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Abstract

The use of digital services is largely non-rival. This paper argues that vanishing marginal costs of supply change policy incentives. Small countries are incentivized to tax the import of digital services. In fact, various countries have already moved towards expanded source taxation of online business activities. If such practice spreads, the quality of digital services will be negatively affected. This paper argues that countries exporting digital services have reason to respond by promoting an international tax regime in which the profit earned on remote supplies of digital business services is split between the countries involved.

JEL-Codes: H250, M480.

Keywords: digital services, remote supply, import tax, alleviating double taxation, profit splitting.

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1. Introduction

The digitalization of the economy presents serious challenges for international corporate income taxation (OECD, 2015; Commission Expert Group, 2014). A particular challenge is raised by the cross-border supply of remote digital services. Such services are supplied without relying on a permanent establishment in the customer's country of residence. According to the conventional view, it is business without nexus in the destination country. Current international tax standards assign the right of taxing the profit earned on remote supplies to the seller's country of residence.

This assignment of taxing rights is increasingly challenged in its application to digital services. In fact, quite a number of countries have implemented specific measures all aimed at expanding source taxation of online business activities. In an overview, the OECD (2018a, pp. 134) groups those measures into four categories: (i) diluted requirements for establishing nexus; (ii) withholding taxes; (iii) turnover taxes; and (iv) specific regimes to deal with large multinational enterprises (MNEs). The specific example motivating the present paper is the proposal of the European Commission (2018) to levy a "Digital Services Tax" (DST) of 3 percent on revenues made from services where the "main value" is claimed to be "created through user participation".² With its proposal the Commission reacts to widespread concern in Europe that profits earned in the digital economy are not effectively and fairly taxed (European Commission, 2017). Academic tax experts have criticized the Commission's initiative (Becker et al., 2018; Schön, 2018; inter alia).³ Olbert et al. (2019) argue that the "DST is clearly ring-fencing, bears a substantial risk of double taxation and legal uncertainty, and most likely, does not justify its administrative costs". The move towards expanded source taxation of online business activities can, however, be observed worldwide. It is particularly striking to see that many small countries are part of the move. Examples are Austria, Greece, Israel, Hungary, Malaysia, Thailand, and Turkey (OECD, 2018a). Cui et al. (2019) offer a rationalization of the DST as a tax on location-specific rent.

This paper takes the view that the double taxation of digital services is not a problem *per se*. The real problem is that the observed development is jeopardizing global production efficiency and

² The Commission explicitly mentions the online placement of advertising, the sale of collected user data, and the provision of digital platforms. The DST is only meant to serve as an interim measure until international agreement is reached on new rules specifying nexus in the digital economy. See Section 2 below.

³ Becker et al. headline: "a populist and flawed proposal". Schön is less dismissive but also critical.

undermining the international cooperation on issues of taxation. Designing effective countermeasures, however, requires understanding the economic forces driving the deplored development. This paper aims at contributing to such an understanding.

For this purpose, the import of digital services is compared with the import of non-digital goods and services. The point is made that the political incentives to tax the import of the former are not the same as the incentives to tax the import of the latter. The difference comes from the marginal cost entailed by increased supplies. The use of digital services is largely non-rival. The (variable) cost of servicing additional customers is so low that it can be ignored (Commission Expert Group, 2014). Positive (fixed) costs are only entailed by the development of service quality. Technically speaking, the marginal cost of quantity is zero and the marginal cost of quality is positive. Non-digital goods and services are different. In their case, the marginal costs of producing both quantity and quality are strictly positive. Their use is rival and their development is costly. It will be shown that vanishing marginal costs of quantity change policy incentives. (Sufficiently) small countries are shown to benefit from taxing digital services (Proposition 3). This contrasts with well-known findings of trade theory. In general, a small country cannot benefit from levying an import tariff. If small countries are increasingly observed to expand source taxation of online business activities, this paper therefore explains the development by changed policy incentives.

If expenditures on digital services are taxed and the practice of taxing the profit from the remote supply of services in the seller's country of residence is maintained, double taxation is the result. This problem is not easily overcome simply by calling upon the common interest of all parties involved. Inherent in the digital economy is a fundamental asymmetry of national interests dividing exporting and importing countries. International trade in digital services is far from being balanced. Digital innovation is not evenly spread throughout the world and the costs to efficiency would be large if policy was implemented to impose a uniform spread. For reasons of technology, small countries suffer a comparative disadvantage in commercializing digital services. This biases their stance on trade policy. If many small countries choose to tax expenditures on digital services and if the resulting double taxation is not mitigated, digital innovation and global production efficiency will suffer harm. A benevolent interpretation of the European Commission's DST proposal would be that it aims at averting uncoordinated policy moves by the EU's individual member states.

In Sections 6 and 7, I argue that the countries exporting digital services have reason to promote international cooperation in the taxation of digital business services. Unilateral action might well be ineffective. More specifically, it is shown that simply reducing the profit tax rate in the exporting country does not eliminate the incentive of the importing country to levy a tax. At most, it reduces the incentive. A more expedient policy might be to promote an international tax regime in which the right of taxing profits from remote digital business services is shared by the countries concerned. An appealing method of sharing rights would be one in which profits are split for the purpose of taxation and where the splitting parameter is exogenously fixed. The specific appeal of such profit splitting is its ability to provide resilience against tax competition for the location where R&D is conducted and where digital services are developed (Proposition 4).

