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Abstract

The employment of capital is rival in nature. Small countries do not benefit from taxing its employment. By contrast, the use of digital services is non-rival and small countries do benefit from taxing expenditures on such services. In fact, some countries have already decided to tax digital activities. If such practice spreads, the development of digital services is negatively affected. It is argued that countries exporting digital services have reason to respond by promoting an international tax regime in which the right of taxing the profit earned on the direct sales of digital services is split between the countries involved.

JEL-Codes: H250, M480.

Keywords: taxing digital services, import tax, tax exemption, profit splitting, Shapley value.

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1. Introduction

European policy makers see the fair and effective taxation of profits earned in the digital economy at risk (European Commission, 2017). One of the concerns being raised relates to the taxation of direct sales of digital services. Direct sales are carried out without relying on a permanent establishment in the customer's country of residence. The governing tax system assigns the right of taxing the profit earned on such sales to the seller's country of residence. This assignment has rarely ever been challenged in the academic literature. The merit, in that efficiency in global production is enhanced, seems to be too obvious. Still, European governments brought up the discussion in 2017 of whether it is fair and effective to extend the traditional assignment of taxing rights to the digital economy.

In March 2018, the European Commission (2018a) reacted to the discussion and proposed a new tax which covers the main digital activities that currently escape taxation in the EU. The new tax is explicitly intended to be an interim solution which is why it is called "interim tax" by the Commission. For the longer term, the Commission promotes a common reform of the EU's corporate tax rules for digital activities. This common reform can be characterized by two keywords: (i) the acknowledgment of a taxable digital presence and (ii) the introduction of the CCCTB. The acronym stands for the Common Consolidated Corporate Tax Base already proposed by the Commission in 2011 and 2015. The CCCTB amounts to unitary taxation of multinational enterprises (MNEs) and an apportionment of the MNEs' consolidated profit according to a formula weighting labor, capital (assets), and sales (Fuest, 2008, a.o.).

In this article, I provide an economic justification for a specific tax on business to business (B2B) digital services. The justification is derived from a positive-theoretic analysis of the participating countries' national interests. Small countries benefit from taxing digital services. This is quite different from what is known about capital taxation. A small country cannot benefit from taxing the employment of capital. The difference results from two distinguishing features: (i) the use of slightly deviant notions of smallness to be explained in Section 7 and (ii) the fact that the employment of capital is rival while the use of digital services is non-rival. The claimed efficiency of a unilateral tax on digital services may serve as an explanation for the increasing propensity of countries to tax digital businesses. Olbert and Spengel (2017) mention Australia, Hungary, India, Italy and the United Kingdom. The claimed efficiency may also be used to

provide support for the interim tax proposed by the European Commission, though some discrepancy between practice and theory remains. The interim tax is targeted at digital activities that currently escape taxation in the EU, while the claimed efficiency extends to all taxable digital services. Still, policy goes in the same direction.

If small countries choose to tax digital services and if the practice of taxing direct sales of services in the seller's country of residence is not changed, there will be a problem of double taxation. This problem is not easily overcome by simply calling upon the common interest. In the digital economy, there is a fundamental asymmetry in national interests dividing exporting and importing countries. Trade in digital services is far from being balanced. Digital R&D is not evenly spread throughout the world and costs to efficiency would be large if policy tried to impose a uniform spread. For reasons of technology, small countries suffer from a comparative disadvantage in commercializing digital services. This biases their stance on trade policy. If many small countries choose to tax the import of digital services and if the resulting double taxation is not mitigated, digital R&D is harmed and global production efficiency suffers.

In this paper, I argue that the countries exporting digital services have reason to react and to promote an international tax regime in which the right of taxing the profit earned on the direct sales of digital services is shared by the countries involved. The justification of such a profit split is not, however, based on positive-theoretic reasoning, only. As I argue, there are also normative reasons derived from an application of cooperative game theory to the analysis of inter-country tax equity. The Shapley theory suggests that the profit earned on direct sales of digital services should be split between the exporting and importing countries for the purpose of taxation. The reason is that both countries are needed to generate taxable profit: the exporting country provides services and the importing country provides the market – an idea vaguely expressed before by Hongler et al. (2015) and others. The two provisions are comparable insofar as neither entails positive costs at the margin. In the old economy, such symmetry does not hold: exports usually entail positive costs even at the margin.

If it is correct to expect that the forces of tax competition sustain profit splitting applied to the direct sales of digital services, the proposals made by the European Commission (2018a) for the longer term can and should be discarded. First, the concept of a digital presence is dispensable. The justification of profit splitting relies on lacking rivalry in use and not on the firm's verified

presence. Secondly, the arguments in favor of the CCCTB are critically weakened. The CCCTB and profit splitting depart in different directions. The application of profit splitting is restricted to the profit earned on exported services, while the CCCTB includes home profit in the allocation of the profit tax base. Furthermore, profit splitting is exogenous, while the CCCTB relies on formulary apportionment with endogenous weights. The Commission may well be right in arguing that the introduction of the CCCTB would help make profit taxation in the digital economy fairer, as the CCCTB uses sales for apportioning profit. The CCCTB however has significant disadvantages. As has been argued by Richter (2017), it lacks incentive compatibility in information exchange between participating countries, i.e., the tax authorities of countries in which costs are borne have an incentive to tolerate misreporting by resident MNEs. Another disadvantage is the lack of robustness to tax competition. Income division based on costs incentivizes MNEs to move cost-intensive activities to low-tax jurisdictions. This is particularly problematic when R&D is at stake. High-tax countries with strong R&D activities have good reason not to join the CCCTB system.

