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# Sorting into Outsourcing: Are Profits taxed at a Gorilla's Arm's Length?*

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Preliminary

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**Abstract**

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**JEL:** F23, L22, H25, H21

**Keywords:** Outsourcing, Offshoring, Profit Taxation, Arm's Length Principle

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# 1 Introduction

Arm's length pricing is the standard principle to tax transactions within multinational enterprises (see e.g. Art. 9 of the OECD's Model Tax Convention). This principle proposes that transactions within the firm should be valued as if they had taken place between independent parties. Lacking this counterfactual, it is commonly presumed that the cost of producing an input within the firm is same as sourcing it from the market.

This inference may not be correct. Firms regularly face the decision of whether to make or buy, and only a fraction of firms optimally chooses foreign direct investment (FDI) over foreign sourcing, suggesting systematic differences between outsourcing and FDI firms. In light of newly available data, recent literature on the international organization of production has substantiated large and persistent productivity differences across firms in narrowly defined industries, and has demonstrated that this may involve sorting into organizational forms (see, among others, Grossman and Helpman, 2002, Antràs and Helpman, 2004, and Grossman, Helpman, and Szeidl, 2006). Predictions of these models for the joint pattern of firm productivities and organizational structures fit the data well.

We apply the idea of sorting into outsourcing and set up a new model of outsourcing where only firms that are better than the market produce inputs internally. In this setting the arm's length principle causes new distortions, but may also increase welfare. This is because the impact of taxation differs across firms with different productivity levels and arm's length pricing favors the most productive firms.

In more detail our model works as follows. Firms in a differentiated goods industry need a specialized variety of a generic input for production which can either be obtained on the market (outsourcing) or from a fully-owned subsidiary (integration). Firms differ in their ability to produce the input in a subsidiary, and face customization costs if it is bought on the market. This combination of heterogeneity in input production and otherwise homogenous technologies generates a simple model suitable for policy applications.

We then explore the implications of profit taxation and demonstrate how the organizational form adjusts. Transactions between a firm's headquarter and its subsidiary are taxed according to the arm's length principle; i.e., the tax authority requires transactions to be valued at "market prices".

As within-firm transactions occur only in firms that are better than the market, market prices systematically exceed marginal costs, thus allowing for a reduction of tax payments with each unit produced. Profit shifting therefore occurs even though the firm strictly adheres to the tax code. We show that arm's length pricing effectively acts like an implicit per-unit production subsidy to the integrated firms, thereby generating lower consumer prices.

Profit taxation according to the arm's length principle has several effects on welfare. First, lower prices lead to higher sales of integrated firms. This induces some of the outsourcing firms to start their own subsidiaries and causes some of the

less efficient outsourcing firms to exit the market. As a consequence, the total number of available varieties falls. Furthermore, taxation affects incomes. We assume that tax revenues are redistributed to consumers lump-sum. Aggregate pre-tax profits rise as resources are re-allocated to more efficient firms. However, some profits are shifted to the foreign country and taxed there. As tax revenue in the foreign country is effectively lost from the domestic point of view, the national welfare effect of the ALP is not clear. From a global perspective, however, the effect is unambiguously positive. Globally, the arm's length principle constitutes an effective pick-the-winner-strategy.

While we do not model tax competition explicitly, our paper may also contribute to this literature. In our model, a lower foreign tax rate is positive for the home country. We do not, however, allow for profit shifting beside that which is already inherent in the arm's length principle. Our work can therefore be seen as complementary to this literature.

Our analysis relates to two different strands of literature. A first set of papers analyses the outsourcing decision of heterogeneous firms (see Spencer (2005) for a survey). The bulk of this literature takes an incomplete contracts approach to the theory of the firm and focusses on contractual frictions between final goods producers and producers of specialized inputs; see, among others, Grossman and Helpman (2002), Antràs (2003), Antràs and Helpman (2004), and Grossman and Helpman (2005). In our model, firms are heterogenous in their ability to produce an intermediate input in a foreign subsidiary, and decide whether to integrate or outsource based on whether or not they are able to "beat the market". This way of modeling makes outsourcing firms homogenous in their production technology, and allows for a particularly simple solution, while capturing the effects of sorting into outsourcing.

Most recently, a second set of papers introduces profit taxation in models with heterogenous firms. These papers study the effects of corporate taxation on incentives to relocate (Baldwin and Okubo (2009), Davies and Eckel (2010)) and profit shifting (Krautheim and Schmidt-Eisenlohr (2011)). Similarly, a number of studies have analyzed the effects of taxation on deciding which markets to serve and how to serve them, in particular exporting vs. FDI (e.g. Becker (2009)). Here, we focus attention on the decision whether to integrate with a foreign supplier or engage in foreign outsourcing.

Closer to our focus is Egger and Seidel (2011), who also model the interaction of corporate taxes and intra-firm trade. They show that the possibility to shift profits and lower the tax burden constitutes a reason to do FDI instead of outsourcing. However, the model of Egger and Seidel (2011) does not incorporate the arm's length principle. Our model differs in this and in the introduction of sorting into outsourcing even in the absence of taxation. A paper that also deals with the arm's length principle is Devereux and Keuschnigg (2009). They model the interaction between arm's length pricing and financial frictions, finding that even in the absence of taxes headquarters would like to charge their subsidiaries higher prices in order to provide them with liquidity. While we do not model financial constraints,

our model finds positive welfare effects of arm's length pricing.