Before proceeding, the scope of analysis needs to be delineated. This analysis does not attempt to derive solutions for the many challenges that taxation of the digital economy presents; the objective is a modest one. This paper establishes the lack of rivalry in the use of digital services as a reason for reconsidering the standing tradition of assigning the right to tax the profit from remote supplies exclusively to the seller's country of residence. The paper pleads for regulated and internationally coordinated profit splitting and presents positive reasons supporting this position. Normative reasons are presented in Richter (2019) by elaborating on the OECD's objective to align profit taxation with value creation. The present paper's analysis focuses on services provided from business to business (B2B) even though the fiscal relevance of B2C services may well be larger (Olbert et al., 2019). The taxation of consumption, however, raises questions that go beyond the scope of this paper. The focus on business services is justified with regard to theory. Production efficiency is, after all, the least debated normative principle of taxation. The uncoordinated taxation of productive inputs jeopardizes production efficiency, whereas the uncoordinated taxation of consumption does not necessarily do so. An appropriate example of services analyzed in this paper would be the provision of advertising space for targeted marketing messages or the provision of cloud-based software.⁴

⁴ Spending on digital B2B advertising in the U.S. is estimated to reach only \$4.07 billion in 2017. See <https://www.emarketer.com/Report/US-B2B-Digital-Advertising-eMarketer-Forecast-Three-Factors-Affecting-Growth/2002156>. However, the market for public cloud computing services is broader and estimated to reach \$214.3 billion worldwide in 2019 with high rates of growth. Included are services encompassing business process services, platforms, infrastructure, software, management, security, and advertising services.

The paper is structured as follows. Section 2 briefly summarizes related literature. Section 3 introduces a simple model of remote supplies. The focus is on a firm doing business at home and abroad. Section 4 looks at implications if home and abroad fail to coordinate profit taxation. Section 5 focuses on rivalry and non-rivalry in the firm's cost of supply and analyzes the incentive of abroad to tax imports. Section 6 addresses the question of home's optimal policy response. Section 7 discusses home's incentives to provide relief from double taxation. It is argued that a high-tax country exporting digital business taxes has reason to negotiate over internationally coordinated profit splitting. The main reason is that profit splitting provides resilience against tax competition for the location of digital R&D. Section 8 concludes.

2. Related literature

The taxation of income earned on remote digital services is discussed by the Commission Expert Group (2014), OECD (2015), Baez et al. (2017), Hongler et al. (2015), and others. Profit splitting is not among the options examined closely. An explanation may be that the OECD subsumes profit splitting under transfer pricing rules applied to transactions by related parties in global value chains where each party is assumed to make "unique and valuable contributions" (OECD, 2018b). Remote supplies violate this condition. It has, however, been argued that user participation in the provision of digital services is a source of value creation. Therefore, under the BEPS Action Plan 1, the OECD (2015) discusses (i) an equalization levy to be applicable to specified digital services, (ii) a withholding tax on certain types of digital transactions, and (iii) redefining nexus as a "significant economic presence". None of these options is recommended; however, countries may introduce any of these three options provided they respect existing treaty obligations.

Work on implementation issues has been continued in the so-called OECD/G20 Inclusive Framework on BEPS. In its Interim Report (OECD, 2018a), the Inclusive Framework provides an in-depth analysis of common characteristics of digital businesses. Three characteristics are stressed: cross-jurisdictional scale without mass, heavy reliance on intangible assets, and the importance of data, user participation and their synergies with intangible assets. Low marginal

costs of supply are repeatedly mentioned in the text but they are not among the highlighted characteristics. The present paper considers vanishing marginal costs as pivotal for understanding policy incentives in the digital economy.

Early in 2019, the Inclusive Framework on BEPS held a public consultation on possible solutions to the tax challenges arising from digitalization (OECD, 2019a,b). The proposals were grouped into two pillars. Those made under Pillar One focus on the allocation of taxing rights. If realized, they “would modify current profit allocation rules to require that, for certain businesses, an amount of profit be allocated to jurisdictions in which those businesses’ active and participatory user bases are located, irrespective of whether those businesses have a local physical presence” (OECD, 2019a, p. 10). Such a modification gets close to what is discussed in Section 7, below.

The European Commission’s proposals of March 2018 build on the OECD/G20 discussions. The proposed DST can be interpreted as an equalization levy; however, it is only intended to be an interim solution. 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 recognition 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 the unitary taxation of MNEs and an apportionment of the MNEs’ consolidated profits according to a formula weighting labor, capital (assets), and sales (Fuest, 2008, *inter alia*).

It is important to note the difference between the Commission’s concept of the CCCTB and the present paper’s concept of profit splitting. The justification for profit splitting relies on non-rivalry in use and not on the firm’s recognized presence. A digital presence is not deemed to be given; the supplier of digital services need not be multi-national. Profit splitting is only proposed for profits earned on exported services, while the CCCTB includes home profit in the allocation of profits. Furthermore, the apportionment of profit in the present paper’s interpretation is exogenous whereas under the CCCTB, the apportionment of the consolidated profit is dependent on endogenous factors.

The question of how to tax MNEs in the digital economy is not elaborated upon in the present paper; in that regard, see McLure (2000a), OECD (2015), Richter (2019) *inter alia*. The present analysis focuses solely on the taxation of profits earned on transactions between non-affiliated

companies. Earning a profit from the remote supply of services implies that those services are provided in return for a payment. Even then, 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 special feature of digital services is that they are non-rival in use. Therefore, revenues from sales and profit contributions are two sides of the same coin, and the European DST can be interpreted either as a tax on income or as a tax on sales. The European Commission (2018) recognizes the ambivalence. It speaks of the taxation of revenues and sales but assigns the DST to the realm of income taxation. It should be noted that even without the DST, digital services are already liable to the European system of broad-based consumption taxation that is implemented as value added taxation (VAT). The challenges which the inclusion of electronic commerce raises for a system of sales taxation or VAT are discussed, inter alia, by McLure (2000b and 2003), Ligthart (2004), Hellerstein (2016), OECD (2018a).

