

# Agency Relationship and Transfer Pricing Inefficiency<sup>#</sup>

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## 1 The simple model of Transfer pricing

In this first part of the paper, my analysis is based on the study by Baldenius and Reichelstein (2006). Some aspects of their analysis will be preserved, others will be replaced or modified. Baldenius, Reichelstein study a firm which consists of two divisions and transactional interactions within these two divisions. First division (Sub 1) produces one product which can be sold to external market or to the second division (Sub 2) as an intermediate product which is used for the production of the final product. Other assumption of this model is that the costs of production are supposed to increase linearly together with the total quantity. The unit variable costs  $c(\theta)$ <sup>1</sup> connected to this intermediate product are constant. It is clear that for any market price  $p$  of intermediate product, the Sub1 meets the external demand  $Q_e(p, \theta)$  for its product. At the same time the Sub1 meets the internal demand of Sub2. We can say that Sub2 buys  $q_i$  of intermediate product from Sub1 and produces the final products which are sold to external customers. Sub2 makes net-revenue  $R_i(q_i, \theta)$ <sup>2</sup>. Before setting the quantity and price of the production, managers are interested in the  $\theta$  level.

The total profit of the firm can be quoted as follows:

$$\pi = p \cdot Q_e(p, \theta) + R_i(q_i, \theta) - c(\theta) \cdot (Q_e(p, \theta) + q_i). \quad (1)$$

In the case of transfer price existence, the total profit of the company can be divided between Sub1 and Sub2 as follows:

$$\pi_1 = p \cdot Q_e(p, \theta) + TP \cdot q_i - c(\theta) \cdot (Q_e(p, \theta) + q_i). \quad (2)$$

$$\pi_2 = R_i(q_i, \theta) - TP \cdot q_i. \quad (3)$$

Pricing and quantity decisions are made according to the following scheme. In dependence on  $\theta$ , the Sub1 determines the price  $p$  for external customers. This price determines the external demand  $Q_e(p, \theta)$ . The central management sets the transfer price  $TP(p)$  as a function of the market price  $p$ . The model assumes that Sub2 sets the requested quantity of intermediate product  $Q_i(TP, \theta)$  from Sub1, which must satisfy this demand prior to the external one.

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<sup>1</sup>  $\theta$  is a vector of real-valued parameters, where  $\theta \in \Theta$ .  $\Theta$  is a set of all possible states.

<sup>2</sup> This net-revenue reflects the gross sales revenue of the Sub2's final product less applicable costs other than those for the intermediate product.

When the relation between the transfer price  $TP(p)$  and the market price  $p$  is established, the profit of Sub1  $\pi_1$  can be quoted as follows:

$$\pi_1(p, \theta, TP(p)) = [p - c(\theta)] \cdot Q_e(p, \theta) + [TP(p) - c(\theta)] \cdot Q_i(TP(p), \theta), \quad (4)$$

$$Q_i(TP(p), \theta) + Q_e(p, \theta) \leq K, \quad (5)$$

where  $K$  – the production capacity of Sub1.

At the end of this part, the maximization model is introduced. The model will deal with one parameter which differs from the above mentioned ones. The production capacity is supposed to be fully used:

$$Q_i(TP(p), \theta) + Q_e(p, \theta) = K. \quad (6)$$

The variables of the model are as follows:

- $TP(p)$  – transfer price,
- $\lambda$  – multiplier.

The maximization model is:

$$L = [p - c(\theta)] \cdot Q_e(p, \theta) + [TP(p) - c(\theta)] \cdot Q_i(TP(p), \theta) - \lambda \cdot [K - Q_i(TP(p), \theta) - Q_e(p, \theta)]. \quad (7)$$

To solve this maximization model we must compute the partial derivatives of the function  $L$  with respect to  $TP$  and  $\lambda$ .

$$\frac{\partial L}{\partial TP} = 0, \quad (8)$$

$$\frac{\partial L}{\partial \lambda} = 0. \quad (9)$$

The solution of this equation system leads to the optimal when the profit of the firm is maximal.

