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Sorting into outsourcing: Are profits taxed at a gorilla's arm's length?☆

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ABSTRACT

This article analyzes profit taxation according to the arm's length principle in a model where heterogeneous firms sort into foreign outsourcing. We show that multinational firms are able to shift profits abroad even if they fully comply with the tax code. This is because, in equilibrium, intra-firm transactions occur in firms that are better than the market at input production. Moreover, market input prices include a mark-up that arises from the bargaining between the firm and the independent supplier. Transfer prices set at market values following the arm's length principle thus systematically exceed multinationals' marginal costs, leading to a reduction of tax payments for each unit sold. The optimal organization of firms hence provides a new rationale for the empirically observed lower tax burden of multinational corporations.

1. Introduction

Multinational firm activity has become one of the most striking features of the global economy. Multinational enterprises (MNEs) now account for a major share of economic activity around the world. Some of these firms have an economic power similar to a middle-income country. General Electric, for example, which is active in over 100 countries, earned revenues of 182 billion US-dollars in 2008, more than the GDP of a medium-sized economy like Chile.

Such enterprises are not only big, but also highly productive and profitable.[1] They are consequently very attractive for governments, as they not only provide jobs and investments, but their high profits also offer the opportunity to generate tax revenue. However, there are widespread concerns that MNEs' profits are especially hard to tax, as—due to their internationality—they can avoid taxation in high-tax countries. Anecdotal evidence supports this claim: In 2008, the car manufacturer BMW, who has split production among various facilities in and outside Europe, effectively paid 6% tax on its income in Germany, where its headquarters are located. In the same year, on average, German corporations paid 30% of their earnings as profit taxes.[2]

Empirical evidence substantiates this phenomenon. Bartelsman and Beetsma (2003) show that multinational firms are able to shift income abroad and thus pay substantially less tax relative to their profits. Grubert et al. (1993) and Harris (1993) directly compare foreign-owned and domestically-owned firms, providing evidence for lower taxable profits of MNEs in the United States. Most recently, Egger et al. (2010b) have studied a large dataset of European firms using a matching approach. They find that an average subsidiary of a multinational corporation pays about 32% less tax in a high-tax country than a similar domestically-owned firm. In absolute terms, the tax payments of the foreign-owned firm are on average 1.3 million Euros lower than those of an otherwise identical domestic company.

In this article, we contribute to the literature that aims to explain lower tax payments of MNEs. This literature has established that MNEs are able to shift profits to low-tax locations by manipulating

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[1] For empirical evidence on the superior productivity of MNEs see, among others, Head and Ries (2003) and Helpman et al. (2004).

[2] See the financial statements of BMW (2008, p. 14) and, for average tax payments in Germany, Deutsche Bundesbank (2011, p. 22).

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transfer prices and/or intra-firm debt. We provide a new and complementary explanation by showing that even a correct application of transfer prices under the ruling arm's length principle may imply profit shifting and lower taxes for MNEs if their optimal organizational choice and the bargaining process is taken into account.

We develop this result in a variant of the Antràs and Helpman (2004) model of global sourcing. Firms procure an input from a foreign country either by producing it in a fully-owned subsidiary or by purchasing it from an independent supplier. In both organizational forms, firms and their suppliers operate in an environment of incomplete contracts. The decision to "make or buy" is driven by the heterogeneity in productivity across firm–supplier pairs. In equilibrium, added fixed costs of integration imply that, consistent with the empirically observed sorting pattern, only the most productive firms engage in vertical foreign direct investment (FDI) and become a MNE.[3]

In this framework, we explore the implications of profit taxation. We explicitly model the determination of transfer prices according to the arm's length principle. This principle, which is prevalent worldwide, implies that intra-firm transactions have to be valued at arm's length, i.e. as if the transaction had taken place between independent parties.[4] In practice, market prices of comparable transactions are used. However, integrated firms are able to obtain the input at significantly lower prices, as they are more productive and have a better bargaining position vis-à-vis their suppliers than firms that obtain the input from an external source. Therefore, the market (and transfer) price systematically exceeds the marginal cost of input production within the multinational firm. The arm's length at which intra-firm transactions are taxed exceeds the intended length—profits are taxed, metaphorically speaking, at a gorilla's, not a human's, arm's length.[5]

Taxation at this "gorilla's arm's length" has several implications for firm behavior. As the transfer price exceeds marginal cost, multinational firms can shift some profits abroad with each unit produced. This shows that some profit shifting of MNEs is a feature inherent in the tax system, and that even correct application of the arm's length principle implies that MNEs pay lower taxes than purely domestic firms.

Our argument is based on the widespread use of the arm's length principle in international taxation. This principle is the starting point of both Art. 7 of the OECD Model Double Tax Convention and Art. 9 of the UN Model Treaty, and has been implemented by almost all countries worldwide.[6] Its importance has also been confirmed recently by legal cases at high-level courts.[7]

As mentioned above, the guiding principle of the arm's length standard is to treat transactions within a multinational corporation as if they had taken place between independent enterprises. This proposes the use of a price that is not directly observable. In reality, it has to be approximated with the help of other transactions. In our model, we follow the "comparable uncontrolled price" (CUP) method, which uses a third party price for an identical or similar input. If such a comparable uncontrolled price exists, both the legal literature (cf. Kobetsky, 2011, p. 332) and many local country transfer pricing regulations (cf. Bronson et al., 2010, p. 25–26) prefer this method to alternatives such as the cost-plus, the resale-minus or the comparable profit method.[8] All these methods have in common that they compare characteristics of transactions (e.g. mark-ups, list price discounts) or the division of profits with those of other, independent firms.

By modeling a realistic tax system, we thus offer a new rationale for the empirically observed lower tax burden of MNEs. As we show in an extension, it is complementary to the existing explanations, which focus on transfer price manipulation. So how important is the proposed effect of taxation at a "gorilla's arm's length" quantitatively? In our model, the magnitude of the effect depends on the productivity difference between MNEs and firms that engage in foreign outsourcing. Tomiura (2007) finds in a large dataset of Japanese firms that firms which engage in FDI are on average 18% more productive (as measured by value-added per worker) than firms who outsource input production. This suggests that there may be a substantive profit shifting effect due to productivity differences.

Our paper relates to several strands of literature. First, there is a vast literature on profit shifting by multinational firms. Early theoretical contributions include, for example, Janeba (1996) or Haufler and Schjelderup (2000). Huizinga and Laeven (2008) provide empirical evidence that there is substantial profit shifting between European countries.[9] Other empirical studies have focused on different methods of profit shifting. The use of intra-firm loans or adjustments of the capital structure to avoid taxation has been analyzed, among others, by Buettner et al. (2009) and Egger et al. (2010a). Furthermore, transfer prices, especially of intangible assets, have long been suspected to be manipulated for the purpose of profit shifting (see Dischinger and Riedel (2011) and Clausing (2003) for empirical evidence).

The theoretical literature on the tax implications of transfer pricing mostly focuses on situations where no arm's length price is observable. For example, Gresik and Osmundsen (2008) discuss how transfer prices are chosen in a vertically integrated industry. Also in the absence of an arm's length price, Elitzur and Mintz (1996) study the choice of the transfer price in a setting where it affects both incentives of the subsidiary's manager as well as the tax burden. From a government point of view, Matsui (2012) studies optimal auditing standards of transfer prices in the absence of an observable arm's length price.

Keuschnigg and Devereux (2012) explicitly consider the arm's length principle and model its interaction with financial frictions. Similar to our article, they find that the arm's length principle provides a flawed benchmark for taxation. The mechanism underlying this result is however very different. In Keuschnigg and Devereux (2012), the distortion arises from financial constraints, which incentivize the headquarter to pay elevated transfer prices to provide the subsidiary with liquidity. Arm's length taxation penalizes this practice. In our article, in contrast, arm's length transfer pricing is advantageous for MNEs. This arises due to selection into FDI according to productivity, which is not captured by Keuschnigg and Devereux (2012). In their model, in which firms are homogeneous, the arm's length price would be correct in the absence of financial frictions. We show that this is not the case if firms differ in productivity.