A tax proposal combining elements of VAT with profit taxation is the Destination-Based Cash Flow Tax (DBCFT) of Auerbach et al. (2018). The appeal of the DBCFT is its ability to sustain global production efficiency if implemented worldwide. Such implementation would, however, produce deep changes in the current system of taxation. In any case, the discussion of the pros and cons of the DBCFT go far beyond the scope of this paper.

3. A model of remote supplies

The world is assumed to consist of two countries. One is home and the other is abroad. The focus is on a firm producing in home and selling the product in home as well as abroad. Foreign sales are remote sales from home and are made without relying on a permanent establishment abroad. The product is sold in quantity and quality. Sold quantities are denoted by X for those at home and by x for those abroad. Marginal cost of quantity is constant and non-negative, $W \geq 0$. If $W > 0$, the use of quantity is rival and if $W = 0$, the use is non-rival. Quality is denoted by Q . The cost of producing quality, $C(Q)$, is positive, increasing, and convex. The provision of digital services is modelled by $W = 0$ and the provision of non-digital goods and services is captured by $W > 0$. According to this definition, a computer would be a non-digital good as the production of

hardware is costly even at the margin. $P(X, Q)$ is average revenue from home and $p(x, Q)$ is average revenue earned abroad. By assumption, $P_X, p_x \leq 0, P_Q, p_Q > 0$. Whenever subscripts are used in connection with functions, they indicate (partial) derivatives.

In the base model, the focus is on the effect which uncoordinated profit taxation has on production and efficiency. This aim suggests concentrating on B2B-sales. Let T and t be the profit tax rates applied in home and abroad, respectively. The general rule applied to remote sales would require to treat $xp(x, Q)$ as taxable revenues in home and to allow offsetting of $xp(x, Q)$ against other taxable income abroad. When complying with this rule, profit is only taxed once. The object of analysis, however, is the increasing tendency of countries to break the rule. In the base model, revenues earned abroad are taxed abroad as well as in home and no provision for mitigating double taxation exists. The effective tax rate is denoted by θ . Home may feel justified to tax $xp(x, Q)$ as these foreign revenues are revenues of a resident firm. Without policy coordination, abroad may equally feel justified to deny the offsetting of $xp(x, Q)$ as these expenditures remain otherwise untaxed abroad. From a joint perspective, $xp(x, Q)$ is a (pure) profit contribution if $W = 0$ and it is revenue with allocable cost, Wx , if $W > 0$. The firm is assumed to maximize profit after tax, Π^a . The implications are the same as if the firm maximized $\Pi(X, x, Q; \theta) = \Pi^a / (1 - T)$ with

$$\Pi \equiv XP(X, Q) + (1 - \theta)xp(x, Q) - W \cdot (X + x) - C(Q). \quad (1)$$

The parameter θ is an effective tax rate specified below. The objective function (1) features a firm acting as a monopolist and discriminating prices between home and abroad. Excludability of the product's use is the basis for monopoly pricing. Without exercising market power the cost of quality could not be covered. By differentiating between P and p one assumes that discriminating prices by country is a technologically feasible and profit maximizing strategy. An example from e-commerce would be Google Ads. In this case, price discrimination by country results from the automated auctioning of advertising space. A counter-example would be Amazon's electronic marketplaces. The commission rates charged by Amazon on business selling are known to differ strongly between product categories but hardly between marketplaces. A possible explanation might be that any discrimination of commission rates by country could be bypassed by diverted transactions.

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

$$P + XP_x = W, \quad p + xp_x = \frac{W}{1-\theta}, \quad (2a)$$

$$XP_Q + (1 - \theta)xp_Q = C_Q. \quad (2b)$$

Conditions (2a) refer to quantities and they require marginal revenue of quantity to equal marginal cost in each country. Condition (2b) refers to quality and it requires the sum of marginal revenues to equal the marginal cost of quality. In Appendix A, it is shown that optimal quality Q as well as optimal quantity x are decreasing functions of the effective tax rate θ :

$$\frac{dQ}{d\theta}, \frac{dx}{d\theta} < 0 \quad (3)$$

These inequalities are proved by exploiting second-order conditions and the mild assumption that marginal revenue from selling quantity, $p + xp_x$, does not decrease in quality.

As mentioned, $xp(x, Q)$ are expenditures made by foreign firms. This assumption suggests interpreting x as an input in foreign production which can be substituted for other non-specified factor inputs. By contrast, the quality Q is assumed to have an increasing effect on total factor productivity. Let $f(x, \dots; Q)$ denote the foreign production function and let

$$e(p, Q) \equiv \min\{px + \text{other factor costs} \mid f(x, \dots; Q) = \text{const}\} \quad (4)$$

denote foreign firms' expenditure function. The partial derivatives are obtained by applying standard calculus techniques:

$$e_p = x(p, Q) > 0 \quad \text{and} \quad e_Q = -p \frac{f_Q}{f_x} \equiv -p \cdot MRS(p, Q) < 0 \quad (5)$$

An increase in p increases foreign firms' expenditures while an increase in quality, Q , decreases those expenditures.