The paper is structured as follows. Section 2 briefly summarizes related literature. Section 3 introduces a simple model of a firm doing business at home and abroad. The analysis in Section 4 is normative, while the analyses in Sections 7 to 9 are positive. Section 4 applies the Shapley theory to the problem of assigning taxation rights. Section 5 explains why the practice of taxing the profit earned on direct sales exclusively in the seller's country of residence is supported under the conditions of the old economy. Section 6 argues that the absence of rivalry in the use of digital services gives reason to review the current practice. Section 7 analyzes the incentives of countries to tax the import of digital services when the supplier of services is assumed to be a price-taker. Section 8 extends the analysis to monopoly pricing. Section 9 discusses the case in which digital services are exported from a high-tax country. It is argued that such a country has reason to negotiate over internationally coordinated profit splitting. The main reason is that profit splitting provides resilience against tax competition. Section 10 concludes.

2. Related literature

Thus far, academic experts have been largely dismissive of the European Commission's (2018a) proposals for fair taxation of the digital economy. Becker and Englisch (2018) headline: "a populist and flawed proposal". Schön (2018) is less dismissive but also critical. Devereux and Vella (2017) take a more fundamental perspective and argue against any attempt at "ring-fencing" the digital economy. The present paper does not, however, recommend taxing the digital and the old economies differently as such. Rather, it argues that the lack of rivalry in the use of services be a key determinant in the international taxation of profit.

The Commission's proposals to acknowledge a digital presence of firms and to introduce an interim tax build on discussions which have earlier been conducted as part of the OECD/G20 Base Erosion and Profit Shifting (BEPS) Project (OECD, 2015). Among the options discussed under the BEPS Action Plan 1 are a new nexus in the form of a "significant economic presence" and the introduction of an "equalisation levy" to be applicable to specified digital services. However, in the final reports (OECD, 2015), none of these or further options are recommended. The idea to complement a firm's physical presence by a firm's digital presence is promoted by Hongler and Pistone (2015). A closer look at digital business models, value creation, and tax consequences is taken by Olbert and Spengel (2017).

There is extensive literature on the use of the profit split method when applying arm's length pricing to controlled transactions carried out between related parties. See OECD (2017). The common understanding, however, deviates from the specific understanding promoted in this paper. First, profit splitting is discussed in this paper as an option for taxing the profit earned on uncontrolled transactions. Second, the splitting is meant to be fully exogenous. No attempt is made to measure relative contributions of the involved parties, since splitting is only applied to profit earned on digital services, which are supplied at zero marginal cost.

The proposal to apply profit splitting to income earned on direct sales of digital services is structurally related to the proposal in Richter (2017) to apply profit splitting to income earned with intellectual property (IP). The connection to the present paper is the following: IP and digital services share the characteristic that their use is non-rival and they are distinguished by the need for a permanent establishment in the receiving country when exporting IP and not when delivering digital services.

Gonnet et al. (2007) and Vögele et al. (2008) were the first to to use the Shapley value for assigning taxing rights. These authors, however, fail to draw specific conclusions. By contrast, Richter (2017) uses the Shapley value to make a case for splitting the profit earned with imported IP.

Before proceeding, the narrow scope of the analysis has to be stressed. This paper's main objective is to establish the lack of rivalry in the use of digital services as a reason for reconsidering the taxation of direct sales. To be clear, the questions raised by taxing electronic commerce internationally go far beyond the scope of questions analyzed in the present paper. In particular, the paper does not address the challenges raised when including electronic commerce in a system of sales taxation or VAT. See McLure (2000b and 2003) and Ligthart (2004) on this. The question of how to tax MNEs in the digital economy (McLure, 2000a; Richter, 2017), is also not addressed. The focus is solely on the taxation of profits earned from direct sales. Earning a profit from direct sales implies that the services are provided in return for payment. Even here, the discussion is limited to B2B transactions. Sales to consumers are ignored, as the recommended profit split can only be implemented when business partners are subjected to profit tax accounting. The example of digital services most appropriate to this paper's analysis is the provision of advertising space for targeted marketing messages.

3. A model of direct sales

For simplicity's sake, the world is divided into two countries. One is home and the other is abroad. The focus is on a firm residing in home and producing goods or services to be sold at home and abroad. Foreign sales are direct sales from home and are made without having a permanent establishment in the foreign country. In the base model, the firm is a price taker. The role of market power in the new economy is analyzed in Section 8. Assuming price-taking behavior and normalizing product prices to one, allows equating revenues with quantities sold. Let X denote sales made at home and let x denote sales made abroad. Production is in home and requires two factor inputs, one being rival in use and the other being non-rival. The rival factor is labor. An equally valid interpretation would be land or capital. L_h is labor used to service the home market and L_a is labor used to service the market abroad. L_Q is labor used to produce the non-rival factor, Q, interpreted as service quality. Total supply of labor is denoted by $\mathcal{L}$. Market

clearing requires $\mathcal{L} = L_h + L_a + L_Q$. The supply of labor is fixed while the supply of quality is variable; it is the output of R&D. The non-labor cost of R&D is denoted by $C(Q, L_Q)$. A global tax planner would maximize *production efficiency*. This means that (s)he maximizes producer surplus,

$$\Pi(Q, L_h, L_a, L_Q) \equiv X(Q, L_h) + x(Q, L_a) - C(Q, L_Q) \text{ in } Q, L_h, L_a, L_Q, \quad (1)$$

subject to the labor market clearing condition. Let the maximum be denoted by $\Pi^* = \Pi(Q^*, L_h^*, L_a^*, L_Q^*)$. The maximization is assumed to be well-behaved. This means, in particular, that the revenue functions X and x are increasing and concave. By contrast, the cost function is increasing and convex in Q while decreasing and concave in L_Q. Any increase in quality is costly while the non-labor cost of producing some given amount of Q is reduced at decreasing increments when the input of labor is increased.

