Negotiated Transfer Pricing  
in a Team-Investment Setting

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Abstract. We consider a team-investment setting, in which transfer prices between two divisions are negotiable. Investments are made independently and simultaneously after the bargaining stage, i.e., with a given transfer price “on the table”. Both divisions’ investments jointly affect the sales volume of the final product and hence total revenue. The bargaining problem over transfer prices is shaped by equilibrium profits in these investment games. We analyze cost- and revenue-based transfer pricing schemes and their corresponding bargaining problems. Moreover, we discuss how concepts from bargaining theory are used to select a transfer pricing scheme and the transfer price. Finally, we demonstrate, how supplementary lump-sum payments among the divisions may solve well-known problems of inefficiency.

Keywords: Transfer pricing, specific investment, incomplete contracts, negotiation, revenue sharing

JEL Classification: M40, C78, L22

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1 Introduction

In decentralized firms central management partly delegates decision competence to the divisional level in order to cope with the complexity of decisions, to motivate the divisional managements, or to benefit from superior knowledge on the part of the division managers. However, delegation naturally calls for the coordination of decisions which is a major concern of managerial accounting. A prominent case is given by vertically integrated firms, in which the decisions pertaining to the production and marketing of a good are split between at least two divisions.

In this setting, transfer pricing is a widespread and much discussed instrument in the attempt of inducing goal congruence, i.e., to provide incentives for the division managers to act in the firm’s interest. Such a transfer pricing system is typically nested in a profit or investment center organization and influences the decentralized decisions by pricing intrafirm transfers of goods and services.\(^1\) The basic idea behind the pricing of transfers is to influence the decentralized decisions via a manipulation of the costs of the purchasing division and the revenues of the selling division in such a way that optimally divisional profit maximization coincides with corporate profit maximization. However, inducing goal congruence between central and divisional management is not a trivial task, because the divisional managers typically are better informed than central management and (by virtue of the organizational form) self-interested. Consequently, divisional managers generically seek to maximize divisional profit at the expense of other divisions and ultimately of the firm. In addition, central management has to respect limitations on the elements that can be included in a transfer pricing scheme due to issues of limited observability and verifiability.\(^2\)

We make use of the following transfer pricing terms. A transfer price is the actual value at which a transfer is priced. A transfer pricing scheme is the (mathematical) function used to calculate the transfer price. A transfer pricing system consists of the whole set of rules, such as the delegation of decision rights or the transfer pricing scheme to employ, associated with the pricing of transfers.

Recent literature on transfer pricing roughly falls into two strands: There are several works that analyze the above problem from the point of view of mechanism design. For

\(^1\)Cf. Zimmerman (2000, pp. 182–196) for a characterization of responsibility centers. A physical exchange of goods and services is not a prerequisite to transfer pricing, so that transfer pricing is also common for functional organizations. Cf. Anthony & Govindarajan (2000, pp. 65–71) for different types of organizations.

\(^2\)This aspect is intimately linked to the concept of incomplete contracts. See Tirole (1999) for an introduction to the topic and a review of related literature.
example, Hart & Moore (1988), Chung (1991), MacLeod & Malcomson (1993), Aghion, Dewatripont & Rey (1994), Edlin & Reichelstein (1995, 1996), Nöldeke & Schmidt (1995), Che & Hausch (1999), Wielenberg (2000), and Böckem & Schiller (2004) deal with (non-)existence and design of an optimal transfer pricing system. In these models, first best investments and trade decisions are typically achieved by making transfers contingent on a minimum or fixed quantity and then relying on a revision of the initial contract.\(^3\) Yet, they are rarely found in business practice of intrafirm transactions.\(^4\)

Papers of the second strand explore the performance of a given set of alternative transfer pricing systems. Following Lengsfeld & Schiller (2003, p. 5) this may be called the comparative analysis approach. The systems under consideration typically do not induce first-best results but try to reflect business practice. The typical procedure is to juxtapose two or more transfer pricing systems or schemes and to determine the circumstances under which one system or scheme dominates another with respect to corporate profit. For research along this line we refer to Baldenius, Reichelstein & Sahay (1999), Pfeiffer (2002), Chwolka & Simons (2003), Lengsfeld & Schiller (2003), and Sahay (2003).\(^5\) However, in these models the final decision on the specification of the transfer pricing system is taken by central management.

The idea in our paper is to analyze the scenario, in which the decision on the transfer pricing scheme as well as on the actual transfer price is completely left to the divisions. To be precise, the two divisions may first agree on the transfer pricing scheme. Here, we compare a market based and a revenue-based scheme. Then the actual transfer price is negotiated. To model this bargaining problem, we use techniques from bargaining theory. Having reached an agreement, both divisions simultaneously make uncontractible investments, which have an effect on the sales volume of the final good and therefore on total revenues.

For the analysis in the paper, we move backwards. Simultaneous investments that are not contractible clearly call for coordination. Therefore, we ask for equilibria of an investment game, which in turn determine the structure of the preceding bargaining problem. There, we present and discuss the bargaining solutions introduced by Nash

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\(^3\)For instance, the option contract proposed by Nöldeke & Schmidt (1995) gives the seller the right to deliver a fixed quantity and makes the buyer’s contractual payment contingent on the seller’s delivery decision.