The remainder of this paper is organized as follows. Section 2 describes the basic model. The following section derives the equilibrium in a world without taxation. Section 4 introduces profit taxes and the arm's length principle. In the next section, the equilibrium with taxation is derived and the welfare effects of arm's length pricing are discussed. Section 6 concludes.

# 2 Model Setup

In this section, we present the basic framework of our model. For now, we focus sharply on the outsourcing decision and ignore taxes, which we introduce below.

## 2.1 General Assumptions

We consider a static world economy with two countries, labeled $H$ and $F$, each endowed with a fixed amount of inelastically supplied, internationally immobile labor, the only factor of production. $H$'s labor endowment, $L$, is employed in two sectors $X$ and $Y$. In $Y$, homogenous firms produce output one-to-one from labor.

The $X$ sector is a monopolistically competitive differentiated industry with one-good firms. In it, firms assemble one unit of output from one unit of a specialized variety of a generic intermediate input and a fixed amount of overhead labor. The organization of firms in $X$ is endogenous: each differentiated consumer product can be produced either from an input that is custom-made in a fully-owned foreign subsidiary (integration) or from a generic variant of the input supplied by constant returns to scale firms in $F$ (outsourcing) and customized within the firm.[1] Firms in $X$ differ only in their ability to produce the input in a subsidiary. We can think of this as the labor requirement implied by the quality of the blueprint that a firm possesses, its ability to implant the production process in the subsidiary, or specific contracting frictions that affect the subsidiary's productivity.

All markets except the product market in $X$ are perfectly competitive, and there is free trade between $H$ and $F$ in the intermediate input and $Y$.[2] Using $Y$ as numéraire, wages are equal to unity.

The sequence of events is the following: First, firms decide about entry into the product markets based on their anticipated future profits. Second, $X$ sector firms organize and produce optimally given their ability and market conditions. Third, profits are realized and consumption occurs.

[1] Production in a subsidiary at home could also be possible, but yields no additional insights. Assuming that the fixed costs of a subsidiary are the same in each country, producers are in principle indifferent between $H$ and $F$. However, in the world with taxes below, they will strictly prefer the low tax country, which will be $F$ in this model.

[2] It is possible, albeit not necessary, to allow also for trade in $X$.

## 2.2 Consumers

The preferences of a representative consumer in $H$ are given by a log-linear utility function of the following form:

$$U = \mu \ln X + Y,\ X \equiv \left[ \int_{i \in \Omega} x\left(i\right)^{\frac{\sigma-1}{\sigma}} di \right]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where $\Omega$ represents the set of available goods. The elasticity of substitution between any pair $i$ and $i'$ of varieties in the real consumption index for sector $X$ is $\sigma$, $1 < \sigma\left(< \infty\right)$. The constant $\mu \in [0;1]$ measures the relative importance of $X$ .

Utility maximization given total income $I$ yields aggregate demand for $X$ equal to $X = \frac{\mu}{P}$ and, as originally shown by Dixit and Stiglitz (1977), isoelastic demand functions for each variety:

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

where $p_i$ is the price of $i$ and $P$ is the aggregate price index,

$P = \left[ \int_{i \in \Omega} p_i^{-(\sigma-1)} di \right]^{\frac{-1}{\sigma-1}}$. The remaining income is spent on the numeraire good: $Y^D = I - \mu$.

## 2.3 $X$-sector Firms

Active firms in the $X$ sector assemble their variety one-to-one from the intermediate input and incur a fixed overhead cost $c$.[3] Both variable and fixed costs may depend on the organisation of the firm.

Under integration, the variable unit cost is equal to the firm(-subsidiary) specific marginal cost $a_i$, reflecting the firm's ability and the fact that – since the input is custom-made in $i$'s own subsidiary – no further customization costs accrue.[4] However, setting up the foreign subsidiary raises the fixed costs to $c + f$ units of labor. $a_i$ is drawn ex-ante (before the entry decision occurs) from a commonly known distribution $G\left(a\right)$.[5]

[3] We assume that the fixed overhead cost $c$ is low enough to allow at least some firms to become active.

[4] If we think of $a_i$ representing the technological knowledge of firm $i$, the implicit assumption is that this knowledge can be transferred completely and costlessly to the subsidiary. Alternatively, we may presume a matching process that pairs firms and potential foreign subsidiaries and think of $1/a_i$ as the match-specific productivity.

[5] To guarantee positive prices in the case with taxation below, the distribution should be bounded on both sides. Therefore, the common unbounded Pareto distribution is not suited for our purpose. Under this distribution, firms with marginal costs arbitrarily close to zero exist with a positive probability. If firms get a fixed subsidy, there are some firms for which it is optimal to sell an infinite quantity at a price of zero. This problem does not arise with a distribution that does not allow marginal costs close to zero, e.g. a uniform distribution or a bounded Pareto distribution.

Under outsourcing, the firm buys a non-specific variant of the input in $F$ at an exogenous price $r$.[6] This generic variant of the input needs to be customized.[7] We model these costs as if a firm had to buy $1+\tau$ units of the input in order to use one unit in production. Thus, for simplicity, we assume that customization costs are homogenous across firms. Accordingly, under outsourcing, the variable unit costs are $a^o \equiv (1+\tau)\, r$. We make the implicit assumption that the necessity of customization and competitive considerations prevent the subsidiary of the most productive firm to take over the entire market.