The *old economy* is modelled by assuming the rival factor labor to be an essential factor for servicing product markets. This means that the derivatives X_L, x_L and the efficient quantities L_h^*, L_a^* are positive. In the *new economy* it is assumed that the rival factor is not needed to service markets. Hence, $X_L = x_L \equiv 0$ and $L_h^* = L_a^* = 0$. Thus, all labor goes into the production of quality, $\mathcal{L} = L_Q^*$.

The first-order conditions associated with the maximization of eq. (1) are

$$X_Q + x_Q = C_Q \text{ and} \quad (2a)$$

$$X_L = x_L = -C_L \, . \quad (2b)$$

In connection with functions, subscripts indicate partial derivaties. Condition (2a) requires the sum of marginal productivities to equal the marginal cost of quality; this is Samuelson's rule. Condition (2b) says that the marginal product of labor is equal for all uses. In the model of the new economy, equation (2b) is dropped.

According to the governing international tax system, direct sales are taxed in the seller's country of residence. The advantage of this practice is that it secures efficiency in production. The firm has reason to ignore taxes. Maximizing profit after tax is equivalent to maximizing profit before

tax. From the perspective of inter-country (tax) equity it is, however, less obvious why direct sales should only be taxed in the seller's country of residence. This is shown next.

4. Inter-country tax equity

Equity judgements are notoriously debatable. Arbitrariness can only be avoided by adopting rules that individuals would agree upon behind a veil of ignorance. The Shapley value of cooperative game theory fulfills such a requirement. In what follows, it is applied to the problem of dividing the profit-tax base between home and abroad. Before doing so, some further notation has to be introduced.

A cooperative game consists of a set of players and a characteristic function specifying for each subset of players the value v these players are able to create by concerted action. In the present context, the countries take the role of the players and taxable income takes the role of value (Richter, 2017). On a stand-alone basis, the value created by home is $v(home) \equiv \overline{\Pi} = \max[X(Q,L) - C(Q,\mathcal{L}-L)]$ and the value created abroad is $v(abroad) \equiv 0$. The foreign country must forego the firm's supply of goods and services if it stands alone. If home and abroad cooperate, they form a so-called grand coalition. Its value is $v(home, abroad) \equiv \Pi^*$. Shapley's proposal is to divide the value of the grand coalition among the players according to the average marginal value each player contributes when joining the grand coalition in a random order. When applied to the foreign country, this implies the following: With a probability of one half, the foreign country joins the grand coalition before home does; the marginal contribution is zero in this case. With an equal probability of one half, abroad joins the grand coalition after home and its marginal contribution is $v(home, abroad) - v(home)$. According to Shapley, taxable income should be divided between home and abroad in such a way that the following amount of b is apportioned to abroad:

$$b \equiv \tfrac{1}{2}(\Pi^* - \overline{\Pi})$$

$$= \tfrac{1}{2}[\big(X(Q^*, L_h^*) + x(Q^*, L_a^*) - C(Q^*, \mathcal{L} - L_h^* - L_a^*)\big) - \big(X(\bar{Q}, \bar{L}) - C(\bar{Q}, \mathcal{L} - \bar{L})\big)]$$

$$= \tfrac{1}{2}[x(Q^*, L_a^*) - L_a^* X_L(\bar{Q}, \bar{L}) - \mathcal{E}]. \qquad (3)$$

The second equality follows from a Taylor Series expansion. Note that the terms $(Q^* - \bar{Q})[X_Q - C_Q]$ and $(L_h^* - \bar{L})[X_L + C_L]$ cancel. The last term in eq. (3), $\mathcal{E}$, has to be interpreted as an error term capturing derivatives of second and higher order of $X - C$. Because of the concavity and convexity assumptions $\mathcal{E}$ is necessarily non-negative. The other two terms in eq. (3), $x(Q^*, L_a^*)$ and $L_a^* X(\bar{Q}, \bar{L})) \equiv W L_a^*$, have to be interpreted as foreign revenues and (opportunity) costs of rival inputs, respectively. The difference between the two terms, $x(Q^*, L_a^*) - W L_a^*$, is *profit earned on direct sales*. If the error term $\mathcal{E}$ can be ignored, the Shapley value suggests that the profit earned on direct sales should be taxed such that the base is equally split between home and abroad. The rationale is that both countries are needed to generate profit abroad. Home provides service quality and the foreign country provides the market. Note that the profit earned on home sales is not split. This is so as home generates taxable income even when not cooperating with abroad.

In general, the error term $\mathcal{E}$ cannot be ignored. It can only be ignored if the vector of quantities $(Q^*, L_h^* + L_a^*)$ is close to the vector $(\bar{Q}, \bar{L})$ or if the second-order derivatives of $X - C$ are close to zero. The former case results when the foreign country has relatively small weight in the firm's global operations. The other case is obtained when home's value function is close to being linear. Economically speaking, $\mathcal{E}$ captures a *profit adjustment effect*. It can be interpreted as an external effect exerted on home's profit tax base when the firm increases its production in order to match extended operations abroad. The Shapley value suggests the need to compensate for the suffered externality. Note, however, that the profit adjustment effect will never be so large to justify a zero or even a negative value of b. If the foreign market promises any profit potential at all, then Π^* exceeds $\overline{\Pi}$ and b is positive.