4. Unilateral foreign tax policy: The general case

The object of analysis is the increasing tendency of countries to expand source taxation of digital services. As mentioned, a whole bunch of methods exist. According to one, abroad levies a withholding tax, w , on payments to foreign suppliers. According to another, abroad constrains the extent to which the buyer of imported products is allowed to offset payments to foreign suppliers against taxable profit. In this case, the rule is such that just the fraction $(1 - \beta)$ of $xp(x, Q)$ can be offset against the taxable profit earned by the buyer of the imported goods and services. From home's perspective, $\beta xp(x, Q)$ is profit earned and taxed abroad at rate t . If $w = t\beta$, the two methods of source taxation are equivalent. In what follows, abroad is assumed to constrain the offsetting of expenditures by domiciled firms. For a start, it is assumed that home does not mitigate double taxation. Hence, $\theta = \theta(\beta) \equiv \beta \frac{t}{1-T}$. As β is chosen by abroad, the focus is on the effect the increase in β has on the efficiency of abroad. This efficiency is suitably modelled by the sum of tax revenue and private sector income,

$$y(\beta, T, t) \equiv t\beta xp(x, Q) - e(p(x, Q), Q) \quad (6)$$

$$\text{with } x = x(\beta) = x(\theta(\beta, T, t)) \text{ and } Q = Q(\beta) = Q(\theta(\beta, T, t)).$$

The first term, $t\beta xp$, on the right-hand side of eq. (6) is tax revenue. The second one, e , is the private sector's expenditure for purchased inputs. Marginal efficiency with respect to β is

$$\frac{\partial}{\partial \beta} y = txp + t\beta \frac{d}{d\beta} [xp] - e_p \frac{d}{d\beta} p - e_Q \frac{d}{d\beta} Q . \quad (7)$$

In what follows, the marginal efficiency function is evaluated at $\beta = 0$. Hence, the second term on the right-hand side of eq. (7) vanishes. It will not necessarily be mentioned again that eq. (7) is evaluated at $\beta = 0$, and *a fortiori* at $\theta = 0$. However, evaluation at $\beta = \theta = 0$ is always implied when signing $\partial y / \partial \beta$. Making use of equations (5), one obtains

$$\frac{\partial}{\partial \beta} y = txp - x \frac{t}{1-T} \frac{d}{d\theta} p + p \cdot MRS \frac{t}{1-T} \frac{d}{d\theta} Q . \quad (8)$$

The first term on the right-hand side, txp , denotes marginal tax revenue given that the tax base does not erode; its sign is positive. The third term is negative as $\frac{dQ}{d\theta} < 0$. This term captures the

marginal loss in private income caused by the decreased quality of purchased inputs. The second term on the right-hand side of eq. (8) captures the ambiguous effect of θ on price. The effect is ambiguous as both quantity, x , and quality, Q , decrease when θ increases and as the reductions in quantity and quality have opposing effects on price. Hence, the sign of $\partial y/\partial\beta$ is generally ambiguous. Eq. (8) reveals that the effect of θ on private sector income is grossed up by the factor $1 - T$ while the effect on tax revenue is not.

The problem of signing $\partial y/\partial\beta$ can be presented in a different form. For this purpose, one has to interpret $QE \equiv p \cdot MRS \cdot dQ/d\theta$ as a quality effect and $PE \equiv (1 - T)p - dp/d\theta$ as a price effect. Obviously,

$$\frac{\partial}{\partial\beta}y > 0 \text{ at } = 0 \Leftrightarrow x \cdot PE + QE > 0 . \quad (9)$$

The quality effect is clearly negative while the sign of the price effect is ambiguous. The sign of PE is positive at $\theta = 0$, only, if the import price $(1 - t\beta)p(x(\beta), Q(\beta))$ decreases in β at $\beta = 0$:

$$\begin{aligned} 0 > \frac{d}{d\beta} \text{ import price} &= -tp + (1 - t\beta) \frac{t}{1-T} \frac{dp}{d\theta} = -tp + \frac{t}{1-T} \frac{dp}{d\theta} \\ \Leftrightarrow 0 < (1 - T)p - \frac{dp}{d\theta} &= PE . \end{aligned} \quad (10)$$

An immediate implication of equations (9) and (10) is

Proposition 1: Efficiency of abroad increases in β if

- (i) the price effect is positive – meaning that the import price decreases, and if
- (ii) the negative quality effect is small.

Proposition 1 gives rise to the question which particular assumptions ensure a positive price effect and a small quality effect. In what follows, this question is answered by differentiating between $W > 0$ and $W = 0$. Working out deviating answers allows highlighting the relevance which rivalry in the use of imported goods and services has on optimal tax policy abroad. An assumption not being varied in this context is monopoly pricing. The idea is that the cost of

producing quality can only be covered when average revenue after tax exceeds the marginal cost of quantity. Hence, monopoly pricing is assumed throughout even if not given special mention.

5. Unilateral foreign tax policy: Particular cases

The analysis of particular cases starts with revisiting a case which is essentially known from the literature (Brander et al., 1984). The key assumption is rivalry in the use of the commodity's quantity, $W > 0$. The result is stated in the form of a proposition to ease the subsequent discussion.

Proposition 2: (“Non-digital goods and services”) Assume quality to be exogenously fixed and assume profit not to be taxed in home, $T = 0$. If $W > 0$ and if the elasticity of the average revenue function, p , is decreasing, the efficiency of abroad increases in β .