Note that all outsourcing firms (i.e. the firms that acquire the input on the market) effectively produce at the same marginal cost. Therefore, to an outside observer, these firms appear homogeneous – they each sell the same quantity at the same price, and make identical profits.[8]

Finally, there is a large pool of potential entrants. Each firm makes two decisions: $i)$ given the specific integration-input-coefficient $a_i$ and market conditions, it chooses the optimal organizational structure ("make or buy"); $ii)$ it decides about becoming active. In contrast to Melitz (2003), where the mass of potential entrants is endogenously determined, applied models regularly fix the relation between the average price and the mass of firms by imposing an exogenous number of potential entrants (thus, an increase in the mass of firms necessarily requires a decrease in the average productivity). In our model, free entry by outsourcing firms that do not rely on their productivity draw allows the otherwise fixed relationship to be determined by an equilibrium condition.

This concludes the description of the model economy.

# 3 Equilibrium without Taxation

We are now in the position to solve for the equilibrium in our model economy. To begin, consider the organization decision of potential firms in the $X$ sector, which follows from comparing profits under outsourcing and under integration.

Consider first an integrated firm that produces the input in its own subsidiary. Profit maximization gives prices as constant mark-up over firm-specific marginal costs ($a_i$):

$$p_i = \frac{\sigma}{\sigma - 1} a_i. \tag{3}$$

[6] In the benchmark model, we take the existence and productivity of the intermediate input supplier as given and assume that demand of outsourcing firms in $H$ does not affect the world-market price of the input.

[7] 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).

[8] One could say that outsourcing firms behave similar as in the Krugman (1980) model, while integrated firms act as in Melitz (2003). Our model is therefore, in a way, a combination of these two models.

Using optimal demand and pricing, an integrated firm's profit is given by

$$\pi(a_i) = (p_i - a_i) x_i - c - f = \left(\frac{\sigma - 1}{\sigma} \frac{P}{a_i}\right)^{\sigma - 1} \frac{\mu}{\sigma} - c - f. \tag{4}$$

More productive firms sell larger quantities, charge lower prices, and earn higher profits than less productive firms.

Next, consider a firm that outsources and buys the input on the market. As the market price ($r$) and specification costs ($\tau$) are the same for all outsourcing firms, they all charge the same price:

$$p^o = \frac{\sigma}{\sigma - 1} (1 + \tau) r. \tag{5}$$

It follows that all outsourcing-firms also earn the same profits:

$$\pi^o = \left[\frac{\sigma - 1}{\sigma} \frac{P}{(1 + \tau) r}\right]^{\sigma - 1} \frac{\mu}{\sigma} - c. \tag{6}$$

Since $\pi(a_i)$ is strictly increasing in $a_i$, while $\pi^o$ is indepenent of $a_i$, with sufficiently large potential $a_i$'s there exists a unique cutoff $a^*$ such that all firms with $a_i \leq a^*$ choose to integrate. Moreover, as firms may always enter and realize $\pi^o$ under outsourcing, and $P$ is decreasing in the mass of active firms, entry will drive the profits of outsourcing firms to zero. Accordingly, free entry pins down the equilibrium price index. From (6) and $\pi^o = 0$:

$$P^* = \left(\frac{\sigma c}{\mu}\right)^{\frac{1}{\sigma - 1}} (1 + \tau) r \frac{\sigma}{\sigma - 1}. \tag{7}$$

Before exploiting this result, let us take a step back and ask why the zero-profit-condition for outsourcing firms immediately delivers the price index, and what this means for the mechanics of the model. Suppose that an additional integrated firm enters the market. As usual in Dixit-Stiglitz models, the additional variety will lower the price index (even if it is more expensive than other varieties in the market).[9] The decline in the price index translates into a drop in all firms' profits. For outsourcing firms, this profit drop makes them unprofitable, as they can no longer cover their fixed cost. Accordingly, some outsourcing firms exit and the price index rises, up to the point where outsourcing firms again make zero profits. Thus, zero profit in outsourcing keeps the price index constant.

In fact, $P^*$ is equivalent to the price index in the Dixit-Stiglitz model with homogenous firms, with familiar properties. For example, raising overhead costs ($c$

[9]The C.E.S.-price index is the price index of the optimized consumption bundle. If all previously existing varieties remain available, the price index will never rise if an additional variety becomes available. As the elasticity of substitution is positive, it is strictly better to consume the new variety, which implies a fall of the price index.

increases) reduces the number of active firms and thus the number of available varieties. Accordingly, the price index rises in $c$. If customization gets harder or input supplier become less productive ($\tau$ or $r$ increases), the price level increases, as varieties produced by outsourcing firms become more expensive. Lastly, the price index falls in the size of the market as measured by $\mu$. If the importance of differentiated goods for consumers increases, the increase in demand makes market entry more profitable and leads to more varieties (i.e. a fall in the price index).

Next, consider the firm's optimal organisation decision. Comparing (4) and (5) using (7), we find that only firms with $a_i \leq a^*$ integrate, while firms with $a_i > a^*$ outsource. The cutoff $a^*$ is determined by $\pi(a^*) = 0$, which, using (7), gives

$$a^* = \left(\frac{c}{f+c}\right)^{\frac{1}{\sigma-1}} (1+\tau)\, r. \tag{8}$$

We may now state a first result on optimal sorting into outsourcing.

