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Stefan Greil, Christian Schwarz, Stefan Stein

Fairness and the Arm's Length Principle in a Digital Economy



Düsseldorf Working Papers in Applied Management and Economics

# Fairness and the Arm's Length Principle in a Digital Economy

Stefan Greil<sup>a</sup>, Christian Schwarz<sup>b</sup>, Stefan Stein<sup>c</sup>

**Abstract:** The OECD Base Erosion Profit Shifting (BEPS) Initiative as well as the current fairness oriented public discussion regarding the taxation of digital business models highlight the importance and complexity of the arm's length principle. In a theoretical model of an internationally fragmented digital good's production process, we show that fairness considerations of tax authorities (namely inequity aversion) can result in a falling apart between a perceived "fair" and arm's length distribution of profits across tax jurisdictions.

Our model predicts that a multinational firm follows the fundamental paradigm of international taxation, i.e. the arm's length principle, to properly incentivize internal agents involved in the production of a digital good. However, with inequity averse tax authorities, we find that tax authorities "prefer" a more equal distribution of profits compared to the arm's length profit allocation. From a multinational firm's perspective, inequity aversion among tax authorities dampens the strategic effect to – in accordance with arm's length principle – shift profits to low tax countries.

JEL Classification: H26, H25, F23

Keywords: corporate income tax, profit-shifting, arm's length principle, fairness

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## 1 Introduction

Digitalization allows new as well as existing business models to gather, connect and analyze data to create new information based products or services. Typical examples include platform economies such as the Facebook social network, algorithm driven business models such as the Google search engine as well as digitalized technologies that link technical machineries with each other (Industry 4.0). From a policy perspective, these new digital business models are often build around a new value creation which is in general also able to increase welfare from a social perspective. With this new value creation, high-skilled employment, research- and development investments as well as extensive profits come along. This is the reason why countries try to attract those new digital business models. However, despite the indisputable positive effects of digitalization, also challenges for the global society arise. One important issue of this is to secure that states can tax a perceived “fair” share of the profits generated by these new digital business models in their countries.<sup>1</sup> In the past, anecdotal evidence showed that this was not sufficiently secured since especially digital business models were quite successful in avoiding taxation.<sup>2</sup> For example, the European Union estimates that companies with digital business models pay on average half the effective tax rate of companies with traditional business models.<sup>3</sup> Therefore, a vivid discussion how to tax digital business models in principle and how to allocate the tax base across various jurisdictions, has arisen.

One of the key initiatives to solve these problems of international taxation is the G20/OECD Base Erosion and Profit Shifting (“BEPS”) initiative. The BEPS initiative clearly illustrated that the allocation of the tax base across jurisdictions is very difficult based on the current internationally accepted taxation principles as well as often perceived as unfair by both the local tax authorities as well as the public in general. The reason for such a perceived unfairness is that in traditional business models the taxation rights of a jurisdiction correspond with the scope and extent of the multinational’s business activities in the country. Typically, the taxation rights increase the more extensive the multinational’s value creation becomes in that country. However, with digital business models, it is not decisive to have a physical presence in a certain country and therefore the value creation is more difficult to evaluate since typical heuristics such as employees or tangible assets as reference points are not available or reasonable, see BEPS Action Point 1.<sup>4</sup> Most digital goods and services can be provided via the internet without a physical presence in specific county. The latter is however, commonly a precedent condition for taxation rights. Thus, given a fairness norm that all business models should be in principal taxed, the gap in effective tax rates between traditional and digital business models<sup>5</sup> can be perceived as unfair.

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<sup>1</sup> This involves the question how to dam profit shifting as well as new or modified concepts of taxation.

<sup>2</sup> Typical channels include transfer pricing (see Davies et al., 2018), debt shifting (Egger et al., 2014), royalties from intangibles (Dischinger and Riedel, 2011; Karkinsky and Riedel, 2012; Griffith et al., 2014) and shifting of functions (Mutti and Grubert, 2004; Voget, 2011; Ruf and Weichenrieder, 2012).

<sup>3</sup> C.f. EU Commission Expert Group on Taxation of the Digital Economy (2014).

<sup>4</sup> In BEPS Action Point 1 it is argued that digitalization facilitates the internationalization as it is not necessary to create a physical local nexus to provide products and services.

<sup>5</sup> C.f. ZEW (2017).

Historically, the current set of international tax rules that cover cross-border business activities originated from principles devised in the 1920s at a time when factors contributing to the value created by multinational enterprises (“MNE”) were relatively immobile and required intensive use of labor and tangible assets.<sup>6</sup> One of the key cornerstones of internationally accepted taxation principles developed in the past is the arm’s length principle (“ALP”).<sup>7</sup> The purpose of the ALP is to allocate taxable profits to different enterprises of an MNE in accordance with the outcomes of market transactions between independent third parties.<sup>8</sup> For decades, it has become the well-established principle in transfer pricing to allocate profits across different jurisdictions, see Wittendorf (2009). For intercompany transactions based on labor activities or tangibles assets, the ALP is relatively easy to apply in practice. In contrast to this, the ALP is complex for highly integrated transactions that heavily rely on intangibles assets, see BEPS Actions 8-10. Unfortunately, these intangible assets such as algorithms or data sources are of unique importance for the value creation of digital business models. In the light of the increasing importance of intangible assets also for traditional business models, the OECD refined the ALP approach by highlighting the importance of economic criteria over contractual agreements (“substance over form” approach).

However, in practice, complex transfer pricing guidelines and rules often do not provide a satisfactory solution for tax authorities, see Devereux and Vella (2017). In the general public and also among tax authorities there exists currently a strong gut feeling that there could be a mismatch between where taxation of the profit takes place and where value is created for certain digital activities. The main concern is that “user” value creation due to data gathering is located in a tax jurisdiction where the company carrying out a digital activity is not physically established and where its activities thus cannot be taxed. Therefore, some countries are unsatisfied with the ALP and implement innovative tax tools (special levies); for example, India introduced an “equalization levy”, the UK and Australia introduced “Diverted Profits Taxes” and the US the “BEAT”.

One core issue for these recent developments might be that the ALP does not involve fairness considerations. Related to this, various empirical evidence clearly illustrates that the agents involved in the international taxation rights, in particular tax auditors, do judge the outcomes based on such fairness norms. Among others, Kirchler et al. (2001) find that fiscal officers are strongly affected by such fairness norms. Compared to various other groups such as business students, business lawyers or entrepreneurs, the authors find that tax auditors judge all forms of tax reduction as least fair. From a more general perspective, these findings are in line with an overwhelming experimental evidence which shows that humans consider fairness considerations such as inequity aversion as relevant, especially in distribution scenarios such as allocating the tax base across countries is a prominent example for (see Fehr and Schmidt (1999), Bolton and Ockenfels (2000) for the seminal contributions).