By introducing and modeling explicitly the globally prevalent tax system in an otherwise standard framework of global sourcing, our paper also contributes to the literature on the FDI-vs.-outsourcing decision among heterogeneous firms (see Spencer (2005) for a survey). Our article follows the bulk of this literature in taking an incomplete

[3] This manner of modeling follows the literature, see e.g. Antràs and Helpman (2004), Helpman et al. (2004) and Grossman et al. (2006).

[4] For a detailed survey of transfer pricing and the arm's length principle see Wittendorff (2010).

[5] A gorilla's arms are about a foot (ca 30 cm) longer than the arms of a human, even though an average gorilla is shorter than an average man.

[6] In the US, the arm's length standard is codified in subchapter A of the treasury regulations, section 1.482-1(b). At the European level, it is endorsed in Art. 4 par. 1 of the Arbitration Convention of 1990 (see Schön (2011) for details on EU member states). The "Transfer Pricing Global Reference Guide" by Ernst & Young (2011) provides a worldwide overview.

[7] An example is the "SGI" case (C-311/08) at the European Court of Justice, in which the Société de Gestion Industrielle (SGI) took Belgium to court over her transfer pricing rules. SGI claimed that those rules violated the EU freedom of establishment. In its judgment on January 21st, 2010, the Court stressed the value of the arm's length standard to ensure a balanced allocation of tax bases and accepted the validity of legislation following the arm's length principle—even if it is potentially not in accordance with European law. For details, see Boone et al. (2010).

[8] The importance of CUP was confirmed by members of the transfer pricing team of one of the "Big Four" accountancy firms in private conversations. They assured us that CUP is used whenever it is possible to find similar/identical transactions, either between the same firm and an external supplier or between two external, comparable firms. Its use is especially common for financial transactions or standardized inputs.

[9] For a recent survey of the empirical literature see Devereux and Loretz (2012).

contracts approach to the theory of the firm.[10] The only other paper that considers the interaction of taxes with the outsourcing decision is Egger and Seidel (2011). They show that the possibility to shift profits via transfer pricing constitutes a reason to do FDI instead of outsourcing. Disregarding the arm's length principle, they assume that transfer prices can be manipulated at a cost. These profit shifting opportunities are the only reason for integration in Egger and Seidel (2011) and are also the only reason for different tax burdens of integrated and outsourcing firms. In our model, in contrast, firm heterogeneity and profit opportunities drive the outsourcing decision, and transfer prices are set according to arm's length principle. Moreover, we explicitly determine transfer prices following the lead of Antràs and Helpman (2004), taking contracting frictions between headquarters and suppliers into account. Thus, even in the absence of transfer price manipulation, integration may be profitable and integrated firms are taxed less.[11] However, such profit shifting can additionally be incorporated in our analysis, as we show in an extension.

The remainder of this article is structured as follows. Section 2 presents the basic model framework. Sections 3 and 4 derive the equilibrium and our main result. Section 5 offers an extension to transfer price manipulation and discusses robustness with respect to some basic assumptions. Section 6 concludes.

2. Model setup

In this section, we present the basic framework of our model. We first describe the general environment, including the tax system, and consider the agents' optimal decisions in turn.

2.1. General assumptions

Consider a static world economy with many countries which differ in their tax rates. There is a high-tax country, H, with tax rate t_H, and many low-tax countries with tax rates $t_L<t_H$. The tax rate differential can be rationalized in a simple setup in which the headquarter is immobile and tied to consumer markets in H while suppliers are free to move between periphery countries. Competition among the latter will drive their tax rates down while H is able to tax the rents arising from the immobility of the consumer goods producers.[12] We focus on one periphery country, which we label L. Each country is endowed with a fixed amount of inelastically supplied, internationally immobile labor, the only factor of production. The two countries produce and trade a homogeneous numeraire good Y. H also produces a differentiated good X, for which firms source intermediate inputs from L. The X-sector is monopolistically competitive, while the Y-sector is perfectly competitive. There is free entry into product markets and free trade between H and L in inputs and in the Y good.[13] Firms in the Y-sector are homogeneous, and thus earn zero profits. Choosing units so that one unit of the numeraire is produced from one unit of labor, wages are equal to unity in both countries.[14]

In more detail, firms in the X-sector each produce a differentiated consumer goods from a specialized intermediate input and fixed overhead labor. In order to procure the input, a firm needs to engage a supplier. We focus on sourcing from abroad, so that all suppliers are located in L.[15] Firms endogenously decide about the organization of production, choosing to either outsource or produce the input in a fully-owned subsidiary (FDI). Production involves fixed costs that depend on the organizational form. As in Antràs (2003) and Antràs and Helpman (2004), we consider production in an environment of incomplete contracts where agreements prior to production are subject to ex-post renegotiation. This implies that headquarters and suppliers cannot sign ex-ante enforceable contracts that specify the price of the inputs. The input price is renegotiated upon production in a Nash-bargain, where the outside options depend on the organizational mode as in Grossman and Hart (1986).

The differentiated goods producers differ with respect to the quality of their FDI opportunities, which are exogenously assigned to them. We assume that each firm owns a blueprint for input production which it can use to build a subsidiary. Heterogeneity can be interpreted as being implied by the quality of the blueprint that a firm possesses, or as differences in the ability to implant this technology efficiently in a foreign subsidiary. Alternatively, the firm can obtain the same input from an independent supplier. For simplicity, we assume that competition or imperfect protection of property rights has aligned the production technologies of independent suppliers so that outsourcing firms are homogeneous.[16] Appendix A shows that our main result equivalently applies when we further add heterogeneity in the production technologies of non-integrated suppliers.

We implement a realistic tax system where foreign profits are exempt from taxation in the home country, and transfer prices are determined according to the arm's length principle.[17] Recall that the latter imposes that intra-firm transactions are to be assessed at the value that would have prevailed between unrelated parties. As we have explained in the Introduction, this arm's length price is, in reality, often approximated by the CUP method. In our model the CUP price equals the price that an outsourcing firm has to pay for the input. We first treat the transfer price as a parameter, but later explore its determination fully in Section 4.

We consider a one-shot game, where the sequence of events is the following. First, firms decide whether to enter into the product market based on their anticipated future profits. Second, X-sector firms choose their organizational form, and all active suppliers produce. Third, X-sector firms and their individual suppliers renegotiate input prices. Upon agreement, the produced inputs are released, final production and consumption occur, and profits are realized.

[10] See, among others, Grossman and Helpman (2002), Antràs (2003; Antràs and Helpman (2004), and Grossman and Helpman (2005).

[11] Egger and Seidel (2011) also provide empirical evidence for their findings, showing that a higher tax rate differential is associated with more intra-firm imports. This finding is also consistent with our model.

[12] For a similar set-up where headquarters are located in the core and suppliers in the periphery see Fujita and Thisse (2006). The high mobility of suppliers is in line with casual observation: the mobile phone maker Nokia, for example, moved its production from Germany to Romania (in 2007) and from there to China (in 2012), while remaining headquartered in Finland.

[13] Allowing for trade in X is also possible, but not necessary, and is therefore omitted for simplicity.

[14] Therefore, as there are no wage differentials, our model is one of FDI between similar (developed) countries. This is indeed one of the most common forms of FDI. Note that wage differentials would have no consequences for our main proposition, as the arm's length principle uses input prices paid to independent suppliers that are located in the *same* country as a benchmark for integrated suppliers.

[15] In general suppliers may also be located in H, but this yields no additional insights as transfer pricing does not affect tax payments if the firm is active only in one country.

[16] The difference in specific productivities under FDI and the fall-back productivity under outsourcing may equivalently be interpreted as the use of a generic variant of the input, which needs to be customized to fit the differentiated good firm's specific requirements. For a similar approach where a standardized, market-bought input is less suited for the producer's specific purposes see, among others, Lorz and Wrede (2008).

[17] We thus assume that profits are taxed under the exemption method, which is the predominant method in the OECD. It has traditionally been applied by most continental European countries and more recently also by the UK and Japan. The alternative is the tax credit method, under which *worldwide* income is taxed at the home country's tax rate (and foreign tax payments are credited). If the high-tax country uses the tax credit method, in principle only its tax rate matters and transfer prices are irrelevant. It is thus consistent with our treatment that empirical evidence suggests that the effects highlighted in this article arise only under the exemption method, and not necessarily under the tax credit system. For firms in the US (where the tax credit system is used), Desai et al. (2006) do not find a positive effect of the average tax rate of a firm in non tax haven countries on the probability to invest in a tax haven. For Germany, where profits are taxed according to the exemption method, Gumpert et al. (2011) however find a positive effect.