**Result 1 (Existence of Equilibrium and Optimal Organization)** *A unique equilibrium exists. The cutoff for integration is increasing (less firms outsource) in the customization costs ($\tau$) and the overhead costs ($c$), and decreasing in the efficiency of the input supplier on the market ($1/r$) and the fixed costs of owning a subsidiary ($f$).*

**Proof.** The equilibrium is characterized by the solutions for $a^*$ and $P^*$ derived above, which are unique. The only requirement for the existence of the equilibrium is that the fixed cost is not so high that it prevents entry for all firms. ■

These effect are intuitive: As $c$ increases, the number of outsourcing firms in the market falls (there is entry until outsourcing firms earn zero profits, and that point is reached earlier if $c$ is higher). Correspondingly, profits in outsourcing are also lower if the customization costs ($\tau$) or the market price ($r$) are higher. A higher fixed costs of the subsidiary ($f$) makes outsourcing relatively more attractive.

Moreover, we conclude that both the cut-off and the price index are independent of the specific distribution $G(a)$.

**Corollary 2** *Innovations in the production technology, measured e.g. by substituting $G(a)$ with a distribution that is first-order stochastically dominated by $G(a)$, leaves both the cut-off for outsourcing and the price unaffected.*

**Proof.** Follows immediately from the fact that $a^*$ and $P$ are independent of $G(a)$. As $G(a)$ is defined over input coefficients, and not productivity, a first-order stochastically dominated distribution implies an enhanced production technology. ■

To determine the total mass of firms and welfare, we next use the equilibrium price index to get the mass of outsourcing firms $n^{o*}$ (the mass of integrated firms is equal to $1 \times G(a^*)$). From the definition of the price index and the optimal pricing rules we have

$$P = \left[\int_{i\in\Omega} p_i^{-(\sigma-1)} di\right]^{-\frac{1}{\sigma-1}} = \left[n^o \left(p^O\right)^{-(\sigma-1)} + \int_0^{a^*} p_i^{-(\sigma-1)} dG\left(a\right)\right]^{-\frac{1}{\sigma-1}}. \quad (9)$$

Combining (7) and (9), we get the equilibrium number of outsourcing firms as a function of the cutoff for integration, which is explicitly given in (8):

$$n^{o*} = \frac{\mu}{\sigma c} - \left[\left(1+\tau\right) r\right]^{\sigma-1} \int_0^{a^*} a^{-(\sigma-1)} dG\left(a\right) \quad (10)$$

For convenience, we define the average input coefficient of FDI-firms, $\tilde{a}\left(a^*\right)$:

$$\tilde{a}\left(a^*\right) \equiv \left[\int_0^{a^*} a^{-(\sigma-1)} dG\left(a\right)\right]^{-\frac{1}{\sigma-1}}. \quad (11)$$

With this, the number of outsourcing firms solves

$$n^{o*} c = \frac{\mu}{\sigma} - \left[\frac{\left(1+\tau\right) r}{\tilde{a}\left(a^*\right)}\right]^{\sigma-1} c. \quad (12)$$

This equation can be interpreted as a global zero-profit condition in the outsourcing sector. The left-hand side, $n^* c$ gives the total fixed cost of the outsourcing-firm sector. The right hand side is an expression for revenues in this sector: $\frac{\mu}{\sigma}$ are the "potential" aggregate profits (that is, $\frac{\mu}{\sigma}$ would be aggregate profits if there was no possibility for outsourcing), and the last term are aggregate profits of the FDI-firms.[10]

To completely characterize equilibrium, we now solve for the outcome in the $Y$-sector. Demand for $Y$ is determined by the representative consumer's budget constraint.[11] Using that spending on $X$ is equal to $XP = \mu$, we get:

$$Y^D = I - \mu, \quad (13)$$

where income ($I$) is given by the sum of labor and profit income,[12]

$$I = \int_0^{a^*} \left[p_i x_i - \left(f + c + a_i x_i\right)\right] dG + L = \left[\frac{\left(1+\tau\right) r}{\tilde{a}\left(a^*\right)}\right]^{\sigma-1} c - \left(f+c\right) G\left(a^*\right) + L. \quad (14)$$

with $a^*$ given explicitly in (8). Combining (13) and (14), demand for $Y$ is

[10] Note that, as the mass of firms is normalized to one, average and aggregate profits are identical.

[11] Note that $Y^D$ is not equal to the amount of $Y$ produced in the country ($Y^S$), as some of the $Y$-goods must be exported in order to balance trade (inputs are imported from the other country).

[12] In the following, integrals over the distribution $G\left(a\right)$ are written as starting at 0. With a well-defined distribution function, this is equivalent to an integral that starts at the lower bound of the distribution.

$$Y^D = \left[\frac{(1+\tau)\, r}{\tilde{a}\,(a^*)}\right]^{\sigma-1} c - (f+c)\, G\,(a^*) + L - \mu. \tag{15}$$

The demand for $Y$ is given by the income (consisting of the sum of labor and profit income) minus the expenditures on $X$ (which are given by $\mu$). There are two counteracting effects of a change in $a^*$ on $Y^D$. On the one side, a higher $a^*$ implies a larger number of profitable integrated firms, which increases aggregate revenues. On the other side, these additional integrated firms pay fixed costs ($f$) abroad, thereby decreasing profit income.

Finally, we show that the organization cutoff in (8), and hence the equilibrium allocation, is constrained efficient.

