and therefore, rather concave in capital investment anyway.

response to a higher corporate tax rate. The reverse effect occurs if marginal productivity falls short of tax-deductible costs, because the corporate tax functions as an investment subsidy then.

Turning to abusive royalty payments, a change in the deductibility rate μ implies

$$\frac{dR^{\alpha}}{d\mu} = \frac{\hat{\Pi}}{C^{R}_{\xi\xi}} + \xi \frac{\partial \hat{\Pi}}{\partial K} \frac{dK}{d\mu} > 0. \tag{21}$$

The direct effect of a higher deductibility rate is equivalent to the impact under the standard methods in section 4.1. More deductibility (e.g., less royalty taxation) increases the tax savings from shifting profits and induces higher royalty payments. Under the Transactional Profit Split Method this direct effect is accompanied by an indirect effect via investment. The positive effect of tax deductibility on investment, $\partial K/\partial \mu > 0$, triggers larger transactional profits. The latter effect reduces concealment costs of transfer pricing, all else equal, and fosters further abusive royalty payments.

Two implications follow from this observation. First, the payoff of increasing or introducing royalty taxation in terms of reduced profit shifting is larger under the Transactional Profit Split Method than under the standard methods.[20] Second, a ban of royalty taxes (i.e., $\tau = 0$ and $\mu = t$), as for example imposed by current EU law, is more costly under the Transactional Profit Split Method in the sense of triggering higher profit shifting than the standard methods.

Turning to the impact of corporate taxation on profit shifting, holding the deductibility rate μ constant once more, we find

$$\frac{dR^{\alpha}}{dt} = \xi \frac{\partial \hat{\Pi}}{\partial K} \frac{dK}{dt} \gtrless 0, \tag{22}$$

where $\operatorname{sign}(dR^{\alpha}/dt) = \operatorname{sign}(dK/dt)$. This (indirect) effect is new compared to the standard methods in section 4.1. If corporate taxation reduces capital investment, transactional profits will fall and concealment costs of transfer pricing will rise. This hampers profit shifting, and the MNC will reduce its abusive royalty rate. In contrast, if corporate taxation acts as a subsidy on capital, higher investment fosters transactional profits and mitigates concealment costs. This then eases profit shifting, and the abusive royalty rate will be increased. Note that – as in the case of the standard methods – there is no direct effect, because the royalty tax rate τ adjusts implicitly in order to keep the deductibility rate μ constant.

To summarize the effects under a conventional OECD corporate tax system, the Transactional Profit Split Method potentially mitigates the corporate-tax distortion in investment (but might also induce overinvestment instead). The reason is that MNCs want to

[20]The price to be paid for this effect is reduced investment, however. But, the investment effect could be neutralized by granting some deductibility of equity costs if this is a concern for the tax authorities.

increase transactional profits and facilitate transfer pricing. Thus, the potentially beneficial effect on investment is rather achieved at the expense of higher profit shifting, because investment is chosen in such a way that concealment costs of abusive royalty payments are eased. Compared to standard methods, the effects of royalty taxation on royalty rates and capital investment (not on leverage, though) become more complex. Compared to standard methods, a higher royalty tax rate has a more negative effect on capital investment, but also features greater effectiveness in curbing profit shifting.

5 Conclusions

The OECD (2015a) worries that the digital economy both fosters profit shifting, because of mobile intangibles, and challenges the traditional transfer pricing regulation, because observable comparable transactions might no longer exist as the digital economy is characterized by integrated global value chains and a tendency to generate quasi-monopolies. In this paper, we have studied how multinational firms set royalty fees on intangible goods (intellectual property) and how this decision is affected by different transfer pricing rules. Furthermore, we studied how a source tax on royalty payments affects multinationals' behavior under different corporate tax systems.

A main finding of the analysis is that transfer pricing under the Comparable Uncontrolled Price Method, the Transactional Net Margin Method, and the Cost Plus Method does not affect the level of capital investment, i.e., the intensive investment margin. In contrast, audits contingent on the Transactional Profit Split Method allow for a manipulation of the audit characteristic by increased investment. Thus, by providing an additional investment incentive, the latter method mitigates the standard corporate tax distortion, but also results in higher profit shifting, all else equal, and might even trigger overinvestment in capital by multinationals.