2.2. Consumers

Consumers in H are homogeneous and value the two (private) goods X and Y. The preferences of a representative consumer are given by a log-linear utility function[18] of the form

$$U = \mu \ln X + Y^D, \quad X = \left[\int_{i\in\Omega} x_i^{\frac{\sigma-1}{\sigma}} di\right]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where Y^D is the quantity consumed of the numeraire good and Ω represents the set of available varieties in the monopolistically competitive sector. Varieties are consumed in quantities x_i, where i is the index for the variety and its seller. Varieties are substitutes and the elasticity of substitution between any pair of varieties is σ, with $1<\sigma(<\infty)$. The parameter μ weighs the relative importance of the two goods. As in Dixit and Stiglitz (1977), demand for each variety is isoelastic and given by

$$x_i = \frac{\mu}{p_i^\sigma} P^{\sigma-1}, \tag{2}$$

where p_i is the price of variety i and $P = \left[\int_{i\in\Omega} p_i^{-(\sigma-1)} di\right]^{-\frac{1}{\sigma-1}}$ is the price index for good X. Due to the quasi-linearity of preferences, expenditures for X are determined by the constant μ: $\mu = PX$. Denoting total income by I, the residual income is spent on the numeraire good, so that $Y^D = I-\mu$.

2.3. Firms

There is a large pool of potential entrants into the X-sector. Anticipating market conditions, each potential entrant chooses its optimal organizational structure ("make or buy") and, given this structure and the ensuing optimal output choice, decides whether to enter the market.

In the following, we characterize firms' technologies under each of the two alternative organizational forms, FDI and outsourcing, and then describe their objectives and optimal decisions.

2.3.1. FDI

The headquarter produces one unit of the final consumer good from each unit of input. Moreover it incurs a fixed cost, $c>0$.[19] If the firm decides to become a MNE, it has to establish a foreign subsidiary for input production, which causes an additional fixed cost, $f>0$. The subsidiary is located in L and produces one unit of the input, m_i, with a_i units of labor. The firm-specific input coefficients a_i are distributed according to the distribution function $G(a)$. They are exogenously assigned to each firm and known at the time of market entry.

While the headquarter formally has legal control over its subsidiary, it suffers from the incompleteness of contracts. The payment to the foreign supplier is subject to renegotiation once the input has been produced. Following Antràs and Helpman (2004), we model this as a generalized Nash bargaining with outside options that reflect the specificity of the input and the firm's property rights. We assume an outside option of zero for the supplier, as the input cannot be used by a different firm. The headquarter may seize a fraction $\delta\ (\in (0, 1))$ of the produced inputs, as it has property rights over it. We assume that, due to the specificity of the input, the headquarter is tied to its supplier and hence cannot resort to a different (outsourcing) supplier.

Denoting an integrated firm's revenues by R_I, the per-unit payment to the supplier by r_I, and the transfer price for taxation by ρ, the firm's surplus for the Nash bargain is given by[20]

$$\begin{aligned} S_I^{HQ} &= R_I - r_I m_I - c - f - t_H(R_I - \rho m_I) - t_L(\rho m_I - a_i m_I) \\ &\quad - \left[\delta^{\frac{\sigma-1}{\sigma}} R_I - c - f - t_H\left(\delta^{\frac{\sigma-1}{\sigma}} R_I - \rho\delta m_I\right) - t_L(\rho\delta m_I - a_i m_I)\right] \\ &= (1-t_H)\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right) R_I - r_I m_I + (t_H - t_L)(1-\delta)\rho m_I, \end{aligned} \tag{3}$$

where, from Eq. (2), revenues are

$$R_I = \mu\left(\frac{m_I}{X}\right)^{\frac{\sigma-1}{\sigma}}. \tag{4}$$

The first line of Eq. (3) represents the headquarter's profits if it reaches an agreement with the supplier. In the second line, the outcome if negotiations break down is deducted. Profits are taxed according to the exemption system: Foreign profits ($\rho m_I - a_i m_I$) are taxed in L and exempt from taxation in H.[21] The headquarter, as the legal counterparty of the tax authority, is liable for the entire group's tax payments. For simplicity, we assume that fixed costs are not deductible.[22]

When negotiations break down, the headquarter seizes a fraction δ of the inputs. Given our demand specification, this implies that the firm's revenues diminish to a fraction $\delta^{\frac{\sigma-1}{\sigma}}$ of equilibrium revenues. Hence, under the outside option, the tax base in H shrinks to $\delta^{\frac{\sigma-1}{\sigma}} R_I - \rho\delta m_I$.

The supplier is unable to sell the inputs to a third party after production, as they are firm-specific. Her surplus is thus given by

$$S_I^S = r_I m_I - a_i m_I - [-a_i m_I] = r_I m_I. \tag{5}$$

Given the surpluses, the payment to the supplier, $r_I m_I$ is determined by a generalized Nash-bargain, where the headquarter's bargaining weight is given by $\beta\ (\in (0, 1))$. Maximizing the Nash product $(S_I^{HQ})^\beta \cdot (S_I^S)^{1-\beta}$ yields the input price paid to the integrated supplier,

$$r_I = (1-\beta)\left[\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right)(1-t_H)\frac{R(m_I)}{m_I} + (1-\delta)(t_H - t_L)\rho\right]. \tag{6}$$

Taxation influences the bargaining outcome twofold. First, it reduces the available surplus. Second, the supplier participates in the firm's gains from a positive cross-country tax differential due to the arm's length principle.

2.3.2. Outsourcing

Under outsourcing, the firm sources the input from an independent (stand-alone) supplier in L. The foreign supplier obtains one unit of m_i

[18] The choice of a quasi-linear utility function is innocuous, as income effects would not affect our main results: As will be shown later, effective tax rates depend only on parameters and on prices, which are always mark-ups on effective input costs. As the implicit subsidy of arm's length taxation would not be affected by income effects, effective tax rates remain unaffected by changes in profit income. Thus, as income effects are not relevant to our argument, we use quasi-linear preferences for simplicity, as has become standard in the applied literature (see, for example, Chor (2009), Baldwin and Okubo (2009), Cole and Davies (2011), or Krautheim and Schmidt-Eisenlohr (2011)).

[19] Relative to Antràs and Helpman (2004) we abstract from a variable headquarter input, which is not necessary to show our point.

[20] The subscript I (O) denotes variables under integration (outsourcing). To simplify the notation, the variety subscript i is dropped except for the firm-specific input cost coefficient a_i.

[21] Throughout this article, we only look at firms for which $p_I(a_i)\geq\rho$ holds, thus guaranteeing a non-negative tax base. If the tax base were to become negative for some firms, the tax payments of these firms would be zero, as tax authorities generally do not pay out negative taxes. Alternatively, one could argue that the tax authorities observe the consumer price p_I and would veto any transfer price ρ in excess of p_I. Such assumptions are common in the literature, see, for example, Matsui (2012). Here, it spares us the cumbersome case distinction for firms that do not pay any taxes in the high-tax country and focuses attention on the more interesting case of positive tax payments in both countries. As the most productive firms set the lowest prices and are therefore the most likely to have prices below ρ, all our results would go through with the case distinction as well.

[22] This assumption is common in the literature, see e.g. Krautheim and Schmidt-Eisenlohr (2011). Imagine, for example, that these are the costs for landholdings, or language barriers in the case of the additional fixed cost of international integration.

from one unit of labor. As with FDI, the headquarter produces one unit of the final variety with one unit of input after paying the headquarter fixed cost c. As the headquarter and the supplier are now separate legal entities, the headquarter pays taxes only in H.