**Result 3 (Constrained Efficient Organization)** *Taking the market structure as given, $a^*$ maximizes utility of H's consumers.*

**Proof.** In two steps. First, the utility maximizing organization structure will maximize income. To see this, note that the indirect utility function, $\tilde{U} = \mu \ln \mu - \mu \ln P^* + I - \mu$, depends on $a^*$ only through $I$, as $P^*$ is determined independently of $a^*$ by free entry into outsourcing (cf. equation (7)). Thus, second, the efficient organization cutoff $a^\star$ solves the f.o.c. for income maximization:

$$-(\sigma-1)\frac{\partial \tilde{a}\,(a^\star)}{\partial a^\star}\frac{a^\star}{\tilde{a}\,(a^\star)}\left[\frac{(1+\tau)\, r}{\tilde{a}\,(a^\star)}\right]^{\sigma-1} c = (f+c)\, a^\star g\,(a^\star)\,. \tag{16}$$

Since $\frac{\partial \tilde{a}(a^\star)}{\partial a^\star} = -\frac{1}{\sigma-1}\left(\frac{a^\star}{\tilde{a}(a^\star)}\right)^{-(\sigma-1)} \tilde{a}\,(a^\star)\, g\,(a^\star)$, this proves $a^\star = a^*$. ■

An important limitation of this exercise is due to the fact we treat $r$ as exogenous. Appendix A.1 discusses some implications of this limitation.

# 4 Additional Assumptions of Taxation

We now turn to considering the impact of profit taxes on the outsourcing decision in industry equilibrium. Profit taxes are interesting in this environment because, under widely-used real-world tax practices, sorting into outsourcing implies an implicit subsidy to certain types of firms. We begin by briefly describing key elements of real-world taxation practices and then incorporate them in our analysis.

The governing principle in the taxation of multinational enterprises is the arm's length principle (ALP). The principle signifies that – for tax purposes – transactions between different companies of a multinational enterprise should be valued the same as they would have been if the transaction had taken place between independent parties. Ensuring that transfer prices are set on a market value basis, the

idea is that the ALP contains creative transfer pricing designed to shift profits into low tax countries.[13] Of course, in reality, it is not obvious what the price between independent parties would have been exactly. Due to the difficulties associated with uncovering this price (holding all other characteristics constant), it is common practice to identify comparable market transactions of outsourcing firms and impose the associated price when calculating the tax base of integrated firms. Thus, the relevant price for taxation in an integrated firm is commonly determined by (or equal to) the price that the firm would have had to pay to an unrelated party on the market. Only if a firm can present evidence that it incurred higher costs, it may bring these to bear for taxation purposes. However, as artificially elevated transfer prices are used for profit shifting, such evidence is difficult to provide and closely scrutinized by the tax authorities. In the following, we will focus on firms whose marginal cost is at or below the market price.

To the extend that there is systematic sorting into outsourcing, this practice has differential effects on a firm's behavior. Among other things, profit taxation under the ALP becomes distortionary because it grants an implicit production subsidy, which differs in size across firms. Since the sorting process underlying the optimal organizational choice lies at the heart of our model, the environment laid out in the previous section is well suited to study these distortionary effects of taxation at arm's length.

To reproduce real-world taxation of multinational enterprises in our model, we make two assumptions regarding the determination of the arm's length price and the specifics of the tax code.

With respect to the tax code, there is lots of variation in the way different countries tax foreign profits of multinational enterprises. To avoid or limit double taxation of corporate profits, most major economies have established bilateral tax treaties. The OECD promotes such treaties. In its Model Tax Convention on Income and on Capital the OECD presents two alternative systems for the taxation of foreign profits: First, the exemption method, where profits earned in the foreign country are exempted from taxation in the home country. Exemption is applied, for example, in Austria, France, Germany, Netherlands and Spain. The second alternative is the tax credit method, according to which foreign profits are subject to tax both in the home and the foreign country. However, the tax levied on them in the foreign country is credited against the tax paid in the home country. The credit method is used, among others, by the United States, Great Britain, Ireland, Italy, Sweden and Slovakia.

A further possibility is "full taxation after deduction", which firms can opt for in some countries, for example in Germany. It implies that the tax paid in the foreign country is deducted from the domestic tax base before the tax liability is calculated.

Under the tax credit method, taxation has no effects on the firms' decisions because the tax paid in the foreign country is fully deducted from the the tax payment in

[13]The main advantage of the ALP is that it is relatively easy to enforce. Furthermore, it is not obvious what an alternative transfer price which limits profit shifting would be.

the home country. Thus, the foreign tax has no effect on the firm's decision, which makes taxation according to the ALP under this regime equivalent to a pure profit tax, which does not distort firms' decisions. Therefore, the equilibrium outcome is identical to the economy without taxation described above. Highlighting the effects of sorting into outsourcing, our analysis also shows different allocative consequences of these methods.

In the main text, we use the exemption system and discuss full taxation after deduction in Appendix A.2. In doing so, to determine the tax base according to the ALP, we set the transfer price equal to the market price for the intermediate input, $r$.

# 5 Economy with Taxes and Foreign Tax Exemption

In this section, we add the additional assumptions for taxation to our model and show that, because of sorting, taxation according to the ALP may generate an implicit production subsidy.