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<sup>6</sup> Typically, “source” countries were allocated the primary taxing rights to the active income of the business, and residence countries the primary taxing rights to passive income, such as dividends, royalties and interest, c.f. Devereux and Vella (2017).

<sup>7</sup> C.f. Article 9 of the OECD Model Tax Convention.

<sup>8</sup> The fundamental principles of the ALP are laid down in the OECD Transfer Pricing Guidelines (2017) and the OECD Report on the Attribution of Profits to Permanent Establishments (2010).

Even though it is unlikely that the ALP will be substituted by any other distribution norm in the near future, fairness considerations of tax authorities will become more relevant since the BEPS project raised awareness for transfer pricing and increases transparency across the tax base with the standardized transfer pricing documentation and the Country-by-Country Reporting (“CbCR”).<sup>9</sup> Especially, the CbCR will increase transparency since in all jurisdictions the MNE operates in, tax authorities will be informed about the key financials of the global value MNE value creations (revenue, earnings before tax, taxes etc.). In the past, this information was very difficult to gather for the local tax authorities. Consequently, it is likely that MNEs will face more transfer pricing adjustments and potential double taxation if the transfer price for the respective transaction is not perceived as fair by the local tax auditors.

The goal of the present paper is to study the interplay between a profit allocation based on the ALP and fairness considerations of tax authorities in a digital business model. In the spirit of the seminal contribution by Antràs and Helpman (2004), we develop a theoretical model of an internationally fragmented production process of a digital good or service. We assume that the production of the digital good requires two inputs, namely the development of an algorithm and the supply of data. As both inputs are essential also for the success of a digital business model in practice, we consider a production technology which allows to substitute both inputs but not in a perfect manner. In international tax jargon, both inputs are essential value drivers for the digital goods production but both inputs are also provided by input suppliers located in two different countries. International fragmentation of production is necessary since both inputs can only be produced in the respective home countries of the suppliers. The production process is organized by the headquarter of the firm. This agent treats the two input suppliers as if they are independent third parties, such that the headquarter applies – by definition – the ALP. After the digital good has been produced, local tax authorities inspect the declared tax base in each of the two countries. If the local tax authorities do not accept the allocated taxable income in their corresponding countries, a firm can decide to initiate a mutual agreement procedure (“MAP”) to avoid double taxation.<sup>10</sup> In

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<sup>9</sup> C.f. EY (2016).

<sup>10</sup> Technically, a MAP can be provoked by a taxpayer either under the EU Arbitration Convention or the provisions under the applicable double tax treaty if the taxation is not in accordance with the provisions of the Convention. One of the main purposes of double tax treaties is to determine how to deal with issues related to the allocation of revenues generated by foreign activities between host and home countries and therefore to mitigate the possibility of double taxation and untaxed income. In this context, measures that aim to avoid double taxation right from the outset and those that aim to remediate double taxation in situations where the exercise of national taxing rights leads to double taxation issues need to be distinguished. For the former case double tax treaties determine how countries should exercise their taxing rights and provide specific allocation rules for different categories of income. For the latter case, the mechanisms included in double tax treaties such as mutual agreement and arbitration procedures are available (article 25 OECD OECD-Model Tax Convention). A MAP is a procedure between the contracting states which are trying to resolve tax disputes. However, to avoid double taxation in any case a mandatory binding arbitration is needed. Such an arbitration clause is recommended by the OECD Model Tax Convention and is particularly included in newer double tax treaties. Especially in the context of the BEPS process and under Action Point 14 some countries have expressed interest in including a mandatory binding arbitration provision. These countries are Australia, Austria, Belgium, Canada, France, Germany, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States; this represents a major step forward as together these countries are involved in more than 90 percent of outstanding MAP cases at the

this case tax authorities for themselves engage in a bilateral bargaining over the total profits as a basis for their local taxation rights. In practice, the MAP procedure is the most common procedure to avoid double taxation.<sup>11</sup> In the past, the bargaining-related aspects of international taxation have not been in the focus in the literature, but recent evidence by Egger et al. (2018) suggest that tax savings by MNEs are not only routed through profit shifting but also lie in the increased bargaining power of MNEs. In our model, we now shed light on an additional bargaining channel, namely between the two tax authorities. Given the experimental evidence regarding the application of fairness norms, our model framework allows for other regarding social preferences. Intuitively, the utility of a tax authority in one country does not depend only of the level of the tax base in the own domestic country but decreases if tax base is transferred to the other country. This interplay between inequity averse tax authorities and the ALP has – to the best of our knowledge – not been studied yet.

Our results can be summarized as follows. In a hypothetical scenario without inequity aversion and no tax rate differential between both countries, tax authorities follow the declared profit allocation as set by the firm. This profit allocation across jurisdictions is then fully consistent with the ALP. The concrete profit allocation between both countries is, however, not a constant. Given that our model allows different input intensities, we find that a higher importance of one input, for example the algorithm, yields to a higher profit share for the corresponding supplier, e.g. the algorithm developer in the corresponding country. This is the basic principle of transfer pricing such that higher profits go hand in hand with a higher value creation. By introducing asymmetries in terms of a tax rate differential, we find that the headquarter strategically shifts profits to the low tax country. One could argue that this profit shifting is to avoid taxation. In our model the mechanic is however different. Since the headquarter maximizes after tax profits, a lower tax rate in one country is equivalent to lower input production costs in that country. Importantly, the comparative advantage of lower production costs or a lower tax rate in one country would equally apply for independent third party suppliers such that again, the headquarter treats both internal and external suppliers identical. In this case, also tax authorities follow the proposed profit allocation of firms, however if and only if inequity aversion is involved. If tax authorities apply a fairness norm such as inequity aversion, the profit allocation as it is the result of the bargaining outcome between tax authorities follows a more equal distribution. Still, also tax authorities follow the “profits follow value creation paradigm”, but the allocation is less extreme as set by firms by applying the ALP. Therefore, our model predicts that fairness norms yields c.p. a less extreme distribution of taxable profits and thus dilute the fundamental ALP principle that profits follow value creation.

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end of 2013, as reported to the OECD. Under the arbitration provisions of the EU Arbitration Convention, the elimination of double taxation is mandatory for transfer pricing matter within the EU. Furthermore, the EU introduced a new Council Directive on Double Taxation Dispute Resolution Mechanisms in the European Union. The aim is to improve DTDRLMs in the EU in order to ensure an effective and conclusive resolution of cases of double taxation disputes with a full elimination of the double taxation.

<sup>11</sup> Related statistics are regularly provided, c.f. EU Joint Transfer Pricing Forum (2016).