These findings lend support to using the more direct approaches for transfer pricing audits, particularly the Comparable Unrelated Price Method. Only if an active tax discrimination in favor of multinational companies is desired, the Transactional Profit Split Method is the better choice. In all other cases, the more direct approaches remain preferable as long as comparable transactions can be observed, the corporate tax distortion should rather be countered by some tax deductibility of costs of equity, and the Transactional Profit Split Method needs to be combined with a source tax on royalty payments in order to control for the additional profit-shifting incentive. Under any transfer pricing regulation, royalty taxes are effective in reducing profit shifting, but will also reduce investment. For the more direct approaches, however, the negative investment effect only occurs to the extent that some tax burden falls on the arm's length royalty payments.

We also show that a corporate tax system based on the allowance for equity model (ACE) leads to overinvestment, whenever the tax on royalty is lower than the corporate tax rate. This finding holds for any of the OECD transfer pricing methods and documents that the ACE tax, despite its ability to achieve financing neutrality, in general does not guarantee investment neutrality when transfer pricing comes into play.

At least three major policy implications can be drawn from our findings. First, under all OECD transfer pricing methods except the Transactional Profit Split Method, royalty taxation is a very effective instrument to curb profit shifting in intangibles as long as the tax burden does not fall on the arm's length royalty payment. Thus, a (generous) royalty allowance, equivalent to an earnings-stripping rule for interest expenses, and a denial of tax deductibility of royalty payments that exceed a certain percentage of operating profits (EBIT or EBITDA) appear to be a promising policy measure. In addition, such a royalty-stripping rule would avoid that royalty taxes fall on purely domestic firms that we have neglected in our positive analysis. Analyzing the full implications and the optimal design of such a rule is beyond the scope of this paper, however, and is left for future research.

Second, the OECD should also incorporate royalty taxation into its analysis of effective profit-shifting reduction when it follows up on Actions 1 and 8-10 of the BEPS Action Plan by a deeper investigation (and potential promotion) of the Transactional Profit Split Method. Finally, if the EU should conclude from its evaluation of cash flow (or ACE) taxation (European Commission, 2015) that such a corporate tax system is preferable, the ban of royalty taxation for payments between member states of the European Economic Area needs to be reconsidered.

A Appendix: Comparative Static Effects under the Transactional Profit Split Method

Assuming $p(y) = p = 1$ and defining $\xi = R^\alpha(K)/\hat{\Pi}$ where transactional profits are given by $\hat{\Pi} = f(K)$, the first-order conditions for optimal firm behavior under the Transactional Profit Split Method can be summarized as

$$\begin{aligned}
(R^\alpha):&\ \ \mu = C^R_\xi \\
(b):&\ \ \frac{tr}{1-t} = C^E_b \\
(K):&\ \ (1-t)f_K + \left[\mu\xi - C^R(\xi)\right]\frac{\partial\hat{\Pi}}{\partial K} + \mu R^\beta_K - \left[(1-bt)r + (1-t)C^E(b)\right] = 0,
\end{aligned}$$

where we used $\mu = C^R_\xi$ from optimal royalty payments to rearrange the last equation and where $\frac{\partial\hat{\Pi}}{\partial K} = f_K$.

Totally differentiating the set of first-order conditions delivers

$$C^R_{\xi\xi}\left(dR^\alpha - \xi\frac{\partial\hat{\Pi}}{\partial K}dK\right) = \hat{\Pi}d\mu,$$
$$C^E_{bb}db = \frac{r}{(1-t)^2}dt,$$
$$\left\{f_K - [br + C^E(b)]\right\}dt - \left(\xi\frac{\partial\hat{\Pi}}{\partial K} + R^\beta_K\right)d\mu = \underbrace{\left(\mu - C^R_\xi\right)}_{\overset{(R^\alpha)}{=}0}\frac{\partial\hat{\Pi}/\partial K}{\hat{\Pi}}dR^\alpha + \underbrace{\left[tr - (1-t)C^E_b\right]}_{\overset{(b)}{=}0}db$$
$$+\left\{(1-t)f_{KK} + \underbrace{\left[\mu - C^R_\xi\right]}_{\overset{(R^\alpha)}{=}0}\frac{\partial\xi}{\partial K}\frac{\partial\hat{\Pi}}{\partial K} + \left[\mu\xi - C^R(\xi)\right]f_{KK} + \mu R^\beta_{KK}\right\}dK.$$