Under the exemption method, and with international transactions prices according to the ALP, the after-tax profit function of an integrated firm is

$$\pi_t(a_i) = (1 - t_H)(px - rx - c) + (1 - t_F)(rx - a_i x - f), \tag{17}$$

where $t_H$ and $t_F$ are the domestic and foreign profit tax rate, respectively, and foreign after-tax profits can be repatriated without additional costs. In the main text we assume $t_F < t_H$, motivating the absence of domestic sourcing/integration. The tax-rate differential implies that taxation at arm's length affects firms' behavior (cf. Section 5.2).

As mentioned above, the arm's length principle is not applied if a firm can prove that it incurred higher costs than those covered by the market price. According to our model, this case is very rare and applies only if customization costs are very high (high customization costs may induce some firms to decide against outsourcing, even though the per-unit market price is lower than their marginal cost, despite the additional overhead cost of integration). To keep our model focused on the prevalent case, and avoid the distinction of cases that would become necessary otherwise, we restrict the parameter values to ensure that this does not happen. Formally, we therefore assume that[14]

$$\tau \leq (1 - t_H + t_F)\frac{1 - t_H}{1 - t_F}\left[\frac{(1 - t_H)c + (1 - t_F)f}{(1 - t_H)c}\right]^{\sigma-1} - 1. \tag{18}$$

[14]Under alternative taxation systems, such as full taxation after deduction, this assumption is not necessary.

Under this assumption, the arm's length price systematically exceeds the true variable costs of integrated firms, because optimal organization implies that integrating firms are consistently better than the market at producing the input. Accordingly, it allows them to deduct higher "costs" in the high-tax country $H$ and decrease their tax burden with each unit produced.

Maximizing (17) s.t. consumers' demand gives optimal prices:[15]

$$p_t(a_i) = \frac{\sigma}{\sigma - 1}\left(\frac{1 - t_F}{1 - t_H}a_i - \frac{t_H - t_F}{1 - t_H}r\right). \tag{19}$$

In the case without taxes $p(a_i) = \frac{\sigma}{\sigma-1}a_i$ so that the tax wegde on prices, $\Delta(a_i) \equiv p_t(a_i) - p(a_i)$ is equal to

$$\Delta(a_i) = -\left(\frac{t_H - t_F}{1 - t_H}\right)(r - a_i)\frac{\sigma}{\sigma - 1}. \tag{20}$$

So we see that profit taxation at arm's length grants an implicit subsidy that lowers the output price and raises quantities produced.[16] This subsidy is increasing in the tax-rate difference between $H$ and $F$ and in the arm's length price. Importantly, it is larger for more productive firms ($\frac{\partial|\Delta(a_i)|}{\partial a_i} < 0$).

Consider next the profit function of outsourcing firms:

$$\pi_t{}^o = (1 - t_H)\left[p^o x^o - r(1 + \tau)x^o - c\right]. \tag{21}$$

Pure profit taxation leaves the behavior of outsourcing firms unaffected. By the same argument as in the economy without taxation, their after-tax profits will be zero in equilibrium. Accordingly, free entry pins down the price index at its zero-tax equilibrium value.[17] Changes in tax rates alter the composition of average prices, the mass of available varieties, and aggregate tax revenues, but leave the price index unaffected.

We summarize these findings in the following Lemma.

**Lemma 4 (Effects of Profit taxation at arm's length)**

1. *Arm's length taxation does not affect the optimal behavior of outsourcing firms.*
2. *It causes most integrated firms to lower their prices. Under the assumption in* (18)*, this holds for all firms. Therefore, the ALP acts like a per-unit subsidy.*

[15] In order to guarantee positive prices, the input coefficient of the most productive firm may not be too low relative to the market price. This can be guaranteed by a suitable choice of the distribution.

[16] Under the assumption in (18), $r > a_i$ for all $a_i < a^*$.

[17] The pricing decisions of foreign input suppliers are also not affected by taxation, since they face a pure tax on profits.

**Proof.** In the text. ■

We conclude this section by an assumption on the use of tax revenues. For simplicity, we assume that the proceeds of the profit tax in $H$ are redistributed lump-sum to the consumers in $H$.

## 5.1 Equilibrium with Taxation and Foreign Tax Exemption

We now characterize the equilibrium with profit taxation at arm's length, beginning with the optimal organization of firms.

Since the price index is not affected by profit taxes, comparing profits under outsourcing and integration using $P$ as given in (7), optimal prices (19) and (3), and demand (2), we find that firms with $a_i \leq a_t^*$ choose to integrate, where

$$a_t{}^* = \left[\frac{(1-t_H)\,c}{(1-t_H)\,c+(1-t_F)\,f}\right]^{\frac{1}{\sigma-1}} \frac{1-t_H}{1-t_F}\,(1+\tau)\,r + (t_H - t_F)\,r. \tag{22}$$

Less productive firms ($a > a^*$) engage in outsourcing. Profit taxation at arm's length increases the mass of outsourcing firms. The outsourcing cutoff exceeds the cutoff without taxes, $a_t^* > a^*$, allowing less productive firms to integrate profitably. Inuitively, this is because the tax scheme provides an implicit subsidy which makes integration more profitable. This direct effect is captured by the second term in (22). The first term captures the direct effect of taxation on profits and fixed costs.

If the foreign tax rate falls, more can be gained from the profit shifting that becomes possible with the subsidiary, so more firms choose FDI ($\frac{\partial a_t^*}{\partial t_F} < 0$). The effect of a change in the tax rate of the home country is ambiguous. On the one hand, as $t_H$ rises, the incentive to shift profits away rises. On the other hand, after-tax profits fall, so the importance of the additional fixed cost of establishing a subsidiary rises.