The outsourcing firm's surplus in the Nash bargain is

$$S_O^{HQ} = (1-t_H)(R_O - r_O m_O) - c - [-c] = (1-t_H)(R_O - r_O m_O), \tag{7}$$

where $R_O = \mu\left(\frac{m_O}{X}\right)^{\frac{\sigma-1}{\sigma}}$ denotes revenues under outsourcing. The headquarter pays r_O to the supplier for each unit of the input. As headquarter and supplier are separate, the headquarter cannot secure any inputs if negotiations break down. In that case, it is left with the sunk fixed cost c.

The surplus of the supplier under outsourcing is homogeneous and given by

$$S_O^S = (1-t_L)(r_O m_O - m_O) - [-(1-t_L)m_O] = (1-t_L) r_O m_O. \tag{8}$$

As an independent entity, the supplier has to pay the tax in L. If negotiations break down, she is unable to sell the input to a different firm due to its specificity. We assume that the production costs are tax deductible, e.g. because they can be offset against other revenues.

Maximizing the Nash product shows that an independent supplier receives a share $(1-\beta)$ of the firm's revenues.

$$r_O = (1-\beta)\frac{R(m_O)}{m_O}. \tag{9}$$

Tax payments do not influence this outcome as they are – in the absence of intra-firm trade – proportional to the surpluses.

3. Equilibrium

We solve for the equilibrium by backward induction, starting with the optimal production choices in each organizational form.

3.1. Input production and equilibrium quantities

Each input supplier produces the quantity of the input that maximizes her profits, anticipating the result of the bargaining game. The respective optimal quantities under outsourcing (m_O) and integration (m_I) are[23]

$$m_O = \left[(1-\beta)\mu\frac{\sigma-1}{\sigma}\right]^{\sigma} X^{-(\sigma-1)}. \tag{10}$$

$$m_I = \left[\frac{(1-\beta)\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right)(1-t_H)\mu}{a_i-(1-\beta)(1-\delta)(t_H-t_L)\rho}\frac{\sigma-1}{\sigma}\right]^{\sigma} X^{-(\sigma-1)}. \tag{11}$$

Input quantities are high when the supplier has a high bargaining power (low β, and, for integrated firms, low δ) or the market is large (high μ). Taxation only affects the production decision of the integrated supplier. A high foreign tax rate induces the integrated suppliers to produce less, as it decreases the tax advantage inherent in using a transfer price above marginal cost (as will be shown in Section 4). A high transfer price ρ raises the quantity of the input. The effect of changing the home tax rate is ambiguous: while an increase in t_H lowers the available surplus, it also amplifies the tax advantage of using a transfer price above marginal cost. As this tax advantage depends on quantities sold, it constitutes an incentive to increase the production of the input.

[23] To guarantee positive quantities and prices, we make the following technical assumption on the lower bound of the support of $G(a): a > (1-\beta)(t_H-t_L)(1-\delta)\frac{\sigma}{\sigma-1} \equiv \underline{a}$. This permits standard distributions like the bounded Pareto distribution, the uniform distribution, and others.

Using Eq. (2), these input quantities immediately translate into consumer prices.

$$p_O = \frac{\sigma}{\sigma-1}\frac{1}{(1-\beta)}. \tag{12}$$

The prices charged by outsourcing firms do not depend on the level of taxes, as is to be expected with a profit tax that applies equivalently to a firm's revenues and costs.

For integrated firms, however, taxation distorts the pricing decision.

$$p_I = \frac{\sigma}{\sigma-1}\frac{a_i-(1-\beta)(1-\delta)(t_H-t_L)\rho}{(1-\beta)\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right)(1-t_H)}. \tag{13}$$

Again, two effects are at work. The tax term in the numerator captures the incentive to sell more: This lowers the effective tax rate as the transfer price ρ is larger than marginal cost. At the same time, taxation in the home country without full deductability lowers the surplus and thus the incentive to sell, as can be seen in the denominator. More productive MNEs (small a_i) set lower prices than less productive firms. An increase in either β or δ, which improves the HQ's bargaining position and thus discourages input production by the supplier, reduces quantities and raises consumer prices among MNEs. Improving the deductibility of expenses by raising the transfer price, ρ, acts like a per unit production subsidy, whose power is increasing in the tax rate differential.

3.2. Optimal organizational choice and entry

Anticipating market conditions, each potential entrant chooses its optimal organizational structure ("make or buy") and, foreseeing the suppliers' input production and ensuing profits, decides whether to enter. Only sufficiently productive firms incur the added fixed cost of integration with the supplier to become MNEs. Denoting the cutoff productivity by a^*, firms with $a_i \le a^*$ will integrate whereas firms with higher input coefficients will outsource.[24]

Before considering the cut-off a^*, note that, from the point of view of an outside observer, all outsourcing firms behave identically. Therefore, these firms may always enter and realize the corresponding after-tax profit. Since any firm's profits are decreasing in the mass of active firms, entry will drive the profits of outsourcing firms to zero. In equilibrium, using the bargaining outcome in (9) together with Eq. (10), we obtain the aggregate industry quantity X from $\pi_O^{HQ} = (1-t_H)(R_O - r_O m_O) - c = 0$:

$$X = \frac{\sigma-1}{\sigma}\left(\frac{(1-t_H)\beta}{c}\right)^{\frac{1}{\sigma-1}}(1-\beta)\mu^{\frac{\sigma}{\sigma-1}}. \tag{14}$$

As $\mu = PX$, both the aggregate industry quantity and the price index are fully determined by free entry into outsourcing—and thus independent of the distribution of productivities $G(a)$ and of the transfer price ρ.[25] The price index is increasing in overhead costs c

[24] We focus on an industry in which fixed costs are such that both outsourcing and integration take place in equilibrium. Denoting after-tax operating profits as $\tilde{\pi}$, this implies that fixed costs f are such that $\tilde{\pi}_I(a^*) - c < f < \tilde{\pi}_I(\underline{a}) - c$. The first half of this condition states that integration may not be profitable for all firms in the market. The second half implies that fixed costs are such that the most productive firms in the market realize strictly positive profits when integrated. If this condition is not met, the arm's length principle is not applicable as there are either no intra-firm transactions, or no comparable market transactions which can be used as a benchmark.

[25] How does the zero-profit condition of outsourcing firms determine the aggregate industry demand or, as $\mu = PX$, the industry price index? Suppose some shock induces an additional MNE to enter the market. The added demand for overhead labor bids up the real wage ($1/P$) and, other things equal, reduces profits of all active firms. This causes some outsourcing firms to exit the market, so that the price index rises again. It does so up to its starting value, the only level compatible with zero profits of outsourcing firms.

because they reduce the mass of active firms. It is lower in larger markets (as measured by μ), as they induce additional firm entry.

While all outsourcing firms realize zero profits, MNEs are able to realize positive profits as they can produce the input more efficiently in an integrated subsidiary. Thus, headquarters choose to integrate when they are sufficiently productive to pay the additional fixed cost of integration. Hence, the cut-off for integration is implicitly defined by $\pi_I^{HQ}(a^*)=\pi_O^{HQ}=0$. The optimal organizational form is characterized in

Lemma 1. Optimal organization.

Firms with $a_i<a^*$ become MNEs while firms with $a_i\geq a^*$ source the input from the market. The cost cutoff a^* rises in the transfer price, ρ, and falls in the added fixed cost of integration (f).

Proof. See Appendix B. ∎

These properties are immediately intuitive: As the elevated transfer price ρ has effects similar to those of a production subsidy, it forms an additional incentive to become a MNE. If the fixed costs of integration f rise, outsourcing becomes more attractive.

The organizational form is robust to changes in the underlying productivity distribution. Innovations in the production technology, measured e.g. by a shift in the mean of $G(a)$, thus leave the cutoff for outsourcing unaffected. This is because, in our model, such changes are perfectly accommodated by entry into outsourcing.

4. Effective tax burden under ALP-taxation

In this section, we analyze firms' tax burdens to address the stylized fact proposed in the Introduction: that multinational firms pay systematically less tax (relative to their profits) than firms without foreign affiliates. We determine the transfer price ρ endogenously and use it to compare effective tax rates between outsourcing firms and MNEs.