\(^4\)Cf. Baldenius, Reichelstein & Sahay (1999, p. 68) and Lengsfeld & Schiller (2003, p. 5). The assertion can also be inferred from empirical studies which do not explicitly include such mechanisms as methods of transfer pricing. See Horngren, Datar & Foster (2003, p. 767) for an international survey of empirical studies on the use of transfer pricing methods.

\(^5\)See also Wagenhofer (1994), Heavner (1999), and Baldenius (2000) for models with asymmetric information among the divisions.
(1950, 1953) and Kalai & Smorodinsky (1975). That means, for a given scheme, we characterize “fair” transfer prices, where fairness is subject to the given bargaining solution. It turns out that extensions of the two solutions also provide a tool for the divisions to take a decision on which transfer pricing scheme to choose. Finally, we discuss the effects of allowing for lump-sum payments among the divisions. Although such two-step transfer prices are not common in business practice, the possibility of a quantity-independent payment ensures that the divisions agree on the system maximizing corporate profit. That means, given our team investment setting with negotiation, central management can hand over decision responsibilities without bearing inefficiencies. To the best of our knowledge, this is the first paper that deals with a team investment setting in connection with fully negotiated transfer pricing systems.

The paper is organized as follows. The next section introduces and motivates the model. In Section 3 we derive the incentives for divisional decisions for a given transfer price and determine the associated profits in equilibrium. Section 4 analyzes the bargaining problem specifying the transfer pricing system and their impact on corporate profit. The last section concludes.

2 The model

We consider interactions between two divisions, denoted by $D_i$, $i \in \{1, 2\}$, of a decentralized firm being organized as profit or investment centers. The upstream division $D1$ produces an intermediate good that is transferred to the downstream division $D2$ which further processes and sells it as a final product to an external market.\footnote{For ease of presentation, let the traded quantities be normalized such that one unit of the internally transferred product corresponds to one unit of the final product.} We assume that $D2$ acts like a monopolist on this market. Let $q$ denote the corresponding demand function depending on the sales price $p > 0$ which is set by division 2 and on upfront investments determined and realized by both divisions before production and trade take place. The level of each division’s investment is given by its costs $I_i \geq 0$ incurred by division $i$. In the following we will make extensive use of a multiplicative form of the demand function,

$$q(I_1, I_2, p) := \frac{I_1^{d_1} \cdot I_2^{d_2}}{p^b},$$

where the parameters $b > 1$ and $d_i > 0$, with $d_1 + d_2 < 1$, reflect the constant elasticities of demand with respect to the sales price and the divisional investments, respectively. The positive effect of the investments on the sales volume may be motivated along two
interrelated lines. Firstly, the investments may be identified with marketing activities relating to a specified product. While it is straight forward in this context to think of promotional and distributional activities of the downstream division, we may also think that the producer of the intermediate product engages in promotional efforts. For example, Vibram has built up a reputation for high quality shoe soles among consumers so that manufacturers using soles of this brand on their products are likely to have a higher demand than otherwise. Secondly, the investments may be part of a differentiation strategy directed at improving the quality of the product by enhancing its ability to meet customers’ expectations. Apart from obvious product attributes such as performance, reliability, or esthetics, quality comprises in particular the availability of the product so that the investments can be interpreted as the building-up or dedication of production capacity which, in turn, causes shorter lead times. The multiplicative connection of divisional investments reflects a setting of team production as described by Alchian & Demsetz (1972) implying that investments depend on each other as to their effect on demand.

Once investments have been determined, both divisions make use of a linear production technology characterized by constant variable unit costs $v_i \geq 0$. For analytical tractability the production costs are assumed to be independent of the investments.

Given this setting, the central management, hereafter HQ, seeks to coordinate the interrelated decisions concerning the investments $I_i$ and the sales price $p$. This is not a trivial task, since the investments are assumed unverifiable, i.e., it is inefficient to quantify the investment costs $I_i$ or to prescribe and control the actual investment activities these costs are incurred for. Additionally, the demand parameters $b$ and $d_i$ are unobservable to HQ. Unverifiability of investment costs can be justified by the following arguments. Each division may produce and trade several products and thus engages in more than one investment. At the same time, one often observes that divisions dispose of limited financial, physical, and human resources due to budgetary restrictions imposed by HQ or procurement restrictions imposed by external markets. Consequently, the first argument is linked to an insufficiency of the firm’s accounting system which may neither be designed nor possibly be capable of matching the expenses recorded by the financial accounting system with the corresponding investments and products in the managerial accounting system. Reasons for this insufficiency are given by the decentralization of the firm, the existence of indirect costs, and the fact, that tracing the costs of the investments as characterized above calls for a highly sophisticated accounting system.

system. Note that an investment as described above may not even be classified as a “proper” investment by the accounting system in place due to its operative character or its relatively small financial impact. The second argument is that investment costs should comprise opportunity costs in order to reflect the divisions’ limited resources. Lastly, the attempt to derive each division’s investment level from realized demand $q(\cdot)$ is impossible due to the team-investment setting. The idea of the first and the last of the foregoing arguments can easily be adjusted to explain the unverifiability of the actual investment activities. Unobservability of the parameters of the demand function reflects the informational asymmetry between HQ and the divisions. Nevertheless, note that we require that the divisions have complete information about the relevant data, i.e., they both know the function $q$ and its parameters.