The proof is straightforward. The quality effect vanishes, $QE = 0$, by assumption. The price effect is positive, $PE > 0$, as $T = 0$ and as

$$0 < p - \frac{dp}{d\theta} = p - p_x \frac{dx}{d\theta} = p - p_x \frac{p + xp_x}{2p_x + xp_{xx}} \Leftrightarrow \frac{d}{dx} \left(\frac{x}{p} p_x \right) < 0. \quad (11)$$

The second equality in eq. (11) relies on eq. (2a): $\frac{dx}{d\theta} = \frac{W/(1-\theta)^2}{2p_x + xp_{xx}} = \frac{p + xp_x}{2p_x + xp_{xx}}$ at $\theta = 0$. \square

Proposition 2 is a qualification to the general statement that a small country does not benefit from taxing imports. In the scenario considered, benefits are, however, derived abroad. The reason is that imports fetch a price above the marginal cost of quantity. If the elasticity of p is decreasing in x , abroad can use the import tax to improve the terms of trade (Brander et al., 1984). By contrast, if the supplier would service abroad at marginal (variable) cost, $p = W/(1 - \theta)$, it would not pay for abroad to tax imports. In this case, the price effect is non-positive, $PE = p -$

$$\frac{dp}{d\theta} = p \left[1 - \frac{1}{1-\theta} \right] = -p \frac{\theta}{1-\theta} \leq 0.$$

For digital services, $W = 0$, and exogenous Q , the price effect is necessarily positive. In fact, $PE = p > 0$. Average revenue before tax, p , does not react to a change of θ if $W = 0$. This is a trivial implication of equations (2a). The sign of $\frac{d}{dx}\left(\frac{x}{p}p_x\right)$ is therefore of no particular relevance. If Q is endogenous, the size of p_Q is, however, pivotal. This partial derivative captures the effect which quality has on average revenue earned abroad and before tax. If the size of $p_Q > 0$ is small, foreign sales have a small effect on the production of quality. Let abroad be called *sufficiently small* if p_Q is sufficiently small.

Proposition 3 (“Digital services”): If $W = 0$ and if abroad is sufficiently small, the efficiency of abroad increases in β .

The proof relies on eq. (9). According to this equation, marginal efficiency of abroad is positive if $x \cdot PE + QE$ is positive. In Appendix B, it is shown that $\frac{dx}{d\theta}$ and $\frac{dQ}{d\theta}$ tend to zero if p_Q tends to zero. Hence, $QE = p \cdot MRS \cdot \frac{dQ}{d\theta}$ tends to zero. Furthermore,

$$x \cdot PE = x \left[(1 - T)p - \frac{dp}{d\theta} \right] = x \left[(1 - T)p - p_x \frac{dx}{d\theta} - p_Q \frac{dQ}{d\theta} \right] \quad (12)$$

tends to $(1 - T)px > 0$ resulting in $x \cdot PE + QE$ being positive. \square

The fact that a small country benefits from taxing the import of digital services is strikingly different from what is known about tariffs levied on non-digital goods and services. In general, it does not pay for a small country to tax non-digital imports. Things may only be different if the tax is used to fight some market failure such as the market power exercised by the supplier of imports. The definitions of smallness are not perfectly comparable, however. Usually, a country is called small if its policy has no effect on the terms of trade. By contrast, trade in digital services suggests calling a country (sufficiently) small if its policy has a (sufficiently) small impact on the quality of imports.

A point to be noted is that Proposition 2 requires stricter assumptions than Proposition 3. More precisely, Proposition 3 makes no particular assumption on the elasticity of demand and it holds for arbitrary value of $T \in [0,1)$. By contrast, Proposition 2 does not hold for an arbitrary choice of T . This is shown in Appendix C for linear foreign demand. T need not be zero, but it must be smaller than one half. Otherwise, examples are shown to exist where foreign demand is linear and where a marginal tariff on the monopolized supply of non-digital goods and services decreases the foreign country's efficiency. The decrease is caused by an upward move of the import price, $(1 - t\beta)p$. Such an upward move results if the direct effect of β on the import price is dominated by the indirect one, $tp < (1 - t\beta) \frac{dp}{d\beta} = \frac{t}{1-T} \frac{dp}{d\theta}$, if evaluated at $\beta = 0$. The larger T is, the more likely this case happens. If imports are digital services and if the quality is fixed, the import price cannot move upward. The supplied quantity x does not react in this case. The difference in the assumptions of Propositions 2 and 3 corroborates the claim that the incentive to tax monopolized imports changes when replacing $W > 0$ with $W = 0$.

6. Reflections on home's optimal policy response

The following discussion assumes that imports are taxed abroad because marginal efficiency is positive, $\partial y / \partial \beta > 0$. An obvious question then is how home could and should react when acting in its national interest. The answer is not obvious. Home could consider decreasing its profit tax rate. In fact, the recent tax reform of the United States can be interpreted as the attempt to react to international tax competition and to reduce the rate of corporate income taxation. The problem with such policy reaction is that a decrease of home's profit tax rate T does not eliminate the incentive to tax imports which are in monopolized supply. At most, it reduces the incentive. This is easily shown by taking the derivative of $\frac{\partial}{\partial \beta} y = \frac{t}{1-T} \frac{\partial}{\partial \theta} y$ with respect to T and by evaluating the derivative at $\beta = 0$:

$$\frac{d^2}{dT d\beta} y = \frac{t}{(1-T)^2} \frac{\partial}{\partial \theta} y + \frac{t}{1-T} \frac{t\beta}{(1-T)^2} \frac{d^2}{d\theta^2} y = \frac{t}{(1-T)^2} \frac{\partial}{\partial \theta} y = \frac{1}{1-T} \frac{\partial}{\partial \beta} y \quad (13)$$

which exceeds $\partial y / \partial \beta$ whenever this derivative is positive. Hence, reducing T is not a convincing response of home if abroad chooses to set $\beta > 0$. A reduction can even be counterproductive. As

mentioned in the preceding section, a high tax rate T can well ensure a negative incentive to tax imports, $\partial y/\partial\beta < 0$, if only those imports relate to non-digital goods and services.