## 2 Related Literature

Our model framework is closely related to the seminal contribution by Antràs and Helpman introduced in 2004. This model allows to explain patterns of international organization (outsourcing versus integration) along the dimensions of global scale (foreign sourcing), sector characteristics (input intensities) as well as firm-level differences in productivity à la Melitz (2003). The latter one is motivated by the vast empirical evidence regarding firm productivity heterogeneity, see Bernard et al. (2011) for a review of the empirical motivation.<sup>12</sup> We closely follow the original Antràs and Helpman framework but incorporate an additional stage where tax authorities bargain over the taxation rights for the outcome of the production game. Related to this, the increased bargaining power of multinationals with respect to local tax authorities is studied in a recent contribution by Egger et al. (2018). The empirical evidence presented in this papers suggests that that tax savings by MNEs are not only routed through profit shifting but also lie in the increased bargaining power of MNEs. Since we study an incomplete contracts framework, also within the firm agents' bargain about the outcome of production. In the transfer pricing related literature, such bargaining games with cooperative solution concepts have been extensively studied, e.g. by Baldenius et al. (1999), Chwolka et al. (2010), Edlin and Reichelstein (1995, 1996), Haake and Martini (2013), Holmstrom and Tirole (1991), Johnson (2006), Smith (2002), and Wielenberg (2000).

Another important strand of the literature which strongly influences our model are the fairness considerations we integrate in our model at the level of tax authorities. Fairness considerations are an important aspect in taxation. For example, debates about the appropriate income tax schedule are strongly affected by notions of fairness, see Seidl and Traub 1999. Also, the amount of tax evasion is likely to be affected by the perceived fairness of the tax system, see Andreoni et al. 1998, Alm et. al 1995, Frey and Weck-Hanneman 1984. Compliance with contractual obligations, with organizational rules and with the law in general is strongly shaped by the perceived fairness of the allocation of material benefits and by issues of procedural justice, see Fehr et al. 1997, Lind and Tyler 1988. By introducing other regarding preferences with fairness considerations in the utility function of the tax authorities, we clearly deviate from the standard maximizing "own" tax earnings approach and importantly also from the regulatory framework given by the ALP. However, we consider this aspect interesting since the empirical evidence suggests that tax authorities follow fairness considerations (see Kirchler et al. (2001)), tax auditors are public servants and motivation often originates from intrinsic motivation. The latter one might be reinforced by the gut feeling of many tax authorities which believe that "transfer pricing is not an exact science"<sup>13</sup> and therefore the ALP as applied by firms might be used for tax avoidance or evasion.

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<sup>12</sup> In the past, various aspects have been included in the original model framework, e.g. partial contractibility c.f. Antràs and Helpman (2008), multiple inputs c.f. Schwarz and Suedekum (2014) and bi-sourcing c.f. Nowak et al. (2016).

<sup>13</sup> OECD Transfer Pricing Guidelines (2017), textnote 1.12: "Transfer pricing is not an exact science but does require the exercise of judgment on the part of both the tax administration and taxpayer."



Another building block is the empirical evidence regarding profit shifting. Albeit not in the focus of our model, this strand of the is important for the motivation of the paper. As the empirical evidence shows at least some multinationals strategically used the vagueness of the ALP to avoid taxation, see Davies et al., (2014), Dischinger and Riedel (2011), Egger et al., (2014), Griffith et al. (2014), Karkinsky and Riedel, (2012), Mutti and Grubert, (2004), Ruf and Weichenrieder (2012), Voget (2011) among others.

### 3 Model

#### 3.1 Structure of the Game

##### a) Demand

We consider a world with two countries, denoted by 1 and 2, and a unique factor of production, high skilled information technology experts. A firm produces a digital good  $x$  for which it faces the following iso-elastic demand function:

$$x = p^{-1/(1-\mu)} \quad (1)$$

Here,  $p$  denotes the price for a digital product. The demand elasticity is  $1/(1-\mu)$ , which is increasing in  $\mu \in [0,1]$ .

##### b) Technology

Production of the digital good requires a combination of two-specific inputs,  $a$  and  $d$ , which we associate with an algorithm and data sources, respectively. Output  $x$  of the digital product is a Cobb-Douglas function of the two inputs

$$x = \left(\frac{a}{\eta}\right)^\eta \left(\frac{d}{1-\eta}\right)^{1-\eta} \quad (2)$$

where  $\eta$  is a business model specific parameter. The output elasticity with respect to the algorithm input is  $\eta$ , such that the larger  $\eta$  is, the more intensive is the digital business model in the algorithm of the digital product. The algorithm  $a$  can only be produced in country 1 and data  $d$  can only be provided in country 2, with one unit of labor per unit of output in each of the countries. Since both inputs rely on high skilled information technology experts, we assume for simplicity that unit costs of labor are normalized to one.<sup>14</sup> We interpret the final-good as a digital good or service. Albeit the production process of digital goods is often characterized by significant economies of scale due to network externalities or platform technologies, we highly abstract from these production function characteristics<sup>15</sup> and focus only on the two essential parts of a digital good,

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<sup>14</sup> Our model does not focus on the consumer side of the digital business model and therefore we do not include the question whether there is a price of data provision regarding the usage of the digital product. We rather think of the data provider as an agent that structures and harmonizes the consumer data for evaluation by the algorithm.

<sup>15</sup> For a more general version of the model with economies of scale c.f. Acemoglu et al. (2007).

namely an algorithm to explore the second input, data.<sup>16</sup> Furthermore, we also consider the digital goods production process not as a sequential process as often studied in the transfer pricing literature, which is perfectly suitable for traditional business models, but rather as a simultaneous combination of both inputs.<sup>17</sup>

### c) *Agents*

There are two types of agents engaged in the digital good production: the algorithm developer  $A$ , who develops the algorithm input  $a$  and the data provider  $D$ , who supplies data  $d$  for the algorithm. Since we assume a Cobb-Douglas function, both the algorithm developer and the data supplier  $D$  provide essential inputs for the digital good production process and cannot be perfectly substituted. The production process is managed by the headquarter of the firm, denoted by  $H$ . The headquarter is the ultimate owner of the algorithm producer  $A$  and the data supplier  $D$ , such that any country-specific profits after tax on a legal entity level of  $A$  and  $D$  end up at  $H$ .