Effective tax rates are given by a firm's tax payments per unit of operating profits. For an outsourcing firm, which pays taxes only in the high-tax country H, the effective tax rate is given by

$$t_O^{eff}=\frac{t_H(R_O-r_Om_O)}{R_O-r_Om_O}=t_H. \tag{15}$$

In contrast, the effective tax rate of an integrated firm is (using $R_I=p_Im_I$)

$$t_I^{eff}=\frac{t_H(R_I-\rho m_I)+t_L(\rho m_I-a_im_I)}{R_I-a_im_I}=t_H-(t_H-t_L)\frac{\rho-a_i}{p_I-a_i}. \tag{16}$$

The tax burden of MNEs depends on the tax rate differential and on the transfer price, ρ.[26] As explained in the Introduction, the arm's length price is used as transfer price, as governments cannot observe the true cost of the input.[27] This is the price that would have been paid to the supplier if the two parties were not related. We first consider taxation if such a firm-specific, "ideal" transfer price could be utilized. In a second step we look at the distortions caused by implementing the arm's length transfer price with the CUP method.

In our model, the "ideal" arm's length price is the price a headquarter would have paid an independent supplier with the "integrated" input cost a_i. Using Eqs. (4) and (10) in (9) and setting the input cost to a_i, this "ideal" arm's length price is

$$\rho_i^{IDEAL}=\frac{R(a_i)(1-\beta)}{m_O(a_i)}=\frac{\sigma}{\sigma-1}a_i. \tag{17}$$

Hence, in principle, the arm's length price is a firm-specific price. In this idealized case, it fully accounts for productivity difference among firms. Note that the arm's length transfer price ρ is always higher in industries with a lower elasticity of substitution, as the imperfect competition increases the revenues that are shared between headquarter and supplier.[28] Even with this "ideal" arm's length price, MNEs are taxed at a lower rate than outsourcing firms:

$$t_I^{eff}\left(\rho_i^{IDEAL}\right)=t_H-(t_H-t_L)\frac{\frac{1}{\sigma-1}a_i}{p_I(\rho_i^{IDEAL})-a_i}<t_H=t_O^{eff}. \tag{18}$$

The lower tax burden of MNEs arises because the transfer price is higher than the marginal cost of input production. To incentivize the supplier, the outsourcing firm has to pay her an input price above marginal cost. This mark-up translates into an elevated transfer price due to the arm's length principle. Thus, the headquarter will, in equilibrium, shift some profits to the low-tax country. This tax advantage depends on the amount of the good that is produced. Therefore, even with this "ideal" transfer price, more productive firms gain more from the arm's length principle, as they have higher sales.

The profit shifting opportunities of most MNEs are even more enlarged when we consider that, in reality, the "ideal" arm's length price cannot be observed and thus has to be approximated by other values. As detailed in the Introduction, it is common to use market prices for the same input (the CUP method of implementing arm's length prices). In this model, the CUP transfer price is the price that any outsourcing firm in the market pays its supplier, i.e.

$$\rho^{CUP}=r_O=\frac{\sigma}{\sigma-1}. \tag{19}$$

The implementation of the arm's length principle via the CUP method introduces an additional distortion as it ignores the productivity differences among firms. If an integrated supplier has lower production cost than a stand-alone supplier, the CUP transfer price for this firm is higher than the "ideal" arm's length price would be. Using ρ^{CUP}, the effective tax rate of MNEs is

$$t_I^{eff}\left(\rho^{CUP}\right)=t_H-(t_H-t_L)\frac{\left(\frac{\sigma}{\sigma-1}-a_i\right)}{p_I(\rho^{CUP})-a_i}<t_I^{eff}\left(\rho_i^{IDEAL}\right)\text{if } a_i<1. \tag{20}$$

If $a_i<1$, $\frac{\sigma}{\sigma-1}-a_i>\frac{1}{\sigma-1}a_i$ and, as $\rho^{IDEAL}<\rho^{CUP}$, $p_I^{CUP}<p_I^{IDEAL}$. Therefore, all MNEs with a true cost advantage (i.e. $a_i<1$) face an even lower effective tax rate when the transfer price is approximated via CUP.

As the CUP transfer price is based on observed transactions in the market, it ignores systematic productivity differences between MNEs and firms that decided against integration. Consider an industry with sufficiently high fixed costs of integration so that all MNEs are more productive than the market (i.e. so that $a^*\leq 1$ holds).[29] Then, the

[26] If the two countries start coordinating their tax policies so that the tax rate differential decreases, tax burdens of MNEs and outsourcing firms converge.

[27] In theory, input cost could be inferred from observed consumer prices. To avoid this, we assume that β is not accurately observed by the tax authority. Alternatively, we could impose that tax authorities only observe prices with noise, and cannot distinguish between marginal cost and demand shocks; or, in the extension with transfer price manipulation below (Section 5), that the innate costs of undertaking tax evasion are private information. We thank an anonymous referee for stressing this prerequisite.

[28] In his analysis of a welfare-maximizing transfer price, Matsui (2012) finds that tax authorities should relax the price standards if the elasticity of substitution decreases. Our analysis shows that this characteristic is inherent in the arm's length standard.

[29] Note that in general, not necessarily *all* MNEs are more productive than outsourcing firms. Integration not only allows firms to produce with their inherent productivity $1/a_i$, but also brings the advantage of a better bargaining position and lower tax payments. It therefore depends on the additional fixed cost of integration, f, whether all integrated firms have a true productivity advantage (i.e. $a^*\leq 1$). This ambiguity does not arise in the alternative specification in Appendix A, in which all suppliers are heterogeneous.

implementation of the arm's length principle via the CUP method leads to an even lower tax burden of MNEs. It is caused by the difference between the input production cost of an independent supplier, on which the transfer price is based, and the lower input cost of the more productive integrated supplier. This tax advantage of MNEs inherent in the higher productivity of these firms is largest for the most productive firms. Thus, the well-established observation that very productive firms become multinationals directly implies that they face a lower effective tax rate.

We summarize the results on MNEs' tax burden in the following proposition:

Proposition 1. Tax burden of MNEs.

- *Under an exemption system, MNEs face a lower tax burden relative to their profits than outsourcing firms if the "ideal" arm's length price is used as transfer price.*
- *An approximation of the arm's length transfer price via the CUP method reinforces this effect for MNEs with* $a_i<1$.
- *More productive firms face a lower effective tax rate under both the "ideal" and the CUP transfer price.*

Proof. See Appendix C. ∎

The lower tax burden of MNEs results as the transfer price is higher than the marginal cost of input production. The mark-up inherent in the transfer price arises because the arm's length principle ignores fundamental differences between multinational and domestic firms. These disparities may arise from the bargaining, or from productivity advantages, or both. The result of a lower tax burden for MNEs generally holds also if only one of the two sources of elevated arm's length prices is present.[30] It is also robust to a different specification of the effective tax rate.[31]

Our model thus provides a new explanation for well-known empirical observation of lower tax payments of multinational firms. Previously, the common explanation was that firms strategically misprice cross-border transactions (i.e. manipulate transfer prices or intra-firm debt) to shift profits into low-tax jurisdictions.[32] To policy-makers and much of the academic literature, the ideal method to prevent these manipulation activities is the arm's length principle.[33] It is supposed that, if firms adhered perfectly to this principle, no profits shifting would take place. The low tax burden of MNEs would then originate from the ability of MNEs to circumvent the rules by the arm's length principle. As our model above shows, this is not necessarily true.

However, this does not imply that no tax evasion takes place. A major possibility for MNEs to actively reduce tax payments is by manipulating transfer prices. Explanations based on such activities are complementary to the implicit profit shifting that results from the optimal organization of production, as the next section shows.

5. Extension to transfer price manipulation and discussion

In this section, we provide a link to the literature on transfer price manipulation by including this practice in our model and discuss some of our key assumptions.

Allowing for transfer price manipulation, the profit function of a MNE is

$$\hat{\pi}_i=\hat{R}_I-\hat{r}_I\hat{m}_I-c-f-t_H\left[\hat{R}_I-(1+\alpha)\rho\hat{m}_I\right]-t_L[(1+\alpha)\rho\hat{m}_I-a_i\hat{m}_I]-\alpha^2\gamma\hat{m}_I, \tag{21}$$

where α measures the extent of transfer price manipulation and γ is a factor that scales the cost of tax evasion. Manipulating the transfer price comes at a convex cost, which we presume, for simplicity, to have quadratic form.[34] Our analysis in the previous section can thus be seen as the limiting case where $\gamma\to\infty$. We assume that the amount of transfer price manipulation is decided after the headquarter has obtained the input, and that the headquarter is unable to credibly commit to a different level of transfer price manipulation in the bargaining.