## 2 The general transfer pricing model

In the previous paragraph, a model approach of Baldenius and Reichelstein has been described. This paragraph develops more realistic model. This development is based not only on a firm with two divisions but on a firm with general number of divisions. Together with this extension I suppose, that each division produces an intermediate product which is purchased by all other divisions and also by external firms. Each division produces final products using the purchased intermediate products (each kind intermediate product is used for one kind of final product) and sell this final production on the market. These assumptions can be applied on any structure of the firm. Those interactions which do not exist can be easily ignored. All other assumptions from the previous paragraph remain the same. The general transfer pricing model can be described as follows:

$D_i$	–	$i$ -th division, $i=1..n$ , where $n$ is the total number of divisions,
$M_i$	–	$i$ -th intermediate good,
$TP_i$	–	$i$ -th transfer price,
$p_i$	–	$i$ -th external price,
$\pi_i$	–	profit of $i$ -th division,
$c(\theta)_i$	–	unit variable cost of $i$ -th intermediate product,
$Q_{e,i}(p_i, \theta_i)$	–	external demand for $i$ -th intermediate product,
$q_{i,j}$	–	quantity of $i$ -th intermediate product purchased by $j$ -th division, where $j=1..n$ ,
$g_i$	–	quantity of $i$ -th intermediate product,
$R_{i,j}(q_{i,j}, \theta_j)$	–	net-revenue of $i$ -th division.

The total profit of the firm can be expressed as follows:

$$\pi = \sum_{i=1}^n p_i \cdot Q_{e,i}(p_i, \theta_i) + \sum_{i=1}^n \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n c(\theta)_i \cdot \left( Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n q_{i,j} \right). \quad (10)$$

When taking transfer prices  $TP_i$  into account, the total profit of the firm can be divided among divisions as follows:

$$\begin{aligned} \pi_i = & p_i \cdot Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n TP_i \cdot q_{i,j} - c(\theta)_i \cdot \left( Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n q_{i,j} \right) + \\ & + \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n TP_i \cdot q_i. \end{aligned} \quad (11)$$

When we want to find optimal transfer prices  $TP_i$ , we would use the same approach which was described in previous paragraph. Heretofore I supposed non-existence of taxation. Under this assumption, we can say that the only way how to maximize the profit of the whole firm is to choose a proper mix of transfer prices.

Taxation belongs to the strongest motives for implementation transfer pricing within divisions of a firm. Due to this fact I develop a model which contains taxation. I suppose that each division of the firm has a seat in different country with different corporate tax rate. All other assumptions from previous part of the paper remain the same. The only new element used in further analysis is corporate tax rate  $t$ . The corporate tax rate for each division is  $t_i$ . Now I will analyse the situation of two divisions within a firm (each division has a seat in different country with different corporate tax rate). The profit of Sub1 after tax  $\pi_1^{\text{tax}}$  can be described as follows:

$$\pi_1^{\text{tax}} = (1 - t_1) \cdot [p \cdot Q_e(p, \theta) + TP \cdot q_i - c(\theta) \cdot (Q_e(p, \theta) + q_i)]. \quad (12)$$

The profit of Sub2 after tax  $\pi_2^{tax}$  can be described as follows:

$$\pi_2^{tax} = (1 - t_2) \cdot [R_i(q_i, \theta) - TP \cdot q_i]. \quad (13)$$

The total profit of the firm after tax  $\pi_1^{tax} + \pi_2^{tax}$  can be described as follows:

$$\begin{aligned} \pi^{tax} = & (t_2 - t_1) \cdot (TP \cdot q_i) + (1 - t_1) \cdot (p \cdot Q_e(p, \theta) - c(\theta) \cdot (Q_e(p, \theta) + q_i)) + \\ & + (1 - t_2) \cdot R_i(q_i, \theta). \end{aligned} \quad (14)$$

When generalising this approach for the  $n$  number of divisions, we can state:

$$\begin{aligned} \pi_i^{tax} = & (1 - t_i) \cdot \left[ p_i \cdot Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n TP_i \cdot q_{i,j} - c(\theta_i) \cdot \left( Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n q_{i,j} \right) \right] + \\ & + (1 - t_i) \cdot \left[ \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n TP_i \cdot q_i \right]. \end{aligned} \quad (15)$$

The total profit of the firm as a whole is:

$$\pi^{tax} = \sum_{i=1}^n \pi_i^{tax}. \quad (16)$$

### 3 Agency theory and transfer pricing

Jensen and Meckling (1976) published a theory of the firm concept based on conflicts of interest of different participating subjects. These subjects are specified as stockholders, managers and creditors. Jensen and Meckling define the agency relationship as a relationship where one or more persons (principals) hire a different person or persons (Agents) to manage their concerns, which means to delegate decision making rights to agents. If both principal and agents are individual utility maximizers, we can expect them to follow their self-interests which may not be identical. Jensen and Meckling states that the existence of agency costs is based on an incompatibility of individual interest of agents and principals. They distinguish the costs as follows:

1. monitoring costs,
2. bonding costs,
3. residual costs.