### d) *Timing of events*

In the spirit of Antràs and Helpman (2004), we consider the following stages of production with an additional tax negotiation phase at the end of the production phase.<sup>18</sup> The timing of events is as follows:

1. In the *first stage*, the headquarter  $H$  engages with the internal algorithm developer  $A$  and the internal data supplier data  $D$ . The setting is one of incomplete contracts such that  $H, A$  and  $D$  cannot sign ex-ante enforceable contracts specifying the purchase of a business model specific (more generally relationship specific) algorithm or data for a certain price as well as cannot write enforceable contracts contingent on the amount of sales revenues obtained when the digital good is sold.<sup>19</sup> In order to incentivize the production of the two inputs  $a$  and  $d$ , the firm offers a revenue share  $\beta \in (0,1)$  to the algorithm developer  $A$  and the data supplier  $D$  of the sales revenues when the digital good is sold.
2. In the *second stage*, the algorithm developer  $A$  and the data supplier  $D$  independently decide on their inputs levels  $a$  and  $d$  respectively. At this stage, their production incentives to provide inputs  $a$  and  $d$  are given by the revenue shares the headquarter offers in stage 1.
3. In the *third stage*, because no enforceable contract can be signed ex-ante, the algorithm developer  $A$  and the data supplier  $D$  bargain over the surplus from the relationship after the inputs have been produced. We model this ex post bargaining as a generalized Nash bargaining game in which the algorithm

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<sup>16</sup> For a version with multiple inputs c.f. Schwarz and Suedekum (2014).

<sup>17</sup> In the jargon as introduced by Baldwin and Venables (2013) we study a “spider” structure.

<sup>18</sup> In line with Antràs and Helpman (2004) we inter alia consider an incomplete contracts framework and also follow the Cobb-Douglas approach regarding production technology. We simplify the original framework to highlight the role of inequity averse tax authorities. We do not study the make-or-buy question as well as neglect the offshoring option.

<sup>19</sup> Arguments which justify the incomplete contracts are extensively provided by Hart and Moore (1999) and Segal (1999).

developer obtains a share  $s \in (0,1)$  of the ex post gains from the relationship. Notably, the production costs are sunk at this stage.

4. In the *fourth stage*, output  $x$  is produced, revenue  $R$  is realized, and the surplus value is divided among the algorithm developer  $A$  and the data supplier  $D$ . This implies an allocation of total profits  $\pi$  across both countries. We denote the profit level of the algorithm developer  $A$  in country 1 with  $\pi_1$  and  $\pi_2$  for country 2 and the data supplier  $D$  respectively.
5. In addition to the original Antràs and Helpman (2004) framework, we model an additional *fifth* and last stage of the game, in which tax authorities audit the declared tax base, i.e.  $\pi_1$  for country 1 and  $\pi_2$  for country 2 as realized in the fourth stage. Thereby tax authorities engage in a generalized Nash bargaining with the other countries' tax authority.

We solve this game by backward induction.

e) *Equilibrium*

*Stage 5: Bargaining of tax authorities*

The firm declares a taxable income  $\pi_1$  in country 1 and  $\pi_2$  in country 2. We assume that the share  $s$  of total profit  $\pi$  is allocated to country 1 and correspondingly  $(1 - s)$  is the declared taxable income in country 2, i.e.  $\pi_1 = s \pi$  and  $\pi_2 = (1 - s) \pi$ . If the local tax authorities do not accept the allocated taxable income in their corresponding countries, a firm can decide to initiate a mutual agreement procedure (“MAP”) to avoid double taxation. In this case tax authorities for themselves engage in a bilateral bargaining over the total profits  $\pi$  as a basis for their local taxation rights. In our model, we assume that the firm initiates a MAP since tax authorities do not accept the allocated taxable income in the first place.

Given the experimental evidence on inequity aversion as presented in the introduction, which is distinctive for tax inspectors<sup>20</sup>, we assume that a tax authority in country  $i$  with  $i = 1,2$  has a utility  $U_i$  given by

$$U_i = \tau_i t_i \pi - \lambda \max \{ \tau_i \pi (t_j - t_i) ; 0 \} \quad (3)$$

where  $\tau_i(t_j)$  is the tax rate in country  $i$  ( $j$ ) and  $t_i(t_j)$  is share of total profit “captured” by the tax authority in country  $i$  ( $j$ ) in the course of the MAP. Here  $\lambda \geq 0$  is a parameter measuring the inequity aversion of the tax authorities regarding other tax authorities, i.e. c.p. a higher tax base and tax amount in the other country reduces the own utility and this effect is stronger, the higher  $\lambda$ . The utility specification of (negative) inequity aversion directly follows the seminal contribution by Fehr and Schmidt (1999).<sup>21</sup> For simplicity, we assume that this inequity aversion is symmetrical across tax authorities.

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<sup>20</sup> C.f. the discussion of the inequity aversion literature in the introduction.

<sup>21</sup> To simplify the analysis, we do not include an individual parameter of positive inequality aversion. The common assumption in Fehr and Schmidt (1999) is to assume that negative inequality aversion is more important than positive.

We model the MAP procedure as a bilateral Nash bargaining of tax authorities over taxable income, i.e.

$$\operatorname{argmax}_{t_1, t_2} A = (U_1 - \tau_1 \pi_1) (U_2 - \tau_2 \pi_2) \quad (4)$$

where it is assumed that tax authorities in principle have the same bargaining power, but the fallback outcomes (i.e. declared tax  $\tau_1 \pi_1$  and  $\tau_2 \pi_2$ ) are ultimately set by the headquarter  $H$ . The tax authorities capture shares  $t_i^*$  and  $t_j^*$  which depend on input contributions of the two input providers (i.e. the algorithm  $a$  and the data  $d$ ) as well as the allocation of profits which is indirectly given by the revenue share  $s$ .

**Assumption 1:** *To avoid any case distinctions in the following, we assume that the in the MAP realized tax amount (profit share) in country 1 is smaller than the tax amount (or profit share) in country 2, i.e. more formally  $t_1 < t_2$ . In this case “only” tax authority 1 suffers from (negative) inequity aversion.*

Using this assumption, the profit shares of the two tax authorities are given by:

$$t_1^* = \frac{s + \lambda + \Xi}{1 + \lambda(3 - 2s - 2\Xi)} \quad \text{and} \quad t_2^* = \frac{(1 + 2\lambda)(1 - s - \Xi)}{1 + \lambda(3 - 2s - 2\Xi)} \quad (5)$$

with

$$\Xi = \frac{a(1 - s) - d s}{a + d - a^{\mu\eta} d^{\mu(1-\eta)} \eta^{-\mu\eta} (1 - \eta)^{-\mu(1-\eta)}}$$

At this stage and comparative static results are complex to interpret since both tax rates depend on both input contributions ( $a$  and  $d$ ) as well as the allocation of production incentives. Therefore, we proceed with the following stages.