Since transfer price manipulation requires intra-firm transactions, the profits of an outsourcing firm are as before. Therefore, as the decision variables of outsourcing firms are as in the main model, we focus on integrated firms in the following. Solving backwards we first determine the optimal degree of transfer price manipulation by the MNE before considering the bargaining. Given our assumption on manipulation costs, it is always optimal to artificially increase transfer prices at the margin ($\alpha>0$), as this lowers the effective tax burden:

$$\alpha^*=\frac{1}{2\gamma}(t_H-t_L)\rho. \tag{22}$$

The optimal degree of transfer price manipulation equates the marginal cost of transfer price manipulation, $2\alpha\gamma$, with its benefits, $(t_H-t_L)\rho$, which are increasing in the tax rate differential and the transfer price recognized in the absence of manipulation effort. Thus, α and ρ are complementary.

The price for the input, $\hat{r}_I$, is again determined by Nash bargaining. The only difference in the bargaining is that the headquarter's surplus now depends on the costs and benefits of credibly claiming a manipulated transfer price recognized by the tax authority. The supplier anticipates this transfer price manipulation. Maximizing the Nash product, the internal transfer price is given by

$$\hat{r}_I=(1-\beta)\left[\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right)(1-t_H)\frac{\hat{R}_I(\hat{m}_I)}{\hat{m}_I}+(1-\delta)(1+\alpha)(t_H-t_L)\rho-(1-\delta)\alpha^2\gamma\right]. \tag{23}$$

Eq. (23) reflects the rise in the surplus brought about by additional profit shifting, which lowers the MNE's tax burden, and the surplus-reducing manipulation costs. As α is chosen after the supplier's remuneration is determined, the supplier participates in both costs and benefits, with a share given by its bargaining weight $(1-\beta)$. In equilibrium, with the headquarter trading off costs and benefits of transfer price manipulation, transfer price manipulation lowers the per-unit payment to the supplier ($\hat{r}_I\le r_I$), as the supplier herself chooses to increase quantities in response to the higher overall after-tax surplus.[35]

The net benefit of tax evasion incentivizes the supplier to optimally increase the supplied quantity of the input to

$$\hat{m}_I=\left[\frac{(1-\beta)\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right)(1-t_H)\mu}{a_i-(1-\beta)(1-\delta)(1+\alpha)(t_H-t_L)\rho+(1-\beta)(1-\delta)\alpha^2\gamma}\frac{\sigma-1}{\sigma}\right]^{\sigma}(X)^{-(\sigma-1)}. \tag{24}$$

[30] For a model in which the lower tax burden of MNEs arises solely from productivity differences, see the working paper version of this article, Bauer and Langenmayr (2011).

[31] Instead of looking at the whole MNE's profit and tax payment, it is also possible to focus on its activities in H and consider its tax payments in H relative to the headquarter's profit. Appendix D shows that this does not change the results and points out that not only marginal cost, but also the bargained input price is lower than the transfer price (due to the better outside option of MNEs).

[32] See e.g. Haufler and Schjelderup (2000) or Egger and Seidel (2011).

[33] See, however, Keuschnigg and Devereux (2012).

[34] This way of modeling transfer price manipulation follows Egger and Seidel (2011) and others.

[35] For a formal proof of this and the following statements on transfer price manipulation, see Appendix E.

To see that $m_I \geq m_I$, note that X is exclusively determined by outsourcing firms and that the supplier participates proportionally in both the cost and benefits of transfer price manipulation.

Furthermore, as can be verified from Eqs. (24) and (2), positive transfer price manipulation reduces consumer prices charged by MNEs, since the amount of tax they can evade increases with each unit sold. This effect is stronger when the cost of transfer price manipulation γ is low, or the statutory transfer price ρ is high.

It is now straightforward to see that manipulation of transfer prices decreases the effective tax rate of multinationals to

$$\hat{t}_I^{eff} = t_H - (t_H - t_L)\frac{(1+\alpha)\rho - a_i}{\hat{p}_I - a_i}. \tag{25}$$

By providing an additional possibility to raise the transfer price, transfer price manipulation thus multiplies the tax-reducing impact of taxation at arm's length. This larger tax advantage also makes it more attractive to organize as a MNE (i.e. $\hat{a}^* \geq a^*$).

We summarize the added implications of transfer price manipulation in the following proposition:

Proposition 2. Implications of transfer price manipulation.

If multinational firms can manipulate transfer prices, their effective tax rates fall. There are more integrated firms, which set lower consumer prices and produce larger quantities than in the benchmark without manipulation. The behavior of outsourcing firms is unaffected.

Proof. See Appendix E. ∎

The empirical evidence of lower tax payments of MNEs (relative to purely domestic firms) is compatible with both the manipulation of transfer prices and the effect of taxation at a gorilla's arm's length, as they are complementary. However, policy conclusions differ. Importantly, we find that tightening transfer price regulations (increasing γ) may help to reduce tax evasion, but cannot be expected to even out the tax burden between domestic and multinational firms.

We conclude our analysis by briefly discussing the robustness of our main results with respect to some basic assumptions. First, we have employed a highly simplified production structure, where final good production at a MNE's headquarter is modeled exclusively via fixed costs (c). This, however, is innocuous: Under a more elaborate production structure, including a potentially firm-specific production function, the effect of taxation at a gorilla's arm's length remains present as long as the MNE has a cost advantage of some sort in the procurement of the input from abroad.

Second, we have focused on MNEs whose headquarters are located in the high-tax country. But what about final good producers located in the low-tax country? Consider their alternatives for procuring the input: They can either buy it from the market, or produce it in a subsidiary either at home or abroad. However, given that the other country offers the same wage (i.e. identical production cost) but has a higher tax rate, firms in the low-tax country have no incentive to become a MNE, but will instead produce the input in a subsidiary at home. The case analyzed in our model – with MNEs being headquartered in high-tax countries in Europe or in Japan – is also empirically the most relevant, see Voget (2011).

Lastly, our underlying argument continues to hold if the arm's length price is implemented in a different manner. For example, consider the "comparable profit method", which is discussed in the literature e.g. in Schjelderup and Weichenrieder (1999). It allows tax authorities to tax a MNE's subsidiary on a deemed profit of e.g. 75% of a domestic firm's profit in the same industry. However, given that MNEs are more productive, they realize higher profits than comparable domestic firms. Thus, also this method of implementing the arm's length principle implies an inherently lower tax burden of MNEs.

In all these different specifications, the common reason for the lower tax payments by MNEs is that the arm's length principle ignores the underlying reasons why some firms choose to organize as MNEs while others do not. It follows immediately from the presence of fixed costs that, for firms to optimally choose FDI over foreign outsourcing, variable costs of MNEs usually fall short of variable costs of outsourcing. This is the essence of sorting, which has systematically been shown in the new international trade literature (see Antràs and Helpman (2004) and Helpman et al. (2004), among others). Moreover, integration itself causes MNEs to behave differently, as it gives them more bargaining power. This, too, is disregarded by the arm's length principle. Thus, Proposition 1 holds in a wide range of possible specifications of heterogeneity in production or the quality of the consumer product, as well as for different specifications for the behavior of tax authorities off equilibrium where renegotiations break down.

6. Conclusion

With this article, we hope to contribute to explaining why MNEs pay systematically less tax than domestic firms. Focusing on the endogenous organizational choice of international enterprises, our model complements existing mechanisms for profit shifting, which usually build on the notion that MNEs are able to manipulate transfer prices. In our framework, profit shifting occurs even when MNEs perfectly comply with the tax code. The fact that transfer price regulation has tightened substantially over the last decades, while tax burden differentials between MNEs and domestic firms appear to remain substantial, seems to support this view.