Providing deduction for the tax paid abroad is neither an expedient policy of home. The foreign country's incentive to tax imports would even increase. This is so for the following reason. If deduction is permitted, the firm maximizes $(1 - T)[PX + px - C - \beta tpx]$. The effective tax rate, θ , then is no longer $\beta \frac{t}{1-T}$ but βt . Inspection of eq. (8) reveals that the negative third term and the ambiguous second term of the right-hand side are no longer grossed up by the factor $1 - T$. As a result, the positive first term gains weight. On balance, providing deduction increases the odds for a positive sign of $\partial y/\partial\beta$.

The standard policy reaction discussed in trade theory is retaliation. Retaliation is more effective. If home equally taxes imports, abroad risks being worse off than without taxing imports. In the policy equilibrium, both countries tend to be worse off. In the old economy of non-digital goods and services, small countries even have the least incentive to engage in a war of tariffs. In the new economy of digital services, retaliation could, however, become less threatening. As already mentioned, trade in digital services lacks reciprocity. Reciprocity is neither secured nor necessarily desirable, as the production of digital services often has the characteristics of a natural monopoly. There are economies of scale and scope and there are often network externalities. In addition, spillover effects in R&D bring about regional concentration. The emergence of regionally concentrated natural monopolies fosters growth from which the whole world benefits. It would only harm global efficiency if perfectly substitutable digital services were supplied by independent producers or if digital R&D were spread evenly throughout the world. For this and other reasons, achieving balanced trade in digital services is neither efficient nor competitively sustainable. All of this acts against reciprocity. Countries importing digital services cannot and should not rely on the promise that they will have a fair chance in the future of switching into the role of an exporter of digital services. The bottom line of this reasoning is that retaliation might not be an effective threat when a small country chooses to tax the import of digital services.

If many small countries choose to tax the import of digital services and if double taxation is not mitigated, digital innovation suffers. Uncoordinated policy is no efficient remedy. The world is stuck in a global policy dilemma which can only be overcome by coordinated action. By the very

nature of the conflict, the initiative for policy coordination has to be taken by the countries exporting digital services. Options are discussed in the next section.

7. Providing relief from double taxation

Two major solutions exist for overcoming the global policy dilemma in the taxation of digital services. According to one, home has to compensate abroad for setting $\beta = 0$, i.e., for refraining from taxing the import of digital services. According to the other, home has to offer some double taxation relief exceeding deduction. 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. The exporting countries would have to agree on a coordinated transfer policy. Furthermore, agreement would have to be reached with the receiving countries on minimum profit taxation in return. After all, it pays for a firm to shift digital R&D to a low-tax country even if this country agrees on setting $\beta = 0$. In other words, the location of digital R&D is not resilient to tax competition in such a policy regime. Hence, compensation requires policy coordination to such an extent that it can hardly be considered being a realistic solution to the global policy dilemma.

If the focus is on double taxation relief granted by home, deduction can be excluded from the outset. As shown above, deduction even increases the foreign country's incentive to tax imports. However, tax crediting is neither an expedient policy. If home credits the tax paid abroad on digital sales, $t\beta px$, against the profit tax paid by the supplier at home, $T[PX + px - C]$, this has the following effects. As before, resident firms are incentivized to move the development of digital services to low-tax countries. By contrast, home loses control over β . Tax crediting is like an invitation for the foreign country to drive up the rate. The foreign country can choose high rates 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 $T[PX + (1 - \beta)px - C]$ and the foreign country collects $t\beta px$. This outcome amounts to profit splitting. The profit earned on foreign sales, px , 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 efficiency in the production of quality if t deviates from T as is easily seen when maximizing $(1 - T)[PX - C] + [1 - T(1 - \beta) - t\beta]px$ in Q . The first-order condition of maximization is

$$XP_Q + (1 - \theta)xp_Q = C_Q \text{ with } \theta = \beta \frac{t-T}{1-T}. \quad (14)$$

Eq. (14) reveals that the production of quality is effectively subsidized if $T > t$, and it is effectively taxed if $T < t$. Subsidization (taxation) results if the foreign return to quality is taxed at a rate which is lower (higher) than the rate at which costs are offset at home.

Still, profit splitting is an appealing policy option. It not only secures intercountry tax equity as argued by Richter (2019); it also provides resilience against tax competition for the location of digital R&D. This is easily seen when comparing the firm's aggregate tax payments when developing at home with the aggregate tax payments the firm would have to pay when relocating the development and servicing from abroad:

$$\begin{aligned} T[PX + (1 - \beta)px - C] + t\beta px &\leq t[px + (1 - \beta)PX - C] + T\beta PX \\ \Leftrightarrow (T - t)[PX + px - C] &\leq (T - t)\beta[PX + px] \end{aligned}$$

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

$$(1 - \beta)[PX + px] \leq C \Leftrightarrow \rho \equiv (PX + px - C)/C \leq \beta/(1 - \beta). \quad (15)$$

The interpretation is that a firm producing quality in a high-tax country cannot save on taxes by simply moving the production 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 a strong digital sector will favor a large value for β . There is, however, a contrary reason for favoring a small value for β . Home's loss in tax revenue increases in β . Hence, a high-tax country with a strong digital sector faces a trade off when negotiating over β . The national interest of low-tax countries with weak digital activity is just the opposite. A large β is good for tax revenue whereas a small β eases competition for the location of digital activity promising high rates of expected return. In conclusion, one may expect that international negotiations over β are not as antagonistic as international negotiations over

taxing rights usually tend to be. One could, however, argue that the discussion ignores the fact that the foreign country has an outside option. It could move ahead and force home to react. This scenario is analyzed next.