**Result 5 (Organizational Structure under Taxation)** *There exists a unique outsourcing cut-off under taxation, which is given by* (22)*. Because of the subsidy implicit in arm's length pricing due to the sorting of firms into outsourcing, more firms do FDI than in a world without taxation.*

**Proof.** See appendix A.3. ■.

Note that this result is robust to changing the underlying distribution of input coefficients, $G$.

What happens in the $Y$-sector when taxes are introduced? As this sector is perfectly competitive, taxes do not affect the individual firm's production decision. However, because aggregate income changes, aggregate demand for $Y$ changes. Using equation (13) we get for $Y^D$

$$Y^D = I - \mu = \Pi_t + L - \mu, \tag{23}$$

where aggregate profit income $\Pi_t$ is given by

$$\Pi_t = \int_0^{a_t^*} (1-t_H)(px-rx-c) + (1-t_F)(rx-a_i x-f)\, dG(a) \tag{24}$$

$$= c(1-t_H)^{\sigma} \left( \frac{(1+\tau)r}{\tilde{a}_t(a_t^*)} \right)^{\sigma-1} - G(a_t^*)\left[(1-t_H)c + (1-t_F)f\right], \tag{25}$$

whereby $\tilde{a}_t$ is the average *effective* input coefficient, that is, marginal cost when taking the implicit subsidy of the arm's length principle into account:

$$\tilde{a}_t(a_t^*) = \left[ \int_0^{a^*} \left[(1-t_F)a_i - (t_H - t_F)r\right]^{-(\sigma-1)} dG(a) \right]^{-\frac{1}{\sigma-1}}. \tag{26}$$

## 5.2 Welfare Effects of Taxation

In the following, we will discuss the effects which taxation according to the arm's length principle has on welfare. First, we will derive the welfare function in the benchmark case without taxation and compare it to welfare with taxation according to ALP. Second, we will describe the welfare effects of the ALP both globally and from the national perspective. We find that global welfare unambiguously increases, while from the home country's point of view the welfare effect is ambiguous.

Welfare corresponds to the utility of the representative consumer. In the case without taxation, it is given by[18]

$$W = \mu \cdot lnX + Y^D = \mu \cdot ln\frac{\mu}{P^*} + \Pi + L - \mu. \tag{27}$$

When we look at welfare in the case of taxation under the exemption system, only the income changes. Assuming that the tax revenue in the home country is redistributed to consumers lump-sum, welfare is given by

$$W_t = \mu \cdot ln\frac{\mu}{P^*} + \Pi_t + T + L - \mu. \tag{28}$$

where the tax revenue is given by

$$T = t_h \int_0^{a^*} \left[px - rx - c\right] dG(a). \tag{29}$$

[18] Assuming that tax revenues are redistributed lump-sum to consumers, the welfare function under "perfect" taxation (that is, when marginal costs are fully observable for the state) would be identical.

From equations (27) and (28) it is easy to see that the change in welfare of introducing taxation according to the arm's length principle is fully determined by the difference in aggregate income:

$$\Delta W = W_t - W = \Pi_t + T - \Pi. \tag{30}$$

This result may look surprising, given that we showed before that taxation changes the firms' pricing decisions. As the prices of the differentiated goods produced by the integrated firms fall, consumer welfare increases. However, there is a second, opposing effect as some outsourcing firms exit the market. This loss of varieties has a negative effect on welfare.

In this model, these two opposing effects cancel out. Why is this so? Both effects are captured by the price index. As the prices of the integrated firms fall, the price index decreases. This makes it harder for the outsourcing firms to sell their goods; their revenues and therefore their ability to cover their fixed costs falls. Some of them exit the market. This loss of varieties causes the price index to rise, because, as a C.E.S.-price index, it represents the price of the optimized consumption bundle. In total, the zero-profit condition of the outsourcing firms keeps the price index fixed. As both prices and love of variety only enter the welfare function via the price index, these two effects cancel out in equilibrium.

Therefore, the total welfare effect is decided by the change in income: There is a positive welfare effect if aggregate income rises. This effect can be decomposed into an effect on profit income on the one hand and on the other hand in an effect via (redistributed) tax revenues.

First, we look at pre-tax profits. The cut-off is unambiguously higher in the world with taxation: $a_t^* > a^*$. Hence, there are more firms that make positive profits due to the arm's length principle. The average pre-tax profits also rise.[19] Together, this implies that pre-tax profits unambiguously increase.

However, we may not forget about tax revenues. Tax revenue raised in the home country is redistributed to consumers. However, due to the profit shifting inherent in the arm's length pricing, firms pay some of their taxes in the foreign country. This foreign tax revenue is lost for welfare from the perspective of the home country. The following result sums up the welfare effects:

**Result 6 (Welfare Effects in the Home Country)**

1. *The effects on prices and varieties cancel out.*
2. *While pre-tax income rises, the effect on after-tax income is not clear, as some is lost due to tax payments in the foreign country.*

[19] Average profits are given by $\left[\frac{(1+\tau)r}{\tilde{a}_t}\right]^{\sigma-1} c$ in the case with taxation, and by $\left[\frac{(1+\tau)r}{\tilde{a}}\right]^{\sigma-1} c$ in the benchmark case. As the average effective input coefficient is lower under taxation ($\tilde{a}_t y \tilde{a}$), average profits rise.