*Stage 4: Realization of output and allocation of profits*

In this stage, inputs  $a$  and  $d$  are already produced and entirely relations specific, such that output  $R$  is realized:

$$R = \left(\frac{a}{\eta}\right)^{\mu\eta} \left(\frac{d}{1 - \eta}\right)^{\mu(1-\eta)} \quad (6)$$

The surplus value  $R$  is divided between  $A$  and  $D$  according to the bargaining agreement which ultimately is determined by the allocation of revenues (i.e.  $s$  and  $1 - s$ ) as set by the headquarter  $H$  in Stage 1.

*Stage 3: Intra-firm bargaining between  $A$  and  $D$*

All costs are sunk at this stage and all investments are non-contractible and entirely business model specific. Therefore, the surplus value over which the individual entities bargain is the total sales revenue  $R$ . Again, the intra-firm bargaining between  $A$  and  $D$  is modeled as a generalized Nash bargaining. The bargaining power of the algorithm developer  $A$  is denoted by  $\beta$  and the bargaining power of the data provider  $D$  is  $1 - \beta$ :

$$\operatorname{argmax}_{\beta, 1-\beta} B = [s R]^\beta [(1-s) R]^{1-\beta} \quad (7)$$

The outcome of the Nash bargaining is that each party receive revenue shares that are reflective of their respective bargaining powers, i.e.  $s = \beta$  and  $1 - s = 1 - \beta$ .

*Stage 2: Algorithm development and data supply*

Given the revenue shares  $s$  and  $1 - s$  set in Stage 1, the algorithm supplier  $A$  and the data provider  $D$  maximizes individual profits after tax:

$$\max_a \pi_1 = (1 - \tau_1)[s R(a) - a] \quad \text{and} \quad \max_d \pi_2 = (1 - \tau_2)[(1-s) R(d) - d] \quad (8)$$

by setting individual input contributions  $h$  and  $m$ . The optimal input contributions  $a^*$  and  $d^*$  at this stage still depend on the allocation of profits set by the firm in stage 1 and are given by (c.f. Appendix 1):

$$a^* = \eta s^{\frac{1-\mu(1-\eta)}{1-\mu}} (1-s)^{\frac{\mu(1-\eta)}{1-\mu}} \frac{1}{\mu^{1-\mu}} \quad \text{and} \quad d^* = (1-\eta) s^{\frac{\mu\eta}{1-\mu}} (1-s)^{\frac{1-\mu\eta}{1-\mu}} \frac{1}{\mu^{1-\mu}} \quad (9)$$

Using Eq. (9) yields that relative contributions  $a^*/d^*$  increase in the relative output intensity  $\eta/(1-\eta)$  as well as the relative revenue shares  $s/(1-s)$  but are independent of tax rates. While the first effect via  $\eta$  is technology driven and exogenous in our model approach, the latter effect via relative revenue share can be used by the headquarter  $H$  to properly incentivize  $A$  and  $D$ . Everything else equal, a higher revenue share yields better incentives and higher contributions for the corresponding input provider.

*Stage 1: Headquarter offers optimal revenue distribution*

All agents, including the headquarter  $H$ , anticipate ex-post bargaining between  $A$  and  $D$  in Stage 3. Therefore, it is imported for the headquarter  $H$  to properly incentivize the algorithm developer  $A$  and the data supplier  $D$ . This is independent of the question of make-or-buy and thus also fundamentally mirrors the ALP since the headquarter treats in this scenario the internal algorithm developer  $A$  and data supplier  $D$  exactly as an independent third party. The headquarter  $H$  therefore chooses the allocation of revenue (and consequently the allocation of profits between country 1 and 2) to maximize total profits after tax. This leads to a profit maximizing revenue share  $s^*$  which depends on (i) the algorithm intensity  $\eta$  of the digital product, the exogenously given tax rates  $\tau_1$  and  $\tau_2$  in the two countries and the severity of inequity aversion  $\lambda$ . In the following we discuss the solution of the game by separating the different effects of the parameters. Therefore, we first discuss a scenario (“*Scenario 1*”) with no inequity aversion ( $\lambda = 0$ ) but we allow for different tax rates in the two countries. After that, we hold the tax rates equal ( $\tau_1 = \tau_2 = \tau$ ) but study different levels of aversion (“*Scenario 2*”). Finally, we combine both c.p. scenarios to derive the fully-fledged analysis (“*Scenario 3*”). In all scenarios, the headquarter  $H$  maximizes total after tax profits  $\pi$  given by

$$\max_s \pi = (1 - \tau_1) \pi_1 + (1 - \tau_2) \pi_2 \quad (10)$$

### 3.2 Scenarios

*Scenario 1: No inequity aversion but different tax rates*

If we assume  $\lambda = 0$  for Scenario 1, the after-tax profits as given in Eq. (8) can be written as:

$$\pi = R[1 - s\tau_1 - (1 - s)\tau_2 + \mu(s + \eta + (1 - 2s)\eta + s\eta\tau_1 + (1 - s)(1 - \eta)\tau_2 - 1)]$$

Solving for the after-tax profit maximizing distribution of revenue yields

$$s^* = \frac{\tau_2 - \tau_1 - \mu(\tau_2 - \tau_1 + 2\eta(1 - \tau_2) - (1 - \eta)\eta(2 - \tau_1 - \tau_2)) + \phi}{2(\mu - \tau_1 + (1 - \mu)\tau_2 - \mu\eta(2 - \tau_1 + \tau_2))} \quad (11)$$

with

$$\phi = \sqrt{(1 - \mu + (1 - \eta)\eta\mu^2)((1 - \eta)(\tau_1 - \tau_2)^2 + \mu^2\eta(1 - \eta)(2 - \tau_1 + \tau_2)^2)}$$

If we consider for a moment identical tax rates ( $\tau_1 = \tau_2 = \tau$ ), our model approach boils down to

$$s^*(\eta) = \frac{(1 - \mu)\eta + \mu\eta^2 - \sqrt{(1 - \eta)\eta(1 - \mu + (1 - \eta)\eta\mu^2)}}{2\mu - 1} \quad (12)$$