In this paper I will apply the agency theory on the transfer pricing problem. The primary aim of this paper is to analyze the possibilities how can controlling company motivate the management of subsidiary companies so that they act in the best interest of the controlling company. It can be stated that there must exist an optimal transfer pricing so that the profit of the concern is maximal:

$$\exists_{TD \in M} (\max \pi^{tax}). \quad (17)$$

$$\pi^{tax} = \sum_{i=1}^n \pi_i^{tax}. \quad (18)$$

$$\begin{aligned} \pi_i^{tax} = & (1-t_i) \cdot \left[ p_i \cdot Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n TP_i \cdot q_{i,j} - c(\theta_i) \cdot \left( Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n q_{i,j} \right) \right] + \\ & + (1-t_i) \cdot \left[ \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n TP_i \cdot q_i \right]. \end{aligned} \quad (19)$$

where  $M$  – a set of all possible transfer prices combinations.

### 3.1 Management motivation

The principals motivate agents to act in their best interest. Costs related to this activity can be called bonding costs. In the situation where agents bear the bonding costs, there is no argument that agents do their best to minimize these costs. Agents create systems which are to convince the principal that agents act in their best interest.

#### 3.1.1 Situation when the management of subsidiary firm is interested in the profit of the subsidiary firm

In this simple model I assume that the only motivational fact is the interest in the profit of subsidiary firm. Management will act to maximize the profit of managed firm. In other words, management will maximize its profit function with respect to the capacity restriction:

$$\begin{aligned} \pi_i^{tax} = & (1-t_i) \cdot \left[ p_i \cdot Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n TP_i \cdot q_{i,j} - c(\theta_i) \cdot \left( Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n q_{i,j} \right) \right] + \\ & + (1-t_i) \cdot \left[ \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n TP_i \cdot q_i \right]. \end{aligned} \quad (20)$$

$$Q_i(TP_i, \theta) + Q_{e,i}(p_i, \theta_i) = K_i. \quad (21)$$

This maximization is possible when the management will follow the following rules:

$$TP_i < p_i \Rightarrow \left[ \max Q_{e,i}(p_i, \theta_i) \wedge \min \sum_{j=1}^n TP_i \cdot q_{i,j} \right]. \quad (22)$$

$$TP_i > p_i \Rightarrow \left[ \min Q_{e,i}(p_i, \theta_i) \wedge \max \sum_{j=1}^n TP_i \cdot q_{i,j} \right]. \quad (23)$$

$$\min c(\theta_i). \quad (24)$$

$$\max \left[ \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n TP_i \cdot q_i \right]. \quad (25)$$

When the transfer price of intermediate product produced by  $i$ -th firm is lower than the market price of the intermediate product, the management will try to place all the production of the firm in the market. In other words, the management will do the best to avoid selling the production to concern firms. When the transfer price of intermediate product produced by  $i$ -th firm is higher than the market price of the intermediate product, the approach of the management will be reversed. The effort of the management, when maximizing the profit function, must be focused on minimizing the costs associated with the intermediate product. Finally, the management must strive to achieve the maximum revenue on the final product and to minimize the costs associated with intermediate product purchasing. Based on the model of perfect competition I suppose that the market price of  $i$ -th intermediate product is determined by the market. This implies that the management can only set the transfer price.

These four conditions abstract away from the need of satisfying the demand of concern firms primarily. When we incorporate this condition into the previous model, the four previous defined conditions will change as follows:

$$\max \left[ \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n TP_i \cdot q_i \right]. \quad (26)$$

We can see that the first two conditions from the previous model have been excluded. The firm, with the respect to its production capacity and to given internal demand for its intermediate product within the concern, loses the possibility to influence the amount of products sold to the market and to other concern firms.

When we suppose that the transfer pricing policy is set by parent company, the conditions for profit maximization changes as follows:

$$\max \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j). \quad (27)$$

When considering these conditions, we can see, that the only chance for the management for maximizing the profit is either to minimize the costs associated with the production or to maximize the revenue of the production sold to the external market.