Let us repeat the result. According to Shapley, inter-country equity suggests splitting the taxable income generated by direct sales between the countries involved. In principle, the foreign country should be apportioned a positive share in the taxable income which direct sales generate abroad.[1]

[1] Shapley theory suggests dividing taxable income such that $b = \frac{1}{2}(\Pi^* - \overline{\Pi})$ is assigned to the foreign country while $B = \frac{1}{2}(\Pi^* + \overline{\Pi})$ is assigned to home. The income assignment is the result of an equity consideration. The same division can be derived by a bargaining consideration. I.e., the same values of b and B result when maximizing the Nash product $(B - \overline{\Pi})b$ in B, b subject to the constraint $B + b = \Pi^*$. For the following reason, however, I prefer to draw on the Shapley theory when justifying the solution. If countries were assumed to bargain rationally on the division of taxable income, they would have to internalize the effect that the division has on the choice of tax rates

Clearly, if this rule were implemented, the world would have to pay a price in terms of efficiency. Profit maximization does not sustain global efficiency if the foreign return to R&D is taxed at a rate differing from the rate applied at home. To see this more clearly, assume that home profit is taxed at rate T and that foreign profit is taxed at rate t. If the profit earned on direct sales is perfectly split between home and abroad, it amounts to taxing the foreign profit contribution at an average rate of $(T+t)/2$. A firm assumed to be acting as a price taker on all markets will then maximize

$$(1-T)[\,X(Q,L_h)-C\big(Q,L_Q\big)-W(L_h+L_Q)]+(1-\tfrac{T+t}{2})[x(Q,L_a)-WL_a] \qquad (4)$$

in Q, L_h, L_a, L_Q. The first-order condition with respect to Q is

$$(1-T)\big[X_Q-C_Q\big]+\Big(1-\tfrac{T+t}{2}\Big)x_Q=0, \qquad (5)$$

which obviously conflicts with eq. (2a) whenever T deviates from t. R&D is effectively subsidized if $T>t$, and it is effectively taxed if $T<t$. Subsidization (taxation) results if foreign returns to R&D are taxed at a rate which is lower (higher) than the rate at which costs are offset at home.

5. The governing international tax system

There must be a reason why the governing international tax system does not prescribe splitting the profit earned from direct sales. The model draws attention to the following reasons.

A first one could be that the international order of taxation ranks global production efficiency higher than inter-country tax equity. As the international order of taxation is negotiated by governments in pursuit of their national interest, this kind of rationalization fails to convince.

More convincing is that governments are aware of the fact that direct sales are part of trade and that trade is a reciprocal activity. Inter-country equity is not achieved at the level of a particular firm but only in the aggregate. Imports are matched by exports. The tax base lost on imports is

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and, even more, on the private firm's production decision. That would considerably complicate the analysis with little hope of clear-cut results.

matched by gains on exports if the profit earned on direct sales is exclusively taxed in the seller's country of residence.

An even stronger reason in support of the governing tax system is informational. To understand this one has to take a closer look at eq. (3). In order to levy a tax on base $b = \frac{1}{2}[x(Q^*, L_a^*) - WL_a^* - \mathcal{E}]$, the foreign country would require information about the three bracketed items. However, only the first item, $x(Q^*, L_a^*)$, is readily available abroad. It stands for revenues from direct sales and it materializes in payments authorized by the foreign country. A comparable access to information is not available when the two remaining items have to be quantified. The profit adjustment effect, $\mathcal{E}$, has a technological basis. Allowing for it in taxation requires agreement between the involved governments. This may not be easy to reach and hardly worth the effort. As for the last term, WL_a^*, the foreign country would have to rely on truthful reporting by the firm and/or the home country. Such truthful reporting cannot, however, be taken for granted when home is a low-tax-country, $T < t$. In this case, the firm has an incentive to shift profit from abroad to home. This is achieved by overstating the attributable wage costs, WL_a^*. The problem is that home's government has an incentive to tolerate manipulations by which wage costs attributable to sales at home are declared to be wage costs attributable to sales abroad. This can be shown as follows.

Let Δ denote shifted wage costs. The firm's profit is

$$\Pi = (1-T)[\,X(Q, L_h) - C\big(Q, L_Q\big) - W\big(L_h + L_Q\big) + \Delta +$$

$$+\tfrac{1}{2}(x(Q, L_a) - WL_a + \mathcal{E} - \Delta)] + (1-t)\tfrac{1}{2}[x(Q, L_a) - WL_a - \mathcal{E} - \Delta)]. \qquad (6)$$

As $\frac{\partial \Pi}{\partial \Delta} = \frac{T+t}{2} - T > 0 \Leftrightarrow t > T$, profit after tax increases in shifted wage costs when home is a low-tax country. Equally, home's tax revenue $R \equiv T[X - C - W\big(L_h + L_Q\big) + \Delta + \frac{1}{2}(x - WL_a + \mathcal{E} - \Delta]$ increases in shifted wage costs: $\frac{\partial R}{\partial \Delta} = T(1 - \frac{1}{2}) > 0$.

Hence, high-tax countries have reason to be skeptical of splitting the profit earned on imports. In the old economy, they would have to deal with the problem of manipulated information; things are different in the new economy.

6. Direct sales of digital services

It has been argued that the characteristic feature of digital services is the lack of rivalry in use. This argument could be questioned by pointing out that energy, capital, and even labor are needed to maintain the infrastructure carrying digital services. However, the same argument can be raised by the foreign country. Profit potential is not just there. To do profitable business requires well-functioning markets and costly institutional infrastructure. Hence, it is only fair to discard rival costs on both sides. This may rightly change government attitudes toward inter-country tax equity for the following reasons.

First, the concern of high-tax countries that low-tax home countries might tolerate manipulations of rival cost assignments becomes meaningless. There are no wage costs attributable to provision which can be manipulated. Second, one may reasonably assume that the error term $\mathcal{E}$ becomes less important in the digital economy. The necessity to adjust R&D might well be weaker so that the difference between Q^* and $\bar{Q}$ is negligible. There is also reason to question the concavity of the profit contribution $X - C$. In fact, there is even empirical evidence that R&D productivity increases with scale (Ciftci et al., 2011). Third, and most important, governments might rightly question the symmetry of the distributional effects caused by the governing tax law. The governing tax law denies profit splitting on direct sales. When symmetry is secured, the lost tax base on imports is matched by gains on exports. In the digital economy, symmetry is, however, neither secured nor necessarily desirable, as the production of digital services has the characteristics of a natural monopoly. There are economies of scale and scope and there are network externalities. In addition, spillover effects in R&D bring about regional concentration. The emergence of regionally concentrated natural monopolies fosters growth and is even beneficial for the whole world. It would only harm global efficiency if the same kind of digital service were supplied by independent producers or if digital R&D were spread evenly throughout the world. For such reasons, balanced trade in digital services might be neither efficient nor competitively sustainable. All of this acts against symmetry. Countries importing digital services cannot and should not rely on the promise that they will have a fair chance to switch into the role of a future exporter of digital services. The bottom line of this reasoning is that the digital economy weakens the assumptions justifying the undivided assignment of the right to tax the

profit earned on direct sales to the seller's country of residence. This conclusion raises the question of how profit splitting can be implemented in practice.

7. Taxing the import of digital services

If rival costs are ignored, there is no reason to differentiate between revenue and profit contributions. Taxing foreign profits amounts to taxing the revenue, $x(Q^*)$, earned with direct sales. The Shapley theory suggests granting the right of taxing $b = \frac{1}{2}[x(Q^*) - \mathcal{E}]$ to the foreign country. Questions might be raised by the quantification of the error term, $\mathcal{E}$. As long as opposing arguments are lacking, $\mathcal{E}$ is reasonably assumed to be linearly increasing in foreign revenues. This is so as the error term will be small if foreign revenues are small and it will be large otherwise. This suggests setting $b \equiv \beta x(Q^*)$ and allowing governments to negotiate a specific value for $\beta \leq \frac{1}{2}$. In the absence of reliable empirical evidence in favour of something different, $\beta = 1/2$ might even make an appealing compromise.

Three straightforward options exist for implementing $b = \beta x(Q^*)$ as a tax base. Although their economic effects are largely equivalent, legal and institutional aspects suggest differentiating between them carefully. The first option is only academic. It requires home to share voluntarily the foreign profit-tax base $x(Q^*)$ with the foreign country. As this is against home's national interest and as the foreign country holds no nexus according to the governing tax law, one cannot expect this option to materialize.

The other two options assume that the foreign country takes unilateral action in levying a tax on the import of digital services. The first one amounts to levying a withholding tax of βt percent on payments ordered by foreign buyers of digital services. In the following discussion, preference is, however, given to the second option. This one amounts to constraining the extent to which the buyer of digital services can offset payments against own taxable profit. More precisely, the rule would be that just the fraction $(1 - \beta)$ of payments for digital services can be offset against the taxable profit earned by the buyer of the services. From home's perspective, $\beta x(Q^*)$ is profit earned and taxed abroad at rate t.

A priori, home has no reason to provide relief for taxes paid abroad. The result would, however, be unmitigated double taxation. Double taxation has a clear negative effect on production efficiency. This is easily seen when maximizing the firm's aggregate after tax profit in Q,

$$\Pi = (1-T)[\,X(Q) - C(Q,\mathcal{L}) - W\mathcal{L} + x(Q)] - t\beta x(Q)\,. \tag{7}$$

Let $Q = Q^d(\beta)$ solve the first-order condition, $(1-T)[\,X_Q - C_Q + x_Q] = t\beta x_Q$. It is straightforward to derive $X_Q + x_Q > C_Q$. The marginal return to R&D exceeds its marginal cost as is the case when R&D is taxed. Optimal R&D, $Q^d(\beta)$, decreases in β given that $x_Q > 0$. This follows from an application of the implicit function theorem to the first-order condition:

$$\frac{d}{d\beta}Q^d = tx_Q/D < 0, \tag{8}$$

where $D \equiv (1-T)[\,X_{QQ} - C_{QQ} + x_{QQ}] - t\beta x_{QQ}$ is negative because of the second-order condition.

Home and abroad both suffer from a reduction in Q. Other effects are not, however, equally shared. Home risks losing attractiveness as a location for doing R&D. By contrast, abroad enjoys the benefit of collecting revenue from taxing the import of digital services. *A priori*, it is not clear whether abroad benefits in balance. The answer to this question requires some closer inspection. In what follows, tax rates T and t are assumed to be exogenously fixed. The justification is that the choice of profit tax rates affects all sectors of production, while the present discussion is restricted to the taxation of profit earned by selling digital services.

As β is chosen abroad, the focus is on the effects an increase in β has on the welfare of abroad. This welfare is appropriately modelled by the sum of tax revenue and private sector income, $y(\beta) \equiv t\beta x\Big(Q^d(\beta)\Big) - e(Q^d(\beta))$. The first term, $t\beta x$, is tax revenue. The second term, $e(Q) \equiv \min\{\text{costs} \mid f(Q,\ldots) = \text{const}\}$, is an expenditure function. The private sector's costs increase when the quality of digital services decreases. Hence, $e_Q < 0$. Total differentiation yields

$$\frac{d}{d\beta}y = tx + [t\beta x_Q - e_Q]\frac{d}{d\beta}Q^d. \tag{9}$$

The first term on the right-hand side, tx, is the marginal tax revenue given that the tax base does not erode; its sign is positive. The second term, $t\beta x_Q \, dQ^d/d\beta$, captures base erosion. The sign is negative as is the sign of the last term, $-\, e_Q \, dQ^d/d\beta$. This last term captures the marginal loss in private income caused by the decreased quality of digital services. In general, the sign of $dy/d\beta$ is ambiguous. The change in tax revenue is positive while the two other effects are negative. Note that the ambiguity does not vanish if β is only marginally increased by starting from $\beta = 0$. $dy/d\beta$ is unambiguously positive only if $dQ^d/d\beta$ vanishes.

Let the foreign country be said to be $small$ if the choice of $\beta > 0$ has a vanishing impact on the quality Q of digital services. As a result, a (sufficiently) small foreign country is incentivized to tax the import of digital services. Reduced service quality is no threat. The fact that a small country benefits from taxing the import of digital services is strikingly different from the old economy. In the old economy, it does not pay for a small country to tax imports in general and the import of capital in particular. Things may be different only if the tax is used to fight some market failure such as market power exercised by the supplier of imported services.[2]

The definitions of smallness are not perfectly comparable, however. In the old economy, a country is said to be small if its policy has no effect on the terms of trade. By contrast, a country is said to be small in the new economy if its demand for digital services has a vanishing impact on the service quality.

8. Market power

Up to now, I have assumed price-taking behavior. This may be criticized for poorly capturing pricing behavior in the digital economy. It even conflicts with the assumption that product markets are serviced without positive marginal costs. Under such circumstances, the supplier of services can only break even by exercising market power and by setting prices above zero marginal costs of provision. *A priori*, one might even conjecture that the supplier's market power is an essential ingredient in the attempt to rationalize an import tax. Such a conjecture is clearly

[2] It is well known that a small country can gain from taxing imports if the foreign supply is monopolized. More precisely, a marginal tariff increases a small country's income if (a) the monopolist's marginal cost is positive and constant and if (b) the elasticity of average revenue is decreasing.

not correct as shown. Market power may only bias the decision in favor of an import tax. But it is not a prerequisite.

In order to show this, the base model has to be extended. Monopoly pricing can be analyzed when replacing $X(Q)$ and $x(Q)$ in eq. (7) with $PX(P,Q)$ and $px(p,Q)$, respectively. Since P and p are differentiated, it is assumed that home's monopolist is able to discriminate prices across countries. The monopolist then optimizes over three choice variables, Q, P, and p. In the Appendix, it is shown that $Q^d(\beta)$ continues to decrease in β when assuming $x_Q > 0$. Less obvious is the sign of $dp^d/d\beta$. Its determination deserves a closer discussion.

If the monopolist supplied a traditional service at positive marginal cost, an import tax would drive the demand price up. If the taxed service is supplied at zero marginal cost, this is different. As shown in the Appendix, $p^d(\beta)$ does not increase in β when making the mild assumption that the monopolist's (partially) optimal choice of p does not decrease in Q. This means that $dp^d/d\beta \leq 0$ holds whenever the monopolist sells higher quality at a non-decreasing price. The technical analysis also reveals that an increase in β does only affect p^d via a change in Q. As p^d maximizes revenues, the incidence of a tax on revenues falls on the seller of services except for the case that the service quality is negatively affected.

The setting of β has to balance an increase in tax revenue against an increase in the private sector's cost of production. Other than before, both components do not only depend on Q but also on p. When prices are endogenous, the welfare function can be written as $y(\beta) \equiv t\beta p^d(\beta)x\left(Q^d(\beta), p^d(\beta)\right) - e(Q^d(\beta), p^d(\beta))$. Total differentiation yields

$$\frac{d}{d\beta}y = x[tp - \frac{d}{d\beta}p^d] + [t\beta p x_Q - e_Q]\frac{d}{d\beta}Q^d\,, \qquad (10)$$

see Appendix. Comparing this equation with eq. (9) reveals that monopoly pricing has the effect of adding one more non-negative term, $-x\,dp^d/d\beta \geq 0$. Hence, monopoly pricing may bias the decision in favor of an import tax. However, an import tax only increases y if the first bracketed term, $tp - dp^d/d\beta$, is positive. This is the case if the import price of services, $(1-t\beta)p^d(\beta)$, decreases in β. The first summand in eq. (10) can therefore be interpreted as a price effect. By contrast, the second summand is a quality effect. As $dQ^d/d\beta$ is negative, this effect works against the optimality of $\beta > 0$. In general, it is not clear whether y increases or decreases in β.

This is different if the foreign country is small in the sense that $dQ^d/d\beta$ is vanishing. Income y therefore increases in β if the foreign country is small and this holds irrespective of the pricing behavior. By contrast, y does not necessarily increase if the supplier of digital services exercises market power and the foreign country is large.

All this suggests focusing on the size of foreign countries and treating supplier's pricing behavior as an aspect of subordinate relevance when discussing tax policy for digital services. For the sake of simplicity, I therefore return to the base model with normalized prices.

9. Providing relief from double taxation

The analysis has shown that the international taxation of digital services gives rise to a global policy dilemma. Small countries have an incentive to take unilateral action and to tax the import of such services. If many small countries choose this option, this will harm digital R&D. The whole world suffers from a reduced quality of digital services. To overcome this global policy dilemma two solutions exist. According to one, home has to compensate the foreign country for setting $\beta = 0$, i.e. for refraining from taxing the import of digital services. According to the other, home has to provide relief from double taxation. In what follows, the focus is on double taxation relief. Compensation is a less realistic option, as it would require far-reaching international policy coordination. It would not suffice to transfer negotiated sums of money to countries importing digital services. A high-tax country would be left with the risk that resident firms move digital R&D to a low-tax country. Even if $\beta = 0$, it pays for a firm to locate R&D in a country where the profit-tax rate is low. In other words, the location of R&D is not resilient to tax competition in such a policy regime. A high-tax country would offer compensation only if an agreement could be reached on profit tax rates in return. This is not very realistic.

Things are even worse if home chooses (unlimited) crediting as the method of double taxation relief. If home credits the tax paid abroad on digital sales, $t\beta x$, against the profit tax paid by the supplier at home, $T[X - C + x]$, it has the following effects. As before, resident firms are incentivized to move R&D to low-tax countries. By contrast, home loses control over β. It amounts to an invitation for the foreign country to drive up the value. The foreign country can

choose high values of β as this does not impact the seller's supply of services. The firm behaves as if profit is solely taxed at home.

The standard alternative to crediting is exemption. Home collects $T[X - C + (1 - \beta)x]$ and the foreign country collects $t\beta x$. This amounts to profit splitting as is suggested by the analysis of inter-country tax equity. The profit earned on foreign sales, x, is split between home and abroad for the purpose of taxation, and β is the parameter of split that is to be fixed by international policy coordination. Profit splitting clearly violates production efficiency if t deviates from T. This has been shown in Section 4. Still, profit splitting is appealing. It not only secures inter-country tax equity when $\beta \leq \frac{1}{2}$, but it also provides resilience against tax competition for R&D (Richter, 2017). This is easily seen when comparing the firm's aggregate tax payments when producing at home with the aggregate tax payments the firm would have to pay when relocating:

$$T[X - C + (1 - \beta)x] + t\beta x \;\leq\; t[x - C + (1 - \beta)X] + T\beta X$$

$$\Leftrightarrow \qquad (T - t)[X - C + x] \;\leq\; (T - t)\beta[X + x]$$

Assuming $T > t$, this inequality is equivalent to

$$(1 - \beta)[X + x] \leq C \;\Leftrightarrow\; \rho \equiv (X + x - C)/C \leq \beta/(1 - \beta). \qquad (11)$$

The interpretation is that a firm producing in a high-tax country cannot save on taxes by simply moving R&D to a low-tax country if the expected rate of return ρ does not exceed $\beta/(1 - \beta)$. If $\beta/(1 - \beta)$ were infinite, relocating from a high-tax to a low-tax country would never payoff. Therefore, a high-tax country with strong R&D activity will favour a large value for β. There is, however, an opposing reason favouring a low value for β. Home's loss in tax revenue increases in β. Hence, a high-tax country with strong activity in digital R&D faces a trade off when negotiating over β. The national interest of low-tax countries with weak digital activity in R&D is just the opposite. A large β is good for tax revenue while a small β eases competition for the location of investments promising high rates of expected return. In conclusion, one may expect that international negotiations over β are not as antagonistic as international negotiations over taxation rights usually tend to be. This holds only, however, if exemption is the accepted starting point for negotiations. One could argue that this ignores the fact that the foreign country has an outside option. It could move ahead and force home to react. This scenario is analysed next.

The presumption is that the foreign country sets β without negotiating its value with home. Let $\beta_d > 0$ be the choice of β maximizing foreign welfare, $y(\beta) \equiv t\beta x\left(Q^d(\beta)\right) - e(Q^d(\beta))$. $y_d = y(\beta_d)$ is the maximum welfare the foreign country can attain by optimally setting β in a regime with double taxation. It is an outside option home has to respect when offering a regime with exemption. Note that $Q^d(\beta_d)$ is smaller than the production efficient amount of R&D, $Q^* = Q^d(0)$, as $Q^d(\beta)$ is decreasing in β. Now assume that home offers exemption and negotiation over β. The firm's optimal quality choice, $Q = Q^e(\beta)$, is determined by solving the firm's first-order condition, $(1-T)[X_Q - C_Q] + [1-(1-\beta)T - t\beta]x_Q = 0$. Home has to combine exemption with such an offer of β so that the foreign country can attain the welfare level y_d of the outside option. Home could offer $\beta = \beta_d$ but this would not be optimal. When $T > t$, $Q^e(\beta)$ increases in β. Quality then exceeds the production efficient level $Q^* = Q^e(0)$. Let us assume that the production efficiency theorem applies; hence, any gain in production efficiency translates into a gain in global efficiency. Choosing β below $\beta_d > 0$, therefore, increases global efficiency. Summarizing, one can say that a high-tax country is able to combine exemption with a choice of β guaranteeing the foreign country maximum welfare, y_d, and home a welfare improvement.

10. Concluding remarks

The sole objective of the present paper is to question the tradition of taxing the profit earned on direct sales exclusively in the seller's country of residence. It is argued that this tradition is shaped by the specific conditions governing production in the old economy. In the old economy, exports of goods and services create positive marginal costs. This is different in the new economy. The marginal costs of providing digital services are largely zero. To the extent that marginal costs of provision are zero, the traditional assignment of the right to tax the profit on direct sales can well be questioned from a normative inter-country tax-equity perspective. Splitting the profit earned with imported digital services and assigning split rights of taxation to the countries involved, provides a normatively more convincing tax regime than any exclusive assignment of taxation rights.

The traditional assignment can also be questioned from a positive perspective. In this paper, it has been argued that the traditional assignment causes a global policy dilemma if extended to sales of digital services. If small countries do not expect to export digital services, they can benefit from taxing the import of such services. A tax on the import of digital services can be interpreted as a foreign tax on profit earned from direct sales abroad. This not only undermines the traditional assignment of taxation rights, but if many small countries follow suit, it also harms digital R&D. The whole world suffers from the reduced quality of digital services. It is argued that the best way out of this global policy dilemma is an internationally coordinated tax regime in which the profit earned on direct digital sales of B2B services is split for the purpose of taxation. High-tax countries with strong digital R&D have reason to endorse such a regime. This is so, as profit splitting provides resilience against tax competition for R&D. Also, profit splitting is a welfare enhancing strategy for high-tax countries when small countries have moved ahead with taxing the import of digital services.

Although this paper has a narrow focus, it gives reason to question the principle – emphasized by the OECD – that profits should be taxed in the country where the value is created. Even the OECD (2013) must candidly acknowledge the difficulty of determining the jurisdiction in which value is created in the digital economy.[3] The present paper – like the one of Richter (2017) – suggests that profits should instead be taxed where the opportunity costs are borne. And if these opportunity costs are zero at the margin, the earned profit contribution should be split between the countries involved.

One cannot finish such a paper without stressing the theoretical nature of the analysis. The results are obtained by relying on various simplifying assumptions. Policy makers have to be aware of this and they do well to draw conclusions with due caution.

[3] The conceptual vagueness of "value creation" is used by the European Commission (2018b) to propose the notion of a "significant digital presence" in corporate taxation. According to the Commission, there is an increasing misalignment between the place where the profits are taxed and the place where value is created in the digital economy. The provision of digital services is no longer considered to be the sole source of value creation. User generated content and data collection are considered by the Commission to be core activities for the value creation of digital businesses.

11. Appendix

The focus is on services the use of which is non-rival. Hence, labor costs are ignored. If there is no relief for double taxation, the monopolist is assumed to maximize

$$\Pi = (1-T)[\,PX(P,Q)) - C(Q,\mathcal{L}) + px(p,Q)] - t\beta px(p,Q) \text{ in } P,p,Q. \qquad (12)$$

When setting $\tau \equiv t/(1-T)$ the first-order conditions of the maximization (12) can be stated as

$$X + PX_P = 0,\ x + px_p = 0, \text{ and } PX_Q - C_Q + (1-\tau\beta)px_Q = 0. \qquad (13)$$

Optimal values of P, p, and Q are clearly constant in β if x_Q is zero. If foreign marginal revenues are zero, the firm ignores sales to the foreign country when optimizing over R&D. The derivatives of $Q = Q^d(\beta)$ and $p = p^d(\beta)$ are both multiples of $\tau p x_Q$. More precisely, $dQ^d/d\beta = \tau\, px_Q A$ with $A \equiv (2X_P + PX_{PP})(2x_p + px_{pp})/D$ where D denotes the determinant of the Jacobian matrix associated with the system of first-order conditions (13). Equally, $dp^d/d\beta = \tau\, px_Q B$ where $B \equiv -(2X_P + PX_{PP})(x_Q + px_{pQ})/D$. The second-order conditions imply negativity of A. By contrast, B is non-positive only if $x_Q + px_{pQ} \geq 0$. This condition is best interpreted by studying the (partially) optimized choice of p when Q is assumed to be fixed. The first-order condition is $x + px_p = 0$. Implicit differentiation yields $\frac{dp}{dQ} = -\frac{x_Q + px_{pQ}}{2x_p + px_{pp}}$. Negativity of the denominator follows from the second-order condition. Hence B is non-positive if $\frac{dp}{dQ}$ is non-negative. Summarizing, one can say that $Q^d(\beta)$ is decreasing in β while $p^d(\beta)$ is non-increasing in β only if the partially optimized choice of p does not decrease in Q.

Total differentiation of $y(\beta) \equiv t\beta p^d(\beta)x\Big(Q^d(\beta), p^d(\beta)\Big) - e(Q^d(\beta), p^d(\beta))$ yields

$$\frac{d}{d\beta}y = tpx + t\beta\frac{d}{d\beta}(p^d x) - e_Q\frac{d}{d\beta}Q^d - e_p\frac{d}{d\beta}p^d$$

$$= x[tp - \frac{d}{d\beta}p^d] + [t\beta p x_Q - e_Q]\frac{d}{d\beta}Q^d$$

which is eq. (10). In deriving the second equality, use has been made of Hotelling's Lemma, $e_p = x$, and of the first-order condition associated with p.□

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