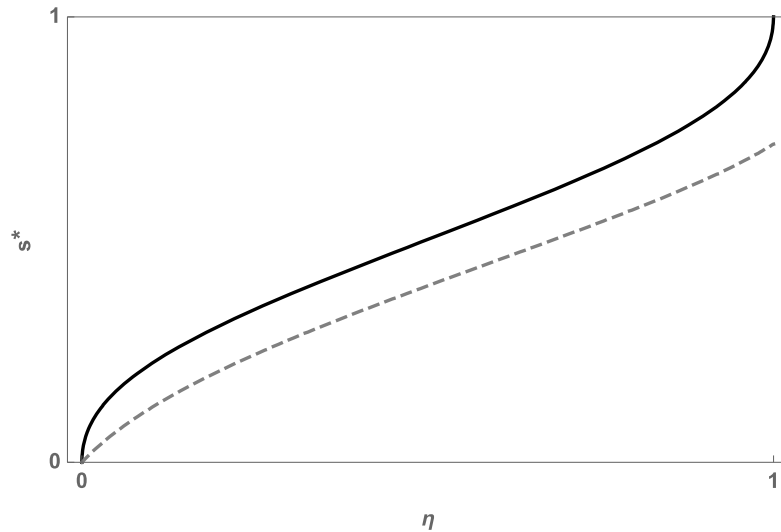
The optimal distribution of revenues  $s^*(\eta)$  as set by the headquarter is then identical to the optimal revenue distribution as in Antràs and Helpman (2004). Therefore, the mechanic of their model approach is one driving force in our model and summarized in the following. Since we are in a setup with incomplete contracts, both agents  $A$  and  $D$  underinvest in the provision of their inputs (i.e.  $A$  and  $D$  face the classical hold-up problem inherent to the incomplete contract framework). However, each party's severity of underinvestment is inversely related to the fraction of the revenue that the agent anticipates. Ex-ante efficiency requires giving a larger share of the revenue to the agent undertaking the relatively more important investment. Thus, a higher algorithm intensity (the larger  $\eta$ ), the higher the profit maximizing revenue fraction assigned to the algorithm developer  $A$  and vice versa for the data supplier  $D$ . The black solid curve in Figure 1 depicts  $s^*(\eta)$ .

Furthermore, for a strictly positive tax differential (e.g.  $\tau_1 > \tau_2$ ) it follows from Eq. (11) that  $\partial s^*/\partial \tau_1 < 0$  and  $\partial s^*/\partial \tau_2 > 0$ , c.f. Appendix 2. A relatively higher tax rate in country 1 therefore provides a *strategic* incentive to relocate production from country 1 to country 2. Since only country 1 can develop the algorithm, this does not result in an international transfer of the algorithm development from country 1 to country 2. However, given the Cobb-Douglas production function, it rather means intensifying data provision  $d$  by providing better incentives for  $D$  and simultaneously reducing incentives for  $A$  to provide the algorithm input  $a$ . Independent of this, the production technology given by the algorithm intensity  $\eta$  is unchanged. This result is also illustrated in Figure 1 by the dashed gray curve with  $\tau_1 = 1/3 > \tau_2 = 1/6$ . We refer to this shifting of incentives as the strategic profit shifting effect orchestrated by the headquarter  $H$ .

Given the profit maximizing distribution of revenue set in the first stage, optimal input contributions  $a^*$  and  $d^*$  in the second stage can be derived. A higher algorithm intensity yields a higher revenue share for the algorithm developer  $A$  which than fosters a more intensive algorithm development and vice versa for  $D$  a less intense data provision. Ultimately, this yields to a profit allocation between country 1 and country 2 which is given by

$$\frac{\pi_1}{\pi_1 + \pi_2} = \frac{s^* (1 - \mu \eta)}{1 - (1 - \eta) \mu - (1 - 2 \eta) \mu} \quad (13)$$

for country 1 and  $\pi_2/(\pi_1 + \pi_2)$  for country 2. Figure 2 illustrates the relationship with respect to  $\eta$ . Like Figure 1, the black graph illustrates the case that no tax differential is prevalent while the dashed grey curve assumes a low tax regime in country 2. The strategic incentive to stimulate production in the low tax country also transfers to relatively higher profits to country 2 which we consider as strategic profit shifting effect, c.f. Appendix 2.



**Figure 1:** Allocation of revenue  $s^*(\eta)$

$\mu=1/3$ , black solid curve:  $\tau_1 = \tau_2 = 1/3$ , gray dashed curve  $\tau_1 = 1/3 > \tau_2 = 1/6$

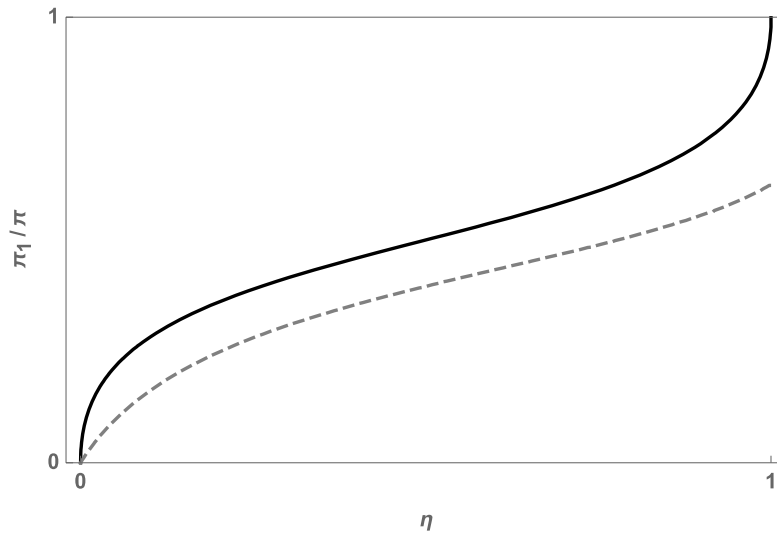
**Result 1:** i) A higher value creation in one country yields to a higher profit share in that country:  $\partial s^*/\partial \eta > 0$  and  $\partial \pi_1^*/\partial \eta > 0$  (“Profits follow Value Creation”) ii) A relatively lower tax rate in one country yields to a shift profit to that country (“Strategic Profit Shifting”)

Using the corresponding country specific profits in the tax authority Nash-bargaining as given in Eq. (4), we can derive the tax authorities profit allocation across countries:

$$t_1^* = \frac{s^* (1 - \mu\eta)}{1 - (1 - \eta) \mu - (1 - 2\eta) \mu} \quad \text{and} \quad t_2^* = \frac{(1 - s^*)(1 - \mu\eta(1 - s^*))}{1 - (1 - \eta) \mu - (1 - 2\eta) \mu} \quad (14)$$

It follows from Eq. (13) and Eq. (14) that tax authorities *exactly* allocate profits across countries based on the allocation of profits as set by the headquarter. Importantly, this is the outcome without any aversion. This result is rather grounded in the Nash-bargaining approach for the tax authorities, since the fallback outcomes are the allocation of profits set by the firm. Since no further asymmetry is imposed in the Nash-bargaining, this implies that tax authorities exactly follow the profit allocation proposition of the firm. Importantly, in the incomplete contracts framework, the firm does not differentiate between internal and external suppliers of algorithms and data, the profit allocation is by definition – the arm’s length – allocation of profits. Furthermore, it follows from Eq. (14) that the share of profits captures by the tax authorities increases in the foreign tax rate and decreases in the own domestic tax rate.<sup>22</sup>

**Result 2:** i) Tax authorities exactly follow the profit allocation as set by the firms in case of no inequity aversion. Since firms set their profit allocation based on the arm’s length principle, the tax authorities’ outcome in case of no inequity aversion is also arm’s length. (“Arm’s Length Ankerung”) ii) The strategic profit shifting due to a relatively lower tax rate in one country also translates into a lower profit share for the tax authorities in that country.