### 3.2 Transfer Pricing Inefficiency

Now I will prove that the managerial motivational system based on the interest in profit level within the transfer pricing system cannot work. The condition  $\max \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j)$  must be observed when  $i$ -th concern firm wants to maximize its profit. From the previous paragraphs it is clear that  $j$ -th intermediate product producer offers its intermediate production to all other concern firms for the same price  $TD_j$ . In the case that the final product made of  $j$ -th intermediate product is profitable, all other concern companies will be interested in purchasing this intermediate product so that they could improve their own profitability. The production capacity of  $j$ -th company  $K_j$  is restricted. The question is how will the  $j$ -th intermediate product be distributed among concern firms? The transfer price is given, the demand exceeds the supply, so other mechanism than transfer pricing must be introduced. The costs associated with the inefficiency when using transfer pricing system can be called agency costs within the concern.

#### 3.2.1 Situation when the management of subsidiary firm is interested in the costs minimization of the subsidiary firm

In this simple model I assume that the only motivational fact is the interest in the costs minimization of subsidiary firm. Management will act to minimize the costs of managed firm. In other words, management will act with respect to condition (24).

This motivational structure can be easily realised, because the intermediate product costs are supposed to be fully under control of the management of each subsidiary firm. On the other hand, it is clear that management is not motivated to maximize the profit of subsidiary firm, so it can act in different than in an effective way. This disproportion can also give rise to agency costs.

#### 3.2.2 Situation when the management of subsidiary firm is interested in the profit of the firm as a whole

When management is motivated to act with the best respect to the firm as a whole, it must meet the following:

$$\pi^{tax} = \sum_{i=1}^n \pi_i^{tax}, \text{ where } \pi_i^{tax} \text{ represents:} \quad (17)$$

$$\begin{aligned} \pi_i^{tax} = & (1-t_i) \left[ p_i \cdot Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n TP_j \cdot q_{i,j} - c(\theta_i) \cdot \left( Q_{e,i}(p_i, \theta_i) + \sum_{j=1}^n q_{i,j} \right) \right] + \\ & + (1-t_i) \left( \sum_{j=1}^n R_{i,j}(q_{i,j}, \theta_j) - \sum_{i=1}^n TP_i \cdot q_i \right). \end{aligned} \quad (17)$$

From the presented relations it is clear that the profit of the firm as a whole is maximal when the sum of the profits of all subsidiary firms is maximal. The maximization of the sum of the profits does not necessarily mean the profit maximization of each subsidiary firm.

## **4 Conclusion**

Transfer pricing policy could be ineffective when the transfer prices are set by the parent firm. The situation, when transfer prices differ from market ones, leads to deformation of supply and demand. When the motivation of management of subsidiary firms is based on the profit of the subsidiary firms, a conflict of interests arises. The management of subsidiary firms cannot influence the prices of inputs and outputs which results in huge inconsistency of authority and responsibility.

## **References**

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## **Vztahy zastoupení a neefektivnost transferových cen**

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### **Abstrakt**

Proces tvorby a aplikace transferových cen je bezesporu velmi důležitou politikou v rámci nadnárodních korporací. V podmínkách globální ekonomiky se význam této politiky neustále zvyšuje. Nastává tak čím dál více situací, kdy je vhodné do strategií mezinárodních korporací implementovat politiku transferových cen. Mezinárodní mobilita kapitálu umožňuje mezinárodním korporacím snáze alokovat zdroje mezi své pobočky tak, aby tato alokace primárně zohledňovala daňové politiky jednotlivých států. Není snadné studovat politiku transferových cen, protože tato patří mezi nejlépe chráněné know-how jednotlivých korporací a úzce též souvisí se vztahy zastoupení. V tomto článku je prezentována možná neefektivnost transferových cen z pohledu teorie zastoupení.

**Klíčová slova:** transferové ceny; teorie zastoupení; mezinárodní korporace; daňová politika.

## **Agency Relationship and Transfer Pricing Inefficiency**

### **Abstract**

Transfer pricing policy is a very important activity within multinational firms. The importance of this policy has been increasing since the time of globalization has come. There are many reasons for implementing such a policy. The international capital mobility allows multinational firms to allocate capital among their subsidiaries mainly due to savings connected to the taxation policies of individual states. It is not easy to study transfer pricing because it belongs to best guarded know-how of each firm. In this article I will show possible inefficiencies of transfer pricing using an agency theory point of view.

**Key words:** transfer pricing; agency theory; multinational firm; taxation policy.

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