The presumption is that the foreign country sets β without negotiating its value with home. Let $\bar{\beta} \in (0,1]$ be the choice of β that maximizes foreign efficiency, $y(\beta) \equiv t\beta xp(x, Q) - e(p(x, Q), Q)$, with $x = x(\beta)$, $Q = Q(\beta)$. $\bar{y} = y(\bar{\beta})$ is the maximum efficiency the foreign country can achieve by optimally setting β in a regime with unmitigated double taxation. It is an outside option home has to respect when offering profit splitting. Note that $Q(\bar{\beta})$ is smaller than the production efficient quality, $Q^* = Q(0)$, as inequalities (3) imply that $Q(\beta)$ is decreasing in β . Now assume that home offers profit splitting and negotiation over β . The firm's optimal quality choice, $\bar{Q}(\beta)$, is determined by solving the firm's first-order condition, $(1 - T)[XP_Q - C_Q] + [1 - (1 - \beta)T - t\beta]xp_Q = 0$. Home has to combine profit splitting with such an offer of β that the foreign country can attain the efficiency level \bar{y} of the outside option. Home could offer $\beta = \bar{\beta} > 0$ but this would not be optimal. When $T > t$, $\bar{Q}(\beta)$ increases in β . Quality then exceeds the production efficient level $Q^* = \bar{Q}(0)$. Let us assume that the production efficiency theorem applies; hence, any gain in production efficiency translates into a gain in global efficiency. Choosing a non-negative value of β below $\bar{\beta}$, therefore, increases global efficiency. In summary, one can say that a high-tax country is able to combine profit splitting with a choice of β guaranteeing the foreign country \bar{y} and home an increase in efficiency.

Proposition 4: For high-tax countries, profit splitting is appealing because it provides resilience against tax competition for the location of R&D. By appropriate choice of β the gains of policy coordination can be distributed so that all countries benefit.

The reasoning in favor of profit splitting is not readily applicable to non-digital goods and services. Although profit splitting provides resilience against tax competition even if non-digital goods and services are produced, home might prefer to react by retaliation. The threat is credible

as the trade in non-digital goods and services tends to be reciprocal which has been denied in the case of non-digital services.

8. Concluding remarks

Quite a number of countries are seen moving towards expanded source taxation of online business activities. A topical example is the proposal of the European Commission (2018) to levy a tax on digital services. The introduction of the DST is justified by the European Commission as a first step towards achieving “fair taxation of the digital economy”. Still, the DST would violate current international tax standards and has been criticized by tax experts for doing so. The remote supply of services is particularly affected. Current tax standards assign the right of taxing the profit earned on such supplies to the seller’s country of residence. This assignment is no longer taken for granted in its application to digital services. This paper aims at identifying economic forces which can explain the development.

It is argued that the tradition of taxing profits earned on remote services exclusively in the seller’s country of residence is shaped by the specific conditions governing production in the old economy. In the old economy, exports of goods and services cause positive marginal costs of quantity. This is different in the digital economy. The use of digital services is largely non-rival. It is argued that vanishing marginal costs of quantity change policy incentives. Small countries are incentivized to tax the import of digital services and to benefit from doing so if the supplier of the digital services discriminates prices between countries (Proposition 3). Retaliation might not be an effective threat as small countries are no natural candidates for developing and exporting digital services. Technology favors development in large countries. In the old economy, small countries have more reason to fear retaliation. In general, small countries do not benefit from taxing non-digital imports. Things are only different if the tax is used to fight some market failure such as market power exercised by the supplier of imports (Proposition 2).

The fact that small countries have an incentive to tax the import of digital services is worrisome. It clearly harms digital innovation if many small countries follow suit. The whole world suffers from the reduced variety and quality of digital services. In this paper, 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 remote digital 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 the hosting of digital R&D (Proposition 4). In any case, profit splitting is a policy option deserving of careful consideration by all the countries being strong exporters of digital services.

This paper argues that rivalry in use as opposed to non-rivalry is the key difference between the old and the digital economy that should be noted when designing the taxation of remote service supplies. Such a view could be questioned by arguing that zero marginal variable costs are no specialty of the new economy. The drug industry is an example in the old economy where the marginal cost of servicing additional customers is often so low that it can be ignored. However, this argument can be countered by pointing out that the import of drugs seems to provoke other policy responses. In fact, countries usually intervene with price regulation. This response seems to garner more international tolerance than import taxes on drugs.

One has to stress the theoretical nature of the analysis and its partial character. The conflict of interest in taxation between home and abroad has been taken as a given one. Corporate tax rates are exogenously given. The restrictions set by international tax law for national policy design have been ignored. Doing so can, however, be justified by referring to the growing practice of countries to discard agreed rules when it comes to taxing the proceeds of intellectual property. The expanded source taxation of online business activities is just an example. The granting of tax deductions for foreign-derived intangible income, and also the introduction of patent boxes are other examples of a general tendency toward undermining the agreed standards of international cooperate taxation. As shown, the introduction of digital services taxes, however, has the noteworthy potential to steer a development towards an international tax regime characterized by regulated and coordinated profit splitting. Clearly, one has to admit that this optimistic result is obtained by relying on various simplifying assumptions. Policy makers have to be aware of this caveat and they are well advised to draw conclusions with due caution.