The focus of this article is on positive economic analysis, as it provides a new explanation for a well-known empirical observation. However, it is also worthwhile to see which normative inferences can be drawn from our model. It cautions against the use of costly policies to hamper transfer price manipulations, as it is not clear to what extent the comparatively low tax payments by MNEs are due to such manipulations. Cost-benefit analysis of anti-avoidance measures has to take into account that only one part of empirically observed profit shifting can be addressed by these policies. As such measures usually imply efficiency or monetary losses for the firms, they should be employed cautiously as tax payments are likely to remain low even if MNEs perfectly adhere to the tax code.

A second normative question that arises from this article is the desirability of the arm's length principle for taxation in general. In a tax system based on separate accounting, there is no clear alternative to it. Using firm's marginal cost or internal input prices does not seem feasible, as such unobservable values would be overstated by MNEs to lower their tax payments. Therefore, we conclude that the inherent limitations of the arm's length principle provide an argument against separate accounting. The alternative is a tax system based on formula apportionment, where the profit of the MNE as a whole is calculated and then split between countries depending on the location of the firm's capital, labor and sales. Under formula apportionment, transfer pricing rules are thus no longer necessary. Such a proposal has been made for the European Union (see European Commission (2011)). The distortions inherent in arm's length transfer pricing, as shown in this article, provide a further argument to pursue this alternative approach to the taxation of MNEs.

Appendix A. Heterogeneous independent suppliers

In this appendix, we derive our main result in an alternative model specification in which both integrated as well as outsourcing firms are heterogeneous. This variant of the model is closer to the established literature (see e.g. Antràs and Helpman (2004)), but has

the disadvantage that the arm's length transfer price under CUP is not unique. It is thus further from an ideal environment for the application of the arm's length principle.

In contrast to the model in the main part of the paper, assume now that *all* suppliers differ in productivity, i.e. they produce with a firm-specific input cost of a_i. Otherwise, the model environment is as in the main text.

Internal input prices, determined by Nash bargaining, are as in the main model (Eqs. (6), (9)). They depend on input quantities, which are a function of the firm's productivity under both outsourcing and integration:

$$m_O = \left[\frac{(1-\beta)\mu}{a_i}\frac{\sigma-1}{\sigma}\right]^{\sigma} X^{-(\sigma-1)}, \tag{A.1}$$

$$m_I = \left[\frac{(1-\beta)\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right)(1-t_H)\mu}{a_i-(1-\beta)(1-\delta)(t_H-t_L)\rho}\frac{\sigma-1}{\sigma}\right]^{\sigma} X^{-(\sigma-1)}. \tag{A.2}$$

As the "ideal" arm's length price coincides with the main model, we directly look at the implementation of arm's length pricing via CUP. Then, the transfer price used for taxing integrated firms is again given by the price an outsourcing firms pays its supplier. Thus, using Eq. (A.1) and $R = \mu\left(\frac{m_O}{X}\right)^{\frac{\sigma-1}{\sigma}}$ in Eq. (9), we see that in equilibrium, outsourcing firms pay their supplier for a unit of the input

$$r_O(a_i) = (1-\beta)\frac{R(a_i)}{m_O(a_i)} = \frac{(1-\beta)\mu}{X^{\frac{\sigma-1}{\sigma}} m_O^{\frac{1}{\sigma}}} = \frac{\sigma}{\sigma-1}a_i. \tag{A.3}$$

As in the main model, this is a mark-up on the actual cost of input production. However, it is no longer unique. We thus have to specify which observable transaction is used to determine transfer prices for taxation. While firms would – other things being equal – prefer to use a transaction of a relatively unproductive firm, the tax authority would want to use input purchases of a firm close to the integration cutoff. We choose the least favorable setting for our point, i.e. that the tax authority is able to dictate which market transaction is used as the arm's length benchmark. To maximize tax revenues it will choose the cut-off firm, which has an input cost coefficient of a^*, so that the arm's length transfer price under CUP is

$$\rho^{CUP} = \frac{\sigma}{\sigma-1}a^*. \tag{A.4}$$

To compare the tax burden of the two firm types, we again use the effective tax rate. For an outsourcing firm, it is

$$t_O^{eff} = \frac{t_H(R_O - r_O m_O)}{R_O - r_O m_O} = t_H. \tag{A.5}$$

In contrast, integrated firms' tax payments relative to their profits are given by

$$\begin{aligned} t_I^{eff}\left(\rho^{CUP}\right) &= \frac{t_H(R_I-\rho m_I) + t_L(\rho m_I - a_i m_I)}{R_I - a_i m_I} \\ &= t_H - (t_H - t_L)\frac{\frac{\sigma}{\sigma-1}a^* - a_i}{p_I - a_i}. \end{aligned} \tag{A.6}$$

By the definition of the cut-off a^*, all integrated firms have an input coefficient $a_i < a^*$. Thus, $t_I^{eff}(\rho^{CUP}) < t_I^{eff}(\rho^{IDEAL}) < t_O^{eff}$.

The effective tax rate is again lowest for the most productive firms:

$$\frac{\partial t_I^{eff}\left(\rho^{CUP}\right)}{\partial a_i} = -(t_H - t_L)\frac{-(p_I - a_i) - (\frac{\sigma}{\sigma-1}a^* - a_i)\left(\frac{\partial p_i}{\partial a_i} - 1\right)}{(p_I - a_i)^2}. \tag{A.7}$$

Rearranging shows that the numerator is negative:

$$-\left(\frac{\sigma}{\sigma-1}a^* - a_i\right)\frac{\partial p_i}{\partial a_i} - (p_i - \rho) < 0. \tag{A.8}$$

$\frac{\partial p_i}{\partial a_i} > 0$ follows after inserting Eq. (A.2) in the demand function, $\frac{\sigma}{\sigma-1}a^* > a_i$, and $p_I > \rho^{CUP} = \frac{\sigma}{\sigma-1}a^*$ because tax payments may not be negative. Hence, also in this setting $\frac{\partial t_I^{eff}}{\partial a_i} > 0$.

Appendix B . Proof of Lemma 1: optimal organization

The cutoff a^* is characterized by $\pi_I^{HQ}(a^*, \cdot) = 0$, where

$$\pi_I^{HQ}(a^*, \cdot) = R_I - r_I m_I - t_H(R_I - \rho m_I) - t_L(\rho - a_i)m_I - c - f. \tag{B.1}$$

Rearranging and using Eq. (6) for r_I yields

$$\begin{aligned} \pi_I^{HQ}(a^*, \cdot) = &\left[1-(1-\beta)\left(1-\delta^{\frac{\sigma-1}{\sigma}}\right)\right](1-t_H)R_I \\ &+ [1-(1-\beta)(1-\delta)](t_H - t_L)\rho m_I + t_L a_i m_I - c - f. \end{aligned}$$

From Eqs. (11) and (4) it follows that $\frac{\partial R_I}{\partial a_i} < 0$ and $\frac{\partial m_I}{\partial a_i} < 0$; and $\frac{\partial a_i m_I}{\partial a_i} < 0$ as $\frac{\sigma}{1-(1-\beta)(1-\delta)(t_H-t_L)\frac{\rho}{a_i}} > 1$. The denominator of the last fraction is always positive, as prices would be negative otherwise (cf. footnote 23). It follows that $\frac{\partial \pi_I^{HQ}}{\partial a_i} < 0$. Thus, firms with $a_i \le a^*$ integrate while firms with higher input coefficients outsource.

Raising ρ shifts $\pi_I^{HQ}(a^*, \cdot)$ upwards, showing formally that reducing the tax base of MNEs allows less productive matches to integrate profitably: a^* is an increasing function of ρ. Similarly, if the added organization costs of MNEs, f, rise, $\pi_I^{HQ}(a^*, \cdot)$ falls, implying that fewer firms become MNEs.