**Proof.**

1. This directly follows from the fact that the equilibrium price index is independent of the tax rate.

2. Pre tax profits rise, as there are i) more firms that make profits (i.e. integrated firms) and ii) those firms realize, on average, higher profits (c.f. footnote 19). For the distribution of these profits between the country and the condition under which the welfare effect is positive, see appendix A.3.

■

If we look at welfare from a global point of view, taxation according to the arm's length principle unambiguously increases welfare. This is easy to see when taking into account that in the home country, the only negative welfare effect arises from the fact that some tax revenue is lost to the other other country. This tax revenue directly increases welfare in the foreign country, and as there are no other welfare effects in Foreign, global welfare increases.

**Result 7 (Global Welfare)** *From a global perspective, the welfare effect of the arm's length principle is positive.*

**Proof.** See appendix A.3 ■

This result supports the view that international organizations such as the OECD should promote the use of the arm's length principle worldwide.

As mentioned above, the welfare effect in the home country is ambiguous because of the profit income lost due to taxes in the foreign country. This income loss is smaller, if the foreign tax rate is lower. A lower foreign tax rate also increases the de-facto subsidy to the integrated firm. This leads to the following proposition:

**Result 8 (Tax competition)** *Tax competition (i.e. a lower foreign tax rate) increases welfare at home, as it implies less income loss to the foreign country and a higher subsidy.*

**Proof.** See appendix A.3. ■

# 6 Conclusion

This paper proposed a simple model of outsourcing based on the idea that only firms that are better than the market at producing an input do so themselves. This model was then used to show how profit taxation according to the arm's length principle affects the sourcing decision and welfare.

The arm's length principle affects an integrated firm's pricing and quantity decisions similar to a per-unit subsidy: It causes them to set lower prices and sell

higher quantities. The magnitude of this effect depends on the tax rate difference and the transfer price. As the arm's length principle increases pre-tax profits, the global welfare effect is positive. From a national point of view, the welfare effect is not clear, as some profit income is shifted to the tax haven and lost there due to taxation. The home country profits from an increase in tax competition in the form of a lower foreign tax rate.

These results offer a reason for international coordination in the setting of the framework of international taxation. While the environment for taxation of cross-border activities is usually set in bilateral treaties, the OECD's Model Tax Convention plays an important role worldwide. This paper shows that using the arm's length principle (as the OECD proposes) increases global welfare and therefore offers an argument for a greater activity of international bodies in setting the guidelines for international taxation.

The model we proposed complements the existing models of profit shifting. It shows that very productive firms can shift some profits abroad, even though they adhere strictly to the rules.

Our outsourcing model offers a new and simple way to clarify the sourcing decision of the firm. It can be interpreted in a way similar to the existing literature (which explicitly models the contractual difficulties of the outsourcing relationship that are only implicitly included in our model). However, in its simplicity, it is very well suited for policy applications and can be used as a building block for a number of interesting policy applications.

# A Appendix

## A.1 Endogenous Input Price

In this appendix we discuss the effects of endogenizing the market price for the intermediate input ($r$). (To be completed.) It is available from the authors on request.

## A.2 Full Taxation After Deduction

Full taxation after deduction implies that the home country taxes repatriated foreign profits at the same rate as it taxes domestic profits. The tax paid on these profits in the foreign country is deducted from the tax base before tax is paid in the home country.

In this case, the profit function of a firm that produces the input in a subsidiary is

$$\pi_{FTD}(a_i) = (1 - t_H)\left[px - rx - c + (1 - t_F)(rx - a_i x - f)\right]. \tag{A-1}$$

Profits of an outsourcing firm are given by

$$\pi_{FTD}{}^{o} = (1 - t_H)\left[p^o x^o - r(1 + \tau)x^o - c\right]. \tag{A-2}$$

This shows easily that taxes do not distort the decisions of the outsourcing-firms. By the same argument as in the economy without taxation, their after-tax profits have to be zero in equilibrium. As before, equation (A-2) pins down the price index. Again, the price index is not affected by taxation.

FDI-firms, however, are affected. This can be easily seen in the FDI-firms optimal pricing decisions:

$$p_{FTD} = \frac{\sigma}{\sigma - 1}\left[a_i - t_F(a_i + r)\right]. \tag{A-3}$$

It is easy to see that due to the implicit subsidy of the arm's length pricing, the optimal price with taxation is lower than without it. The price decrease is stronger if the foreign tax rate or the arm's length price is higher, as these two mechanisms increase the subsidizing character of the tax system.

By comparing the profits of FDI with those realized when outsourcing, we determine the cut-off $a_F TD^*$. Firms with marginal costs lower than this cut-off establish subsidiaries, while those with higher marginal costs buy the input on the market. Under the "full taxation after deduction"-tax system, the cut-off is given by

$${a_{FTD}}^* = \left(\frac{c}{c - (1 - t_F)f}\right)^{\frac{1}{\sigma - 1}} \frac{(1 + \tau)r}{1 - t_F} + \frac{t_F}{1 - t_F} r. \tag{A-4}$$

A higher arm's length price $r$ implies that more profit shifting is possible, which makes FDI more attractive. The effect of a change in the foreign tax rate are ambiguous.

## A.3 Proofs

The proofs are available from the authors upon request.

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