Simplifying the system results in

$$dR^\alpha = \frac{\hat{\Pi}}{C^R_{\xi\xi}}\,d\mu + \xi\frac{\partial\hat{\Pi}}{\partial K}\,dK, \tag{A.1}$$
$$db = \frac{r}{(1-t)^2C^E_{bb}}\,dt, \tag{A.2}$$
$$D_K dK = \left\{f_K - [br + C^E(b)]\right\}dt - \left(\xi\frac{\partial\hat{\Pi}}{\partial K} + R^\beta_K\right)d\mu, \tag{A.3}$$

where $D_K = \left(1 - t + [\mu\xi - C^R(\xi)]\right)f_{KK} + \mu R^\beta_{KK} < 0$ follows from the second-order conditions of the MNC's optimization.

From equation (A.2), the first set of results immediately follows as

$$\frac{db}{d\mu} = 0 \quad \text{and} \quad \frac{db}{dt} = \frac{r}{(1-t)^2C^E_{bb}} = \frac{r + C^E_b}{(1-t)C^E_{bb}} > 0. \tag{A.4}$$

Furthermore, from equation (A.3), we can establish the next set of results as

$$\frac{dK}{d\mu} = -\frac{R^\beta_K + \xi\frac{\partial\hat{\Pi}}{\partial K}}{D_K} > 0, \tag{A.5}$$
$$\frac{dK}{dt} = \frac{f_K - [br + C^E(b)]}{D_K} \gtrless 0, \tag{A.6}$$

as $\frac{\partial\hat{\Pi}}{\partial K} = f_K > 0$.

Finally, when we utilize equations (A.5) and (A.6) in equation (A.1), the last set of results reads

$$\frac{dR^{\alpha}}{d\mu} = \frac{\hat{\Pi}}{C^{R}_{\xi\xi}} + \xi\frac{\partial\hat{\Pi}}{\partial K}\frac{dK}{d\mu} > 0, \tag{A.7}$$

$$\frac{dR^{\alpha}}{dt} = \xi\frac{\partial\hat{\Pi}}{\partial K}\frac{dK}{dt} \gtrless 0, \tag{A.8}$$

where $\text{sign}\,(dR^{\alpha}/dt) = \text{sign}\,(dK/dt)$.

References

DELOITTE (2015) Withholding Tax Rates 2015, https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-withholding-tax-rates.pdf.

DESAI, A.M., C.F. FOLEY, and J.R. HINES (2006) Do tax havens divert economic activity? *Economics Letters* **90**, 219–224.

DISCHINGER, M., and N. RIEDEL (2014) Corporate taxes and the location of intangible assets within multinational firms, *Journal of Public Economics* **95**, 691–707.

EUROPEAN COMMISSION (2015) Experiences with cash-flow taxation and prospects – Final report. Taxation Papers Working Paper N. 55-2015, Brussels.

EUROSTAT (2015) *Taxation trends in the European Union.* Eurostat Statistical Books. Luxembourg: Publications Office of the European Union.

FINKE, K., C. FUEST, H. NUSSER, and C. SPENGEL (2014) Extending taxation of interest and royalty income at source – An option to limit base erosion and profit shifting? ZEW-Centre for European Economic Research Discussion Paper 14-073, Mannheim.

FUEST, C., C. SPENGEL, K. FINKE, J.H. HECKEMEYER, and H. NUSSER (2013) Profit shifting and 'aggressive' tax planning by multinational firms: Issues and options for reform, *World Tax Journal* **5(3)**, 26. September 2013.