**Figure 2:** Firm’s profit allocation

$\mu=1/3$ , black solid curve:  $\tau_1 = \tau_2 = 1/3$ , gray dashed curve  $\tau_1 = 1/3 > \tau_2 = 1/6$

<sup>22</sup> For country 1 since  $\partial s^* / \partial \tau_1 < 0$ ,  $\partial s^* / \partial \tau_2 > 0$  and  $\partial t_1^* / \partial s^* > 0$  for country 1. Analogously for country 2.



*Scenario 2: Positive inequity aversion but same tax rates*

We now study the effect of inequity aversion by considering  $\lambda > 0$ . In Scenario 2, from a firm's perspective the optimal distribution of revenue as well as profits is independent of the inequity aversion parameter  $\lambda$ . As in Scenario 1, the optimal distribution of revenue is given by Eq. (11). Therefore, the “*Profits follow Value Creation*“ as stated in Result 1 also holds in Scenario 2 and is independent of inequity aversion.

However, using this result in the Nash bargaining between tax authorities' yields for the profit share  $t_1^*$  captured by the tax authority in country 1:

$$t_1^*(\lambda) = \frac{\lambda(1 - \mu(1 - \eta)) + s^*(1 - \mu(\eta - \lambda(1 - 2\eta)))}{1 + 3\lambda - 2s^*\lambda - (1 - \eta)(1 + 3\lambda)\mu + s^*\mu(1 + 3\lambda - 2\eta(1 + 2\lambda))} \quad (15)$$

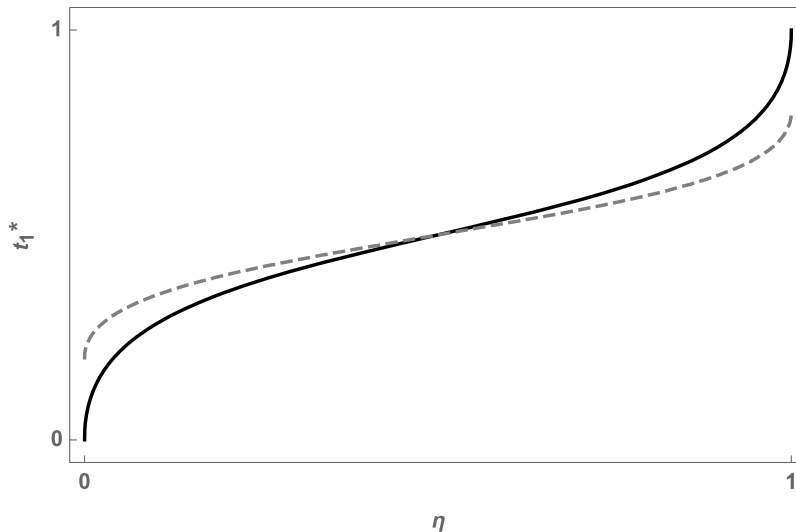
which is monotonically increasing in the algorithm intensity  $\eta$ . Intuitively, the local tax base increases in the local value creation and the profit allocation as set by the firm. This is in line with Result 2 and the “*Arm's Length Ankering*” also holds in Scenario 2.

However, for a strictly positive inequity aversion (i.e.  $\lambda > 0$ ), the firm's and tax authorities' allocation of profits differ. If the algorithm developer  $A$  is relatively unimportant ( $\eta < 1/2$  in case of identical tax rates), higher inequity aversion  $\lambda$  increases  $t_1^*$ , c.f. Appendix A.3. In this case, the ALP as applied by the firm results in a tax base in country 1 that is relatively low compared to the one in the other country 2. Inequity aversion of the tax authority in country 1 now balances against the “extreme” arm's length profit allocation such that in the tax authorities' Nash bargaining outcome a more equal distribution of profits results. This result is illustrated in Figure 3 where the grey dashed curve illustrates a higher  $\lambda > 0$ .<sup>23</sup> We summarize in:

**Result 3:** *In case of positive levels of inequity aversion, tax authorities prefer a more equal distribution of profits compared to the arm's length allocation as set by the firms. This discrepancy between the arm's length perspective of firms and the fairness considerations of tax authorities is fostered by higher inequity aversion (“Fairness Considerations of Tax Authorities Effect”).*

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<sup>23</sup> In Scenario 2 our Assumption 1 holds as long as  $\eta < 1/2$ . The graph is plotted in a way that for  $\eta > 1/2$  tax authority 2 suffers from inequity aversion.

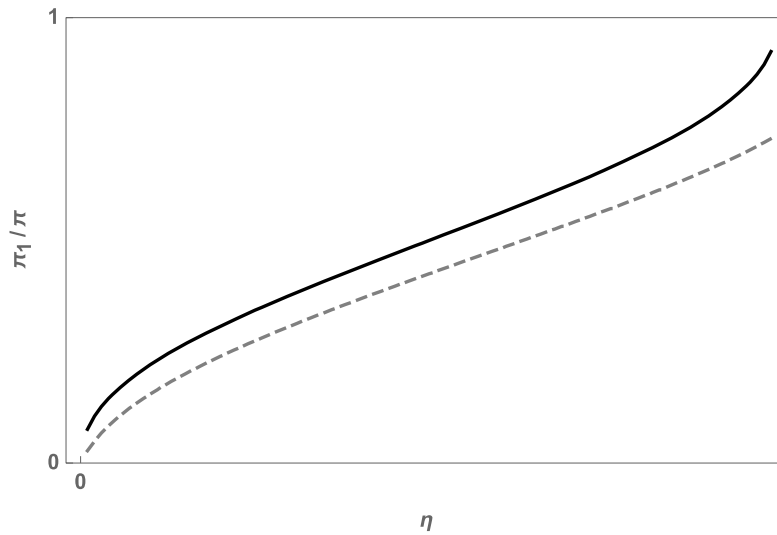


**Figure 3:** Tax authorities' profit allocation  
 $\mu = 1/3$ , black curve:  $\lambda = 0$ , gray curve:  $\lambda = 1/2$