In order to coordinate the decentralized decisions, HQ implements a transfer pricing system in which an amount of $t_j \cdot q(\cdot)$ is charged to $D2$’s and credited to $D1$’s profit account. The index $j \in \{C, R\}$ refers to a cost-based, $j = C$, or a revenue-based, $j = R$, transfer pricing scheme, which are both analyzed in the paper. Thus, the payment is a one-step transfer price consisting of a constant payment per sales unit, $t_j \in \mathbb{R}$. In Section 4.5 we also admit an additional lump sum $\lambda_j \in \mathbb{R}$ being transferred from $D2$ to $D1$. Although two-step transfer prices are rarely used in company practice, we analyze this extension of the transfer pricing system to show that two-step transfer prices possess a strong potential to improve the coordination of the divisions. For the time being, we proceed on the assumption $\lambda_j = 0$.

Scheme $C$ exclusively relies on the sales volume $q(\cdot)$ by setting the transfer price per unit to a constant $\tau_C$, i.e., $t_C := \tau_C \geq 0$. Additional to the sales volume, scheme $R$ bases the transfer price on the sales price of the final product and transfers a share of $100 \cdot \tau_R$ percent of the sales price $p$ to $D1$, i.e., $t_R := \tau_R \cdot p$, $\tau_R \in [0, 1]$. With a slightly

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8This problem would intensify if we allowed for stochastic demand. Following this idea, $q(\cdot)$ could easily be interpreted as expected rather than realized demand.


10Tang (1993, p. 71) reports that out of a sample of 143 Fortune-500 companies approximately 99% of the firms employing transfer prices use one-step transfer prices to account for domestic or international transfers.

11The label cost-based is used since relevant values of $\tau_C$ are readily interpreted as the unit cost $v_1$ plus a markup.

12Scheme $R$ may also be called market-based since the transfer price is derived from data of an external
incorrect use of notions, we also refer to $\tau_R$ (instead of $t_R$) as a transfer price.

Obviously, this kind of transfer pricing is identical to a classical revenue sharing scheme. Note that the considered schemes $C$ and $R$ demand for minimal information because they exclusively rely on the sales volume and sales price of the final product. Neglecting problems related to the allocation of revenues to products that might arise if the sales price is set for a bundle of goods rather than for each product separately both variables are easily extracted from the financial accounting records so that no problems are encountered as to the contractibility of the proposed schemes. Figure 1 summarizes the structure of the firm and the associated flows of payments and goods.

![Figure 1: Structure of the firm](image)

On the basis of the transfer payment $t_j \cdot q(\cdot)$, $j \in \{C, R\}$, it is straightforward to define the profit functions $\hat{P}_{i,j}$ of division $i \in \{1, 2\}$ as

\[
\begin{align*}
\hat{P}_{1,C}(\tau_C, I_1, I_2, p) & := (\tau_C - v_1) \cdot q(I_1, I_2, p) - I_1, \\
\hat{P}_{2,C}(\tau_C, I_1, I_2, p) & := (p - (\tau_C + v_2)) \cdot q(I_1, I_2, p) - I_2, \\
\hat{P}_{1,R}(\tau_R, I_1, I_2, p) & := (\tau_R \cdot p - v_1) \cdot q(I_1, I_2, p) - I_1, \\
\hat{P}_{2,R}(\tau_R, I_1, I_2, p) & := (p - (\tau_R \cdot p + v_2)) \cdot q(I_1, I_2, p) - I_2.
\end{align*}
\]

Let the index $i = 0$ apply to $HQ$. Then the corporate profit $\hat{P}_0(\cdot)$ is given by the sum of divisional profits and does only depend on the investments and the sales price, i.e.,

\[
\hat{P}_0(I_1, I_2, p) := \sum_{i=1}^{2} \hat{P}_{i,C}(\tau_C, I_1, I_2, p) = \sum_{i=1}^{2} \hat{P}_{i,R}(\tau_R, I_1, I_2, p) = (p - (v_1 + v_2)) \cdot q(I_1, I_2, p) - (I_1 + I_2).
\]

Note that this designation is not standard since usually the market in question is that of the intermediate instead of the final product.
Since the divisions are organized as profit or investment centers, each party, i.e., HQ, D1, and D2 pursues to maximize its respective profit function.\footnote{Given a balanced transfer pricing system, the assumption that HQ maximizes the sum of divisional profits is established in the transfer pricing literature. However, the validity of this assumption requires that HQ is indifferent as to the allocation of profit and might be unwarranted with regard to differential divisional compensations or, in the case of legally independent divisions, less than fully owned subsidiaries or differential taxation.}

Figure 2 illustrates the timing in our model. At date 1 the transfer pricing scheme \( j \in \{C, R\} \) is determined. At date 2 the divisions negotiate the transfer price, i.e., they agree on the parameters \( \tau_j \), which are recorded by the firm’s accounting system. Given the fully specified transfer pricing system, the divisions simultaneously determine their investments at time 3. Then, D2 sets the sales price at time 4. Finally, the good is produced and traded. Additionally, HQ calculates the profits of the divisions and compensates their managers.

<table>
<thead>
<tr>
<th>Time</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Divisions negotiate transfer price ( \tau_j ).</td>
</tr>
<tr>
<td>2</td>
<td>Divisions make investments ( I_1 ) and ( I_2 ).</td>
</tr>
<tr>
<td>3</td>
<td>Division 2 sets sales price ( p ).</td>
</tr>
<tr>
<td>4</td>
<td>Production, sales, and accounting</td>
</tr>
</tbody>
</table>

\[ \text{Figure 2: Time line} \]

3 Divisional decisions and profits

In this section we derive the coordinative effects induced by the different transfer pricing schemes. That means, we determine both divisions’ investments at date 3 and D2’s pricing decision at date 4. We do this for a given transfer pricing scheme \( j \) and transfer price \( \tau_j \), which have been determined at dates 1 and 2. Anticipating D2’s decision on the sales price, both divisions have to invest simultaneously at time 3 and thus face a non-cooperative, simultaneous-move game. The payoffs in this game solely depend on the divisions’ investments. We ask for Nash equilibria of the game at time 3. In effect, viewing the decision problems at time 3 and 4 as a game in extensive form, we compute its subgame-perfect equilibria. The section concludes with a characterization of the equilibrium profit functions as they apply at date 3.
In order to assess distortions that are associated with the different transfer pricing schemes, Proposition 1 shows the first-best solution, i.e., the investment and pricing decisions that HQ would make if there were no informational asymmetries.

Proposition 1. The first-best sales price \( p_{FB} \) and investments \( I_{i,FB}(p) \) for \( p \geq (v_1 + v_2) \) and \( i \in \{1, 2\} \) read

\[
p_{FB} = \frac{b}{b-1} \cdot (v_1 + v_2), \tag{2}
\]
\[
I_{i,FB}(p) = \left( \frac{p - (v_1 + v_2)}{p^b} \cdot d_i^{d_3-d_i} \cdot d_{3-i}^{d_3-i} \right)^{1/(d_1-d_2)}. \tag{3}
\]

Proof. The first-best solution maximizes \( \tilde{P}_0(I_1, I_2, p) \) as given in (1) with respect to \( I_1, I_2, \) and \( p \). The first-order partial derivatives are

\[
\frac{\partial \tilde{P}_0}{\partial p}(I_1, I_2, p) = I_1^{d_1} \cdot I_2^{d_2} \cdot \frac{b \cdot (v_1 + v_2) - (b - 1) \cdot p}{p^{b+1}},
\]
\[
\frac{\partial \tilde{P}_0}{\partial I_i}(I_1, I_2, p) = d_i \cdot \frac{p - (v_1 + v_2)}{p^b} \cdot I_i^{d_i-1} \cdot I_{3-i}^{d_3-i} - 1, \quad i \in \{1, 2\}.
\]

Their unique stationary points are given by (2) and (3). Sufficiency of the first-order conditions is warranted by the conditions imposed on the parameters \( b \) and \( d_i \).\footnote{In the following most of the first order and none of the second order conditions corresponding to the various optimization problems are carried out explicitly. Using standard argumentation on concavity, it is easily seen that all given solutions are global optimizers.}

The first-best sales price \( p_{FB} \) is the Cournot price and can be interpreted as the variable unit production costs \( v_1 + v_2 \) plus a markup of \( 100/(b-1) \) percent. As an artefact of the multiplicative demand function, the optimal sales price does not depend on the investments. However, the decisions on the investments and the sales price cannot be decoupled, because the investment decisions depend on the sales price.

3.1 Divisional decisions under scheme C

In contrast to the first best solution, D2’s pricing decision under the cost-based transfer pricing scheme C is based on a distorted contribution margin \( p - (\tau_C + v_2) \), which is not directly linked to D1’s variable unit costs \( v_1 \). The maximization problem reads

\[
\tilde{P}_2,C(\tau_C, I_1, I_2, p) = (p - (\tau_C + v_2)) \cdot \frac{I_1^{d_1} \cdot I_2^{d_2}}{p^b} - I_2 \rightarrow \max!.
\]

Let \( p_{C}(\tau_C) \) denote the corresponding maximizer, which is –like in the first-best case— independent of the investment levels. At date 3, the divisions make their investment decisions under scheme C.
decisions anticipating the sales price \( p_C(\tau_C) > (\tau_C + v_2) \). For a given transfer price \( \tau_C \) the game in normal form, \( \Gamma^{C,\tau_C} \), is given by

\[
\Gamma^{C,\tau_C} := \left( S_1, S_2, \tilde{P}_{1,C}(\tau_C, \cdot, p_C(\tau_C)), \tilde{P}_{2,C}(\tau_C, \cdot, p_C(\tau_C)) \right)
\]

with strategy sets \( S_1 = S_2 = \mathbb{R}_+ \) and payoff functions that depend on both investments. One immediately checks that zero investments are a Nash equilibrium in each game \( \Gamma^{C,\tau_C} \), which results in zero profits as there is no demand. However, using the structure of the payoffs and provided that the transfer price exceeds \( D1 \)'s variable unit costs, \( \tau_C > \tau_C := v_1 \), this equilibrium is always payoff dominated by one, in which positive investments occur. More precisely, there is exactly one equilibrium with positive investments. Proposition 2 summarizes the equilibrium decisions.

**Proposition 2.** Under scheme \( C \) and transfer prices \( \tau_C > \tau_C := v_1 \), the optimal sales price \( p_C(\tau_C) \) and unique positive equilibrium investments \( I_{i,C}(\tau_C) \), \( i \in \{1, 2\} \), are

\[
p_C(\tau_C) = \frac{b}{b-1}.(\tau_C + v_2), \tag{4}
\]

\[
I_{1,C}(\tau_C) = \left( d_1^{1-d_2} \cdot (\tau_C - v_1)^{1-d_2} \cdot \frac{(p_C(\tau_C) - (\tau_C + v_2))^{d_2}}{p_C(\tau_C)^b} \right)^{\frac{1}{1-d_1-d_2}},
\]

\[
I_{2,C}(\tau_C) = \left( d_1^{d_1} \cdot (\tau_C - v_1)^{d_1} \cdot \frac{(p_C(\tau_C) - (\tau_C + v_2))^{1-d_1}}{p_C(\tau_C)^b} \right)^{\frac{1}{1-d_1-d_2}}.
\]

**Proof.** For positive investments the unique maximizer in (3.1) is given by (4). Anticipating the sales price \( p_C(\tau_C) \), the partial derivatives of \( \tilde{P}_{1,C} \) and \( \tilde{P}_{2,C} \) with respect to the investments are

\[
\frac{\partial \tilde{P}_{1,C}}{\partial I_1}(\tau_C, I_1, I_2, p_C(\tau_C)) = d_1 \cdot \frac{\tau_C - v_1}{p_C(\tau_C)^b} \cdot I_1^{d_1-1} \cdot I_2^{d_2-1} - 1,
\]

\[
\frac{\partial \tilde{P}_{2,C}}{\partial I_2}(\tau_C, I_1, I_2, p_C(\tau_C)) = d_2 \cdot \frac{p_C(\tau_C) - (\tau_C + v_2)}{p_C(\tau_C)^b} \cdot I_1^{d_1} \cdot I_2^{d_2-1} - 1.
\]

Provided that \( \tau_C > v_1 \) holds, the unique solution to these conditions are \( I_{i,C}(\tau_C) > 0 \), \( i \in \{1, 2\} \).

Note that both investments, and hence corporate profit, tend to zero as the transfer price \( \tau_C \) tends to \( v_1 \). Primarily, it is \( D1 \)'s investment decision that causes this effect: For any transfer price not exceeding its variable unit costs, \( D1 \) covers at most its production costs making any trade and therefore any trade enhancing investment unprofitable.

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\[16\] This is basically due to the strict concavity of the payoff functions.
Due to the team-investment setting this effect carries over to $D2$. Consequently, with divisional investments prior to the actual trade between the divisions the classical result that –in the absence of an external market for the intermediate product– transfers have to be priced at marginal costs in order to maximize corporate profit looses its validity.\textsuperscript{17} Furthermore, it is interesting to juxtapose the decisions under scheme $C$ and the first-best solution in order to assess the distortions implied by decentralization.

**Corollary 1.** We have the following relations for $\tau_C > \tau_C$: 
\begin{align*}
    p_C(\tau_C) &> p_{FB}, \\
    I_i,C(\tau_C) &< I_{i,FB}(p_C(\tau_C)) < I_{i,FB}(p_{FB}), \ i \in \{1, 2\}.
\end{align*}

*Proof.\* The first two relations result from a straight comparison of the corresponding terms. The third relation holds true because in view of (3) $p_{FB}$ maximizes $I_{i,FB}(p), \ i \in \{1, 2\}$.

According to (5), scheme $C$ induces an upward distortion of the sales price. This is because $D2$ is necessarily charged with more than the total variable unit production costs $v_1 + v_2$. The first relation of (6) shows that there is an underinvestment problem independent of the sales price distortion $p_C(\tau_C) > p_{FB}$. This problem arises from the fact that each division bears the full costs of its investment while sharing the generated revenues with the other division.\textsuperscript{18} The consideration of the sales price differential aggravates the underinvestment problem as shown in the last inequality in (6).

### 3.2 Divisional decisions under scheme $R$

Under the revenue-based transfer pricing scheme, $D2$ chooses the sales price that maximizes its divisional profit $\tilde{P}_{2,R}(\cdot)$ according to 
\[
    \tilde{P}_{2,R}(\tau_R, I_1, I_2, p) = \left((1 - \tau_R) \cdot p - v_2\right) \cdot \frac{I_1^{d_1} \cdot I_2^{d_2}}{p^b} - I_2 \rightarrow \max_p
\]
yielding $p_R(\tau_R)$ as its optimal decision. Again, at time 3, the divisions make their investment decisions based on a given transfer price $\tau_R$ and anticipating the sales price $p_R(\tau_R) > v_2/(1 - \tau_R)$. As in Section 3.1, this defines a simultaneous-move game $\Gamma^{R,\tau_R}$ with zero investments as a payoff-dominated equilibrium. Proposition 3 –as an analogue of Proposition 2– specifies the payoff-efficient equilibrium decisions for scheme $R$.

\textsuperscript{17}Cf. Schmalenbach (1909) or Hirshleifer (1956).
\textsuperscript{18}This underinvestment problem is well known and goes back at least to Schmalenbach (1909) or Williamson (1985).
Proposition 3. Under scheme $R$ and transfer prices $\tau_R \in (\bar{\tau}_R, 1)$ with
\[
\bar{\tau}_R := \frac{(b - 1) \cdot v_1}{(b - 1) \cdot v_1 + b \cdot v_2},
\]
the optimal sales price $p_R(\tau_R)$ and unique positive equilibrium investments $I_{i,R}(\tau_R), i \in \{1, 2\}$, are
\[
p_R(\tau_R) = \frac{b}{(b - 1) \cdot (1 - \tau_R)} \cdot v_2, \quad (7)
\]
\[
I_{1,R}(\tau_R) = \left( \frac{d_1^{1-d_2} \cdot d_2^{d_2} \cdot (\tau_R \cdot p_R(\tau_R) - v_1)^{1-d_2} \cdot ((1 - \tau_R) \cdot p_R(\tau_R) - v_2)^{d_2}}{p_R(\tau_R)^b} \right)^{\frac{1}{1-d_1-d_2}}, \quad (8)
\]
\[
I_{2,R}(\tau_R) = \left( \frac{d_1^{d_1} \cdot d_2^{1-d_1} (\tau_R \cdot p_R(\tau_R) - v_1)^{d_1} \cdot ((1 - \tau_R) \cdot p_R(\tau_R) - v_2)^{1-d_1}}{p_R(\tau_R)^b} \right)^{\frac{1}{1-d_1-d_2}}. \quad (9)
\]

Proof. The proof is analogous to that of Proposition 2. We only give the partial derivatives with respect to the investments:
\[
\frac{\partial \tilde{P}_{1,R}}{\partial I_1}(\tau_R, I_1, I_2, p_R(\tau_R)) = d_1 \cdot \frac{\tau_R \cdot p_R(\tau_R) - v_1}{p_R(\tau_R)^b} \cdot I_1^{d_1} \cdot I_2^{d_2} - 1,
\]
\[
\frac{\partial \tilde{P}_{2,R}}{\partial I_2}(\tau_R, I_1, I_2, p_R(\tau_R)) = d_2 \cdot \frac{(1 - \tau_R) \cdot p_R(\tau_R) - v_2}{p_R(\tau_R)^b} \cdot I_1^{d_1} \cdot I_2^{d_2-1} - 1.
\]
The lower bound on the transfer price, $\bar{\tau}_R$, is equivalent to the condition $\tau_R \cdot p_R(\tau_R) > v_1$ which must hold in order to provide an investment incentive to $D1$. \hfill \Box

Inspection of (7) reveals that $D2$’s share of the optimal sales price always exceeds its variable unit costs, i.e., $(1 - \tau_R) \cdot p_R(\tau_R) > v_2$. At the same time, the range of relevant transfer prices $\tau_R$ is bounded from below by $\bar{\tau}_R$ because $D1$ will invest, only if its revenues exceed its variable production costs, i.e., $\tau_R \cdot p_R(\tau_R) > v_1$. These two inequalities imply that the sales price under scheme $R$ exceeds the total variable costs per unit, i.e., $p_R(\tau_R) > v_1 + v_2$. However, for sufficiently small sharing parameters $\tau_R \in (\bar{\tau}_R, \frac{v_1}{v_1 + v_2})$ the markup on total variable costs falls short of the first-best markup defined in (2). Hence, contrary to scheme $C$ the sales price may be distorted in either direction under scheme $R$. Corollary 2 formalizes this result and further confirms an underinvestment problem which is analogous to the one under scheme $C$.

Corollary 2. We have the following relations for $\tau_R \in (\bar{\tau}_R, 1)$:
\[
p_R(\tau_R) \geq p_{FB}, \quad \text{if and only if} \quad \tau_R \leq \frac{v_1}{v_1 + v_2}. \quad (9)
\]
\[
I_{i,R}(\tau_R) < I_{i,FB}(p_R(\tau_R)) \leq I_{i,FB}(p_{FB}), \quad i \in \{1, 2\}. \quad (10)
\]

Proof. Use Proposition 3 and the strict monotonicity of $p_R$ to derive (9). The proof of (10) is analogous to that in Corollary 1. \hfill \Box
3.3 Divisional and corporate profits in equilibrium

The foregoing analysis shows that both schemes $C$ and $R$ have qualitatively similar effects on the divisional decisions as both of them induce a situation of bilateral underinvestment and distortion of the sales price. To analyze the choice of the transfer pricing scheme $j \in \{C, R\}$ and the actual transfer price $\tau_j$ it is necessary to quantify their effects on divisional profits.

For scheme $j \in \{C, R\}$, let $P_{i,j} : D_j \to \mathbb{R}_+$ denote the profit function of party $i \in \{0, 1, 2\}$ that maps a transfer price $\tau_j$ to the resulting profit in the unique equilibrium with positive investments of $\Gamma^{j,\tau_j}$, where $D_C := (\mathbb{R}_+, \infty)$ and $D_R := (\mathbb{R}_+, 1)$ are the respective domains of the profit functions $P_{i,j}$. Hence,

$$
P_{i,j}(\tau_j) := \tilde{P}_{i,j}(\tau_j, I_{i,j}(\tau_j), I_{2,j}(\tau_j), p_j(\tau_j)), \quad i \in \{1, 2\},
$$

$$
P_0,j(\tau_j) := P_{1,j}(\tau_j) + P_{2,j}(\tau_j).
$$

Proposition 4 computes the corresponding expressions of the profit functions $P_{i,j}$.

**Proposition 4.** The equilibrium divisional profit functions $P_{i,j}$, $i \in \{1, 2\}$, $j \in \{C, R\}$, are given by

$$
P_{1,C}(\tau_C) = k_1 \cdot \left( \frac{(b - 1)^{1-d_2} \cdot (\tau_C - v_1)^{1-d_2}}{(\tau_C + v_2)^{b-d_2}} \right)^{1-d_1-d_2} > 0,
$$

$$
P_{2,C}(\tau_C) = k_2 \cdot \left( \frac{(b - 1)^{d_1} \cdot (\tau_C - v_1)^{d_1}}{(\tau_C + v_2)^{b+d_1-1}} \right)^{1-d_1-d_2} > 0
$$

for scheme $C$ and by

$$
P_{1,R}(\tau_R) = k_1 \cdot \left( \frac{(1-\tau_R)^{b+d_2-1} \cdot ((b - 1) \cdot v_1 + b \cdot v_2) \cdot (\tau_R - \tau_R)}{v_2^{b-d_2}} \right)^{1-d_1-d_2} > 0,
$$

$$
P_{2,R}(\tau_R) = k_2 \cdot \left( \frac{(1-\tau_R)^{b-d_1} \cdot ((b - 1) \cdot v_1 + b \cdot v_2) \cdot (\tau_R - \tau_R)}{v_2^{b+d_1-1}} \right)^{1-d_1-d_2} > 0
$$

for scheme $R$, where $k_i, i \in \{1, 2\}$, is a positive constant defined as

$$
k_i := \left( \frac{(b - 1)^{b-1}}{b^b} \right)^{\frac{1}{1-d_1-d_2}} \cdot \frac{d_3}{d_1^{1-d_1-d_2}} \cdot \left( \frac{d_1}{d_3^{1-d_1-d_2}} - d_1^{1-d_1-d_2} \right).
$$

We omit the proof as it merely consists of straightforward computations.

Figure 3 depicts the profit functions $P_{i,j}$ for a parameter setting inducing (approximately) the same maximal corporate profit for both schemes.\(^{19}\) Additionally, the figure

---

\(^{19}\)The parameter setting is $b = 2$, $d_1 = d_2 = 0.25$, $v_1 = 0.0747$, and $v_2 = 0.01$. Both maximal corporate profits, $P_{b,C}(\tau_{0,C})$ and $P_{b,R}(\tau_{0,R})$, approximately amount to 0.5747.
Lemma 1. The divisional profit functions $\tau_j$, $i \in \{0, 1, 2\}$, $j \in \{C, R\}$, which are defined by

$$\tau_j^i := \arg\max_{\tau_j \in D_j} P_{i,j}(\tau_j).$$

Lemma 1 shows some important properties of the divisional profit functions $P_{i,j}$.

**Figure 3: Profit functions $P_{i,j}$**

**Lemma 1.** The divisional profit functions $P_{i,j}$, $i \in \{1, 2\}$, $j \in \{C, R\}$, exhibit the following properties:

1. Each $P_{i,j}$ is strictly quasi-concave and has a unique maximizer $\tau_j^1 \in D_j$.

2. For the maximizers of $P_{1,j}$ and $P_{2,j}$ the order $\tau_j^2 < \tau_j^1$ holds.

3. For $\tau_j \in (\tau_j^2, \tau_j^1)$, the profit functions $P_{1,j}$ and $P_{2,j}$ satisfy

$$(-1)^i \cdot \left( \frac{P_{i,j}(\tau_j)}{P_{3-i,j}(\tau_j)} \right)' < 0.$$  

**(Proof.** Strict quasi-concavity of $P_{i,j}$ is immediately checked by derivation. We have

$$P_{1,C}(\tau_C) \nLeftarrow 0 \iff \tau_C \nLeftarrow \frac{(b - d_2) \cdot v_1 + (1 - d_2) \cdot v_2}{b - 1} = \tau_C + \frac{1 - d_2}{b - 1} \cdot (v_1 + v_2),$$

$$P_{2,C}(\tau_C) \nLeftarrow 0 \iff \tau_C \nLeftarrow \frac{(b + d_1 - 1) \cdot v_1 + d_1 \cdot v_2}{b - 1} = \tau_C + \frac{d_1}{b - 1} \cdot (v_1 + v_2),$$

$$P_{1,R}(\tau_R) \nLeftarrow 0 \iff \tau_R \nLeftarrow \frac{(b - 1) \cdot v_1 + (1 - d_2) \cdot v_2}{(b - 1) \cdot v_1 + b \cdot v_2} = \tau_R + \frac{(1 - d_2) \cdot v_2}{(b - 1) \cdot v_1 + b \cdot v_2},$$

$$P_{2,R}(\tau_R) \nLeftarrow 0 \iff \tau_R \nLeftarrow \frac{(b - 1) \cdot v_1 + d_1 \cdot v_2}{(b - 1) \cdot v_1 + b \cdot v_2} = \tau_R + \frac{d_1 \cdot v_2}{(b - 1) \cdot v_1 + b \cdot v_2}.$$
The unique stationary point of $P'_{i,j}$ is $\tau^i_j$ and is given by the corresponding expression of (18)–(21). Since we assume $d_i > 0$ and $d_1 + d_2 < 1$, the order of the maximizers can readily be checked. As all profit functions are twice continuously differentiable, it is apparent that properties 1 and 2 are satisfied.

Expanding and simplifying expression (17) yields the equivalent condition

$$(-1)^i \cdot (P''_{1,i,j}(\tau^i_j) \cdot P'_{1,i,j}(\tau^i_j) - P''_{3-i,j}(\tau^i_j) \cdot P'_{3-i,j}(\tau^i_j)) < 0, \quad \tau^i_j \in (\tau^2_j, \tau^1_j).$$

We show (22) for scheme $C$. The proof for scheme $R$ runs along the same lines. Inserting the explicit expressions of $P_{i,j}$, (13)–(14), into condition (22) leads to

$$(b+d_1-1) \cdot (b-d_2) \cdot (\tau_C - v_1)^3 - (b+3d_1-1) \cdot (b-d_2) \cdot (\tau_C - v_1)^2 \cdot (\tau_C + v_2)
+ d_1 \cdot (2b+1-3d_2) \cdot (\tau_C - v_1) \cdot (\tau_C + v_2)^2 - d_1 \cdot (1-d_2) \cdot (\tau_C + v_2)^3 < 0, \quad \tau_C \in (\tau^2_C, \tau^1_C).$$

Inspecting the polynomial (in $\tau_C$) in (23), we find that it is of degree 2 with negative quadratic coefficient $-(b-1) \cdot (b-d_1-d_2) \cdot (v_1 + v_2)$. Define the left hand side of inequality (23) as the function $h$ of the transfer price $\tau_C$. Then, a sufficient condition for (23) to hold is that $\max_{\tau_C \in \mathcal{D}_C} h(\tau_C) < 0$ is satisfied. Calculating this maximum yields

$$\max_{\tau_C \in \mathcal{D}_C} h(\tau_C) = h \left( \frac{(b-d_2) \cdot v_1 + d_1 \cdot v_2}{b-d_1-d_2} \right) = \frac{d_1 \cdot (b-d_2) \cdot (1-d_1-d_2) \cdot (v_1 + v_2)^3}{b-d_1-d_2},$$

which is negative for all admissible parameter settings.

The first two properties of Lemma 1 have a ready interpretation: For any transfer price $\tau^i_j$ from the nonempty set $[\tau^2_j, \tau^1_j]$, the induced allocation of divisional profits is Pareto efficient since any other transfer price $\tau^i_j \neq \tau^i_j$ corresponds to a deterioration of the profit situation of the first or the second division. Property 3 of Lemma 1 basically implies that the set of feasible profit allocations has a well-shaped Pareto boundary which is formally shown in Lemma 2 in Section 4.1.

### 4 Specification of the transfer pricing system

At first sight the analysis of the equilibrium divisional decisions and profits suggests a straightforward answer to the question of how $HQ$ would specify transfer prices in an administered system: Set the transfer price to $\tau^0_j$, $j \in \{C, R\}$, and choose that transfer pricing scheme $j^0$ yielding the highest corporate profit, i.e., $j^0 = \arg\max_{j \in \{C, R\}} P_{0,j}(\tau^0_j)$. However, for this course of action $HQ$ would have to know the values of the parameters $b, d_i$, and $v_i$ in order to make an informed decision. The very fact that the firm is decentralized suggests that $HQ$ does not possess such information and may consider to
(partly) delegate the specification of the transfer pricing system. Therefore, in contrast to an administered system, we analyze negotiated transfer prices. Thus, the two divisions may agree on the transfer pricing method and the price. We start with a general description of the corresponding bargaining problems and then discuss solution concepts and their properties for the case that the transfer pricing scheme is fixed. Next, we address the problem of how the divisions determine an appropriate scheme. Finally, we discuss the advantages of a two-step transfer pricing scheme.

4.1 The bargaining problems

A general bargaining problem (for two parties) is a pair $V = (U, d)$, where $U$ is a closed and convex subset of $\mathbb{R}^2$ and $d$ is an element of $U$. Moreover, we assume that the set $U_d := \{ u \in U : u \geq d \}$ is bounded and hence compact. We interpret the set $U$ as the set of utility allocations that can be realized for two parties. An agreement in the bargaining problem is reflected by a point in $U$. The point $d$ is called disagreement point and defines both parties’ utilities when no agreement can be achieved. Thus, in the description of a bargaining problem we only collect the possible results in terms of utility. For technical reasons, we want to allow the possibility of free disposal, i.e., if $x \in U$ is a feasible utility allocation and $y \leq x$, then $y$ should also be feasible, i.e., $y \in U$. This means, $U$ is comprehensive from below. By $\mathcal{U}$ (resp. $\mathcal{U}_0$) we denote the set of all bargaining problems (resp. with disagreement point $d = 0$).

How does a bargaining problem emerge in our context? First of all, we identify a division’s utility with its profit. Therefore, for a given transfer pricing scheme $j$, we obtain for each transfer price $\tau_j$ a specific profit allocation for the two divisions. Assuming that the disagreement point $d$ is zero\(^{20}\), this determines the resulting bargaining problems $V_j := (U_j, d_j) \in \mathcal{U}$ for $j \in \{C, R\}$ as follows:

$$U_j := \text{compH} \left( \{(P_{1,j}(\tau_j), P_{2,j}(\tau_j)) : \tau_j \in D_j \} \right) \text{ and } d_j := 0,$$

where $\text{compH}(\cdot)$ denotes the comprehensive hull operator.\(^{21}\) So, the possible profit allocations collected in $U_j$ are defined by Nash equilibrium payoffs of the noncooperative game $\Gamma_{\tau_j}^j$ played at time 3, which is given by the chosen transfer price $