GRESIK, T., and P. OSMUNDSEN (2008) Transfer pricing in vertically integrated industries, *International Tax and Public Finance* **15**, 231–255.

HALPERIN, R., and B. SRINIDHI (1987) The effects of the U.S. income tax regulations' transfer pricing rules on allocative efficiency, *The Accounting Review* **62**, 686–706.

HAUFLER, A., and G. SCHJELDERUP (2000) Corporate tax systems and cross country profit shifting, *Oxford Economic Papers* **52**, 306–325.

HOVAKIMIAN, A., G. HOVAKIMIAN, and H. THERANIAN (2004) Determinants of target capital structure: The case of dual debt and equity issues, *Journal of Financial Economics* **71**, 517–540.

HUIZINGA, H., LAEVEN, L., and G. NICODEME (2008) Capital structure and international debt-shifting, *Journal of Financial Economics* **88**, 80–118.

KANT, C. (1988) Endogenous transfer pricing and the effects of uncertain regulation, *Journal of International Economics* **24**, 147–157.

KARKINSKY, T., and N. RIEDEL (2012) Corporate taxation and the choice of patent location within multinational firms, *Journal of International Economics* **88**, 176–185.

KRAUS, A., and R.H. LITZENBERGER (1973) A state-preference model of optimal financial leverage, *Journal of Finance* **28**, 911–922.

MUTTI, J., and H. GRUBERT (2009) The effect of taxes on royalties and the migration of intangible assets abroad. In: International trade in services and intangibles in the era of globalization. Chicago, IL: University of Chicago Press, 111–137.

NOU (2014) Kapitalbeskatning i en internasjonal økonomi. Norges offentlige utredninger NOU2014:13, Oslo.

OECD (2010) *OECD Transfer pricing guidelines for multinational enterprises and tax administrations 2010.* Paris: OECD Publishing.

OECD (2015a) *Addressing the tax challenges of the digital economy, Action 1 - 2015 Final report, OECD/G20 Base erosion and profit shifting project.* Paris: OECD Publishing. http://dx.doi.org/10.1787/9789264241046-en

OECD (2015b) *Aligning transfer pricing outcomes with value creation, Actions 8-10 - 2015 Final report, OECD/G20 Base erosion and profit shifting project.* Paris: OECD Publishing. http://dx.doi.org/10.1787/9789264241244-en

SAN MARTIN, M., and A.I. SARACHO (2010) Royalty licensing, *Economics Letters* **107**, 284–287.

SANSING, R. (1999) Relationship-specific investments and the transfer pricing paradox. *Review of Accounting Studies* **4**, 119–134.

Country	Corporate tax rate (in percent)	Source tax on royalty payments (in percent)	Country	Corporate tax rate (in percent)	Source tax on royalty payments (in percent)
Austria	25.0	20.0	Latvia	15.0	0.0
Belgium	34.0	25.0	Lithuania	15.0	10.0
Bulgaria	10.0	10.0	Luxembourg	29.2	0.0
Croatia	20.0	15.0	Malta	35.0	0.0
Cyprus	12.5	10.0	Netherlands	25.0	0.0
Czech Republic	19.0	15.0[a]	Norway	27.0	0.0
Denmark	23.5	25.0	Poland	19.0	20.0
Estonia	20.0	10.0	Portugal	29.5	25.0[a]
Finland	20.0	20.0	Romania	16.0	16.0
France	38.0	33.33[b]	Slovenia	17.0	15.0
Germany	30.2	15.0	Slovakia	22.0	19.0[a]
Greece	29.0	20.0	Spain	28.0	24.0
Hungary	20.6	0.0	Sweden	22.0	0.0
Ireland	12.5	20.0	U.K.	20.0	20.0
Italy	31.4	30.0	Canada	26.5	25.0
Iceland	20.0	20.0	U.S.	40.0	30.0

[a] 35.0 if payment to a tax haven; [b] 75.0 if payment to a tax haven

Source: Corporate tax rates: Eurostat (2015, p. 144); Royalty taxes: Deloitte (2015)

Table 1: Taxes on royalty payments for European countries, Canada and the U.S., 2015