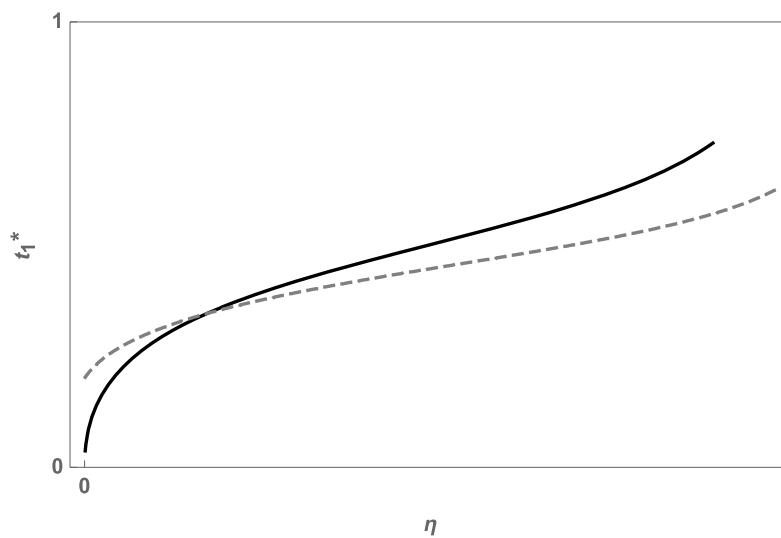
*Scenario 3: Inequity aversion and different tax rates*

This last Scenario 3 considers now different tax rates as well as positive levels of inequity aversion. Since closed form solutions cannot be derived for this case, we rely on numerical simulation to derive the results. Regarding the profit allocation as set by the firm, Figure 4 illustrates that Result 2 is robust, i.e. the firm allocates local profits based on value contributions. However, the firm also considers now the inequity aversion of tax authorities such that the impact of the relative value contribution is offset by the “fear” of inequity aversion on the level of tax authorities. This balancing of profits – irrespective of the technology parameter  $\eta$  – is again a strategic effect on the level of the firm which then further translates in an equalization of profits as negotiated between the tax authorities. The results are illustrated in Figure 4 and 5. We summarize in:

**Result 4:** *In case of positive levels of inequity aversion as well as differences in tax rates, firms strategically shift profits to the low tax country. However, this effect is dampened by inequity aversion of tax authorities such that firm anticipate in their incentive scheme a more equal distribution of profits as preferred by tax authorities.*



**Figure 4: Firm's profit allocation**  
 $\mu = 1/3$ , black solid curve:  $\tau_1 = \tau_2 = 1/3$ ,  $\lambda = 0$ ; blue dashed curve  $\tau_1 = 1/3 > \tau_2 = 1/6$ ,  $\lambda = 1/2$



**Figure 5: Tax authorities' profit allocation**  
 $\mu = 1/3$ , black solid curve:  $\tau_1 = \tau_2 = 1/3$ ,  $\lambda = 0$ ; grey dashed curve  $\tau_1 = 1/3 > \tau_2 = 1/6$ ,  $\lambda = 1/2$

## 4 Conclusion

The current G20/OECD Base Erosion Profit Shifting Initiative as well as the ongoing public discussion regarding the taxation of digital business models highlight the importance as well as the complexity of the arm's length principle. In a theoretical model of an internationally fragmented production process for a digital good, we showed that such fairness consideration of tax authorities can result in a falling apart between a profit allocation that is perceived as "fair" by tax authorities and the arm's length principle as applied by multinational firms. Studying this discrepancy between a "fair" and "arm's length" outcome is the main contribution of our theoretical model. The driving force of this result is the inequity aversion of tax authorities. Thus, a fruitful route for further research could be to empirically verify the importance of inequity aversion on the level of tax authorities in general as well as with respect to taxation rights in a transfer pricing framed setup.

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## Appendix

### A.1. Stage 2: Optimal Input Contributions

For the algorithm provider *A* the profit maximization problem as given in Eq. (8) can be written as

$$\pi_1 = (1 - \tau_1) [s a^\eta d^{(1-\eta)\mu} \eta^{-\eta\mu} (1 - \eta)^{-(1-\eta)\mu} - a] \quad (A1)$$

The first-order-condition (“FOC”) is given by

$$\partial \pi_1 / \partial a = (1 - \tau_1) [s \mu a^{\eta\mu-1} d^{(1-\eta)\mu} \eta^{1-\eta\mu} (1 - \eta)^{-(1-\eta)\mu} - 1] = 0 \quad (A2)$$

Analogously for the data supplier *D* the FOC can be derived. Solving both FOCs yields the optimal input contributions as stated in Eq. (9). Using the FOCs and deriving the second-order-conditions yields

$$\partial^2 \pi_1 / \partial^2 a = (1 - \tau_1) (\eta\mu - 1) [s \mu a^{\eta\mu-2} d^{(1-\eta)\mu} \eta^{1-\eta\mu} (1 - \eta)^{-(1-\eta)\mu}] < 0 \quad (A3)$$

### A.2. Scenario 1

#### i) Optimal Revenue Share and Tax Differential

Differentiating  $s^*$  as given in Eq. (11) with respect to  $\tau_1$  and taking the limit for  $\tau_1$  to  $\tau_2$  yields

$$\frac{\partial s^*}{\partial \tau_1} = \frac{\mu(1 - \mu + (1 - \eta)\eta\mu^2) + (2 - \mu)\mu\sqrt{\eta(1 - \eta)(1 - \mu + (1 - \eta)\eta\mu^2)}}{2\mu^2(1 - 2\eta)^2(1 - \tau)} \quad (A4)$$

It follows  $\partial s^* / \partial \tau_1 < 0$ . Analogously,  $s^*$  with respect to  $\tau_2$  and taking the limit for  $\tau_1$  to  $\tau_2$  yields

$$\frac{\partial s^*}{\partial \tau_2} = -\frac{\partial s^*}{\partial \tau_1} > 0 \quad (A5)$$

#### ii) Firms' Profit Allocation

Calculating  $\pi_1 / (\pi_1 + \pi_2)$  is given in Eq. (13). It directly follows that the relative profit share for the algorithm provider *A* increases the higher  $\eta$  since from Eq. (13) follows  $\partial \pi_1 / (\pi_1 + \pi_2) / \partial s^* > 0$  and  $\partial \pi_1 / (\pi_1 + \pi_2) / \partial \eta > 0$ .

### A.3. Scenario 2

Differentiating  $t_1^*$  as given in Eq. (15) with respect to  $\lambda$  yields:

$$\frac{\partial t_1^*}{\partial \lambda} = \frac{(1 - s^*)(1 - (1 - \eta)\mu)(1 - 2s^* - (1 - s^* - \eta)\mu)}{(1 - (1 - s^* - \eta - 2s^*\eta)\mu + \lambda(3 - 3(1 - \eta)\mu - s^*(2 - 3\mu + 4\eta\mu)))^2} \quad (A6)$$

which is monotonically increasing in the algorithm intensity  $\eta$  as long as  $\eta < 1/2$ .

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