Appendix C . Proof of Proposition 1: tax burden of MNEs

Part (i) of Proposition 1

First, we examine the "ideal" arm's length price, i.e. $\rho_i^{IDEAL} = \frac{\sigma}{\sigma-1}a_i$. We prove that $t_I^{eff}(\rho_i^{IDEAL}) < t_O^{eff} = t_H$ by contradiction:

Suppose to the contrary that $t_I^{eff}(\rho_i^{IDEAL}) > t_H$. Then, from Eq. (16),

$$(t_H - t_L)\frac{\rho_i^{IDEAL} - a_i}{p_I - a_i} < 0. \tag{C.1}$$

This is a contradiction, as $t_H > t_L$ and $\rho_i^{IDEAL} = \frac{\sigma}{\sigma-1}a_i > a_i$. The consumer price p_I is necessarily above marginal cost, a_i, as firms would make a loss otherwise.[36]

Part (ii) of Proposition 1

Next, consider the CUP transfer price, $\rho^{CUP} = \frac{\sigma}{\sigma-1}$. As the effective tax rate is decreasing in ρ, the use of CUP will lower the tax burden if $\rho^{CUP} < \rho_i^{IDEAL}$. Comparison of Eqs. (17) and (19) shows that this is the

[36] As negative taxes are not paid out, taxation does not provide an incentive to set prices below marginal cost.

case if $a_i<1$, i.e. if integrated firms have a true cost advantage. As explained in footnote 29, this does not necessarily hold for all firms. Therefore, those MNEs whose suppliers are more productive than those of outsourcing firms face an even lower tax rate when the arm's length price is approximated via CUP. For firms that integrate despite having higher costs than the market, CUP is less favorable than the "ideal" arm's length price.

Part (iii) of Proposition 1

To prove the systematic relationship between the tax burden and the productivity of MNEs, we need to sign

$$\frac{\partial t_I^{eff}}{\partial a_i} = -(t_H-t_L)\frac{-(p_I-a_i)-(\rho-a_i)\left(\frac{\partial p_I}{\partial a_i}-1\right)}{(p_I-a_i)^2}, \tag{C.2}$$

which carries the same sign as

$$(\rho-a_i)\frac{\partial p_I}{\partial a_i}+(p_I-\rho). \tag{C.3}$$

Using the ideal arm's length price, this term is positive for all firms, implying $\frac{\partial t_I^{eff}(\rho_i^{IDEAL})}{\partial a_i}>0$. Under CUP, Eq. (C.3) is clearly positive for all MNEs with $a_i<\frac{\sigma}{\sigma-1}$. For integrated firms with higher marginal cost, the arm's length principle constitutes a tax disadvantage: it can be seen in Eq. (20) that firms with $a_i>\frac{\sigma}{\sigma-1}$ face an effective tax rate larger than t_H. Therefore, also under CUP, the most productive firms are taxed the least.

Appendix D. Alternative specification of the effective tax rate

In this appendix, we consider an alternative specification of the MNE's effective tax rate that focuses on its activities in *H*. While it is more common to study tax payments of the firm as a whole, concentrating on the headquarter clarifies that the arm's length price is not only above marginal cost, but also above internal input prices.

To show that Proposition 1 is also valid if one only considers activities in *H*, consider the following alternative specification of the effective tax rate, t_I^{eff2}, which relates tax payments in *H* to the profit that remains in the headquarter:

$$t_I^{eff2}=\frac{t_H(R_I-\rho m_I)}{R_I-r_I m_I}=t_H-t_H\frac{\rho-r_I}{p_I-r_I}. \tag{D.1}$$

Thus, in this case, the effective tax rate depends on the difference between the arm's length price of the input, ρ, and the internal input price r_I. Combining Eqs. (6) and (11) shows that in equilibrium, the latter is

$$r_I=\frac{\sigma}{\sigma-1}a_i-(1-\beta)(1-\delta)(t_H-t_L)\frac{\rho}{\sigma-1}. \tag{D.2}$$

First, consider the "ideal" arm's length transfer price (given in Eq. (17)). Then, r_I is smaller than ρ_i^{IDEAL}:

$$r_I\left(\rho_i^{IDEAL}\right)=\rho_i^{IDEAL}\left[1-(1-\beta)(1-\delta)(t_H-t_L)\frac{1}{\sigma-1}\right]<\rho_i^{IDEAL}. \tag{D.3}$$

Given that $p_I>r_I$ (as the headquarter would make a loss otherwise), Eqs. (D.1) and (D.3) imply that MNEs are taxed at a lower rate than domestic firms, which are taxed at the rate t_H: $t_I^{eff2}(\rho_i^{IDEAL})<t_H=t_O^{eff}$.

When the arm's length price is approximated via CUP (see Eq. (19)), this effect is strengthened for firms that are more productive than the market:

$$r_I\left(\rho^{CUP}\right)=\rho^{CUP}\left[a_i-(1-\beta)(1-\delta)(t_H-t_L)\frac{1}{\sigma-1}\right]<r_I\left(\rho_i^{IDEAL}\right)\text{ if }a_i<1. \tag{D.4}$$

As $p_I^{CUP}<p_I^{IDEAL}$ if $a_i<1$, CUP transfer prices imply an even lower effective tax rate for MNEs with $a_i<1$.

Lastly, it holds again that $\frac{\partial t_I^{eff2}}{\partial a_i}>0$ (the proof proceeds analogously to the main proposition). Hence, the results from Proposition 1 are robust to this different definition of the effective tax rate, which highlights the role of internal input prices for the tax burden of the headquarter.

Appendix E . Proof of Proposition 2: implications of transfer price manipulation

To compare $\hat{r}_I$ with r_I, consider the equilibrium value of $\hat{r}_I$ by inserting Eqs. (24), (4) and (22) in Eq. (23), which yields

$$\hat{r}_I=\frac{\sigma}{\sigma-1}a_i-\frac{(1-\beta)(1-\delta)}{\sigma-1}\left[(t_H-t_L)\rho+\frac{(t_H-t_L)^2\rho^2}{4\gamma}\right]. \tag{E.1}$$

Comparison with the corresponding value in the benchmark case, $r_I=\frac{\sigma}{\sigma-1}a_i-\frac{(1-\beta)(1-\delta)}{\sigma-1}(t_H-t_L)\rho$, proves that $\hat{r}_I\le r_I$.

Next, consider $\hat{m}_I$. *X* is exclusively determined by outsourcing firms and thus independent of transfer price manipulation. Comparing $\hat{m}_I$ from Eq. (24) with its benchmark from Eq. (11) shows that $\hat{m}_I\ge m_I$ if and only if

$$(1-\delta)(t_H-t_L)\rho\le(1+\alpha)(1-\delta)(t_H-t_L)\rho-(1-\delta)\alpha^2\gamma. \tag{E.2}$$

As can be seen by using the equilibrium value of α from Eq. (22), Eq. (E.2) is always fulfilled.

As $x_I=m_I$, it follows from the demand curve (Eq. (2)) that $\hat{p}_I\le p_I$. Therefore, as $\alpha^*>0$, $\hat{t}_I^{eff}$ (Eq. (25)) is unambiguously lower than t_I^{eff} (Eq. (16)).

Lastly, the mass of integrated firm is larger if there is transfer price manipulation, i.e. the cut-off rises: $\hat{a}^*>a^*$. Analogous to Appendix B, the cut-off is characterized by $\hat{\pi}(a^*,\cdot)=0$, where

$$\hat{\pi}(a^*,\cdot)=\hat{R}_I-\hat{r}_I\hat{m}_I-t_H\left(\hat{R}_I-(1+\alpha)\rho\hat{m}_I\right)-t_L((1+\alpha)\rho-a_i)\hat{m}_I-c-f. \tag{E.3}$$

Rearranging and using Eq. (23) for r_I yields

$$\hat{\pi}(a^*,\cdot)=\left[1-(1-\beta)(1-\delta^{\frac{\sigma-1}{\sigma}})\right](1-t_H)\hat{R}_I+[1-(1-\beta)(1-\delta)]\cdot\left[(1+\alpha)(t_H-t_L)\rho\hat{m}_I-\alpha^2\gamma\hat{m}_I\right]+t_L a_i\hat{m}_I-c-f.$$

From above, we know that $\hat{m}_I\ge m_I$. Therefore, $\hat{\pi}(a^*,\cdot)$ is larger than $\pi(a^*,\cdot)$ from Eq. (B.1) if $(1+\alpha(t_H-t_L)\rho\hat{m}_I-\alpha^2\gamma\hat{m}_I>(t_H-t_L)\rho m_I$. In equilibrium, this condition holds, as can be verified by inserting Eq. (22) for α. As fixed costs $c+f$ are the same as in the benchmark, the cut-off for integration rises if transfer prices can be manipulated.

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