9. Appendices

A) The derivatives $\frac{dx}{d\theta}$ and $\frac{dQ}{d\theta}$, evaluated at $\theta = 0$, are obtained by solving the following system of equations:

$$\begin{bmatrix} 2P_X + XP_{XX} & 0 & P_Q + XP_{QX} \\ 0 & 2p_x + xp_{xx} & p_Q + xp_{xQ} \\ P_Q + XP_{QX} & (1-\theta)(p_Q + xp_{xQ}) & XP_{QQ} + (1-\theta)xp_{QQ} - C_{QQ} \end{bmatrix} \begin{bmatrix} dx/d\theta \\ dx/d\theta \\ dQ/d\theta \end{bmatrix} = \begin{bmatrix} 0 \\ W \\ xp_Q \end{bmatrix} \quad (16)$$

The determinant of the Jacobian matrix is

$$D = [2p_x + xp_{xx}]D_{22} - (1-\theta)[p_Q + xp_{xQ}]^2[2P_X + XP_{XX}]. \quad (17)$$

$D_{22} = [2P_X + XP_{XX}][XP_{QQ} + (1-\theta)xp_{QQ} - C_{QQ}] - [P_Q + XP_{QX}]^2$ denotes the cofactor associated with the second element in the second column. By Cramer's rule,

$$D \frac{dx}{d\theta} = \frac{W}{(1-\theta)^2} D_{22} - xp_Q [p_Q + xp_{xQ}] [2P_X + XP_{XX}], \quad (18)$$

$$D \frac{dQ}{d\theta} = [2P_X + XP_{XX}] \{ xp_Q [2p_x + xp_{xx}] - \frac{W}{1-\theta} [p_Q + xp_{xQ}] \}. \quad (19)$$

The second-order conditions imply positivity of D_{22} and negativity of D , $2P_X + XP_{XX}$, and $2p_x + xp_{xx}$. p_Q is positive by assumption. The claimed negativity of $\frac{dx}{d\theta}$ and $\frac{dQ}{d\theta}$ then follows when assuming $p_Q + xp_{xQ} \geq 0$. This condition states that marginal revenue from selling quantity does not decrease in quality. \square

B) If $W = 0$, equations (18) and (19) simplify:

$$\frac{dx}{d\theta} = -xp_Q [p_Q + xp_{xQ}] [2P_X + XP_{XX}] / D \leq 0, \quad (20)$$

$$\frac{dQ}{d\theta} = xp_Q [2p_x + xp_{xx}] [2P_X + XP_{XX}] / D < 0. \quad (21)$$

Obviously, both derivatives vanish if p_Q tends to zero. \square

C) Set $p(x, Q) \equiv a - bx + \varepsilon Q$ and assume $W \geq 0$. Note that $p_Q = \varepsilon$. Solving the first-order condition (2.a) for x yields $x = \frac{1}{2b}[a + \varepsilon Q - W/(1 - \theta)]$ and $p(x, Q) = \frac{1}{2}[a + \varepsilon Q + W/(1 - \theta)]$. The derivatives $\frac{dx}{d\theta}$ and $\frac{dQ}{d\theta}$, are obtained at $\theta = 0$ by solving the following system of equations:

$$\begin{bmatrix} 2P_X + XP_{XX} & 0 & P_Q + XP_{QX} \\ 0 & -2b & \varepsilon \\ P_Q + XP_{QX} & \varepsilon & XP_{QQ} - C_{QQ} \end{bmatrix} \begin{bmatrix} dX/d\theta \\ dx/d\theta \\ dQ/d\theta \end{bmatrix} = \begin{bmatrix} 0 \\ W \\ \varepsilon x \end{bmatrix} \quad (22)$$

The determinant $D = -2bD_{22} - \varepsilon^2[2P_X + XP_{XX}]$ obviously tends to $-2bD_{22}$ for $\varepsilon \rightarrow 0$. By Cramer's rule,

$$\frac{dx}{d\theta} = \frac{WD_{22} - \varepsilon^2 x[2P_X + XP_{XX}]}{D} \rightarrow \frac{WD_{22}}{D} = -\frac{W}{2b} \text{ for } \varepsilon \rightarrow 0, \quad (23)$$

$$\frac{dQ}{d\theta} = \frac{-\varepsilon[W + 2bx][2P_X + XP_{XX}]}{D} \rightarrow 0 \text{ for } \varepsilon \rightarrow 0. \quad (24)$$

Furthermore, x tends to $\frac{a-W}{2b}$ and p tends to $\frac{a+W}{2}$ for $\varepsilon \rightarrow 0$. Marginal efficiency of abroad increases in β if, and only if,

$$0 < x \left[(1 - T)p + b \frac{dx}{d\theta} - \varepsilon \frac{dQ}{d\theta} \right] + p \cdot MRS \frac{dQ}{d\theta}. \quad (25)$$

For $\varepsilon \rightarrow 0$, the right-hand side tends to $x \left[(1 - T) \frac{a+W}{2} - \frac{W}{2} \right]$ which equals $x(1 - T) \frac{a}{2} > 0$ if $W = 0$ and which exceeds $x \left[(1 - T) \frac{W+W}{2} - \frac{W}{2} \right] = x \left(\frac{1}{2} - T \right) W$ if $W > 0$. Note that a has to exceed W if x is to be positive. Hence, the right-hand side of eq. (25) remains positive if $W = 0$ and $\varepsilon \rightarrow 0$ which is not necessarily true if $W > 0$. In that case, home's profit tax rate, T , must be smaller than $\frac{1}{2}$, if positivity of the bracketed expression in eq. (25) is to be proven for $\varepsilon \rightarrow 0$. An example for which the bracketed expression in eq. (25) is negative for $\varepsilon \rightarrow 0$ is the following: $a = 2W, b = \frac{1}{2}, W > 0$, and $T > \frac{2}{3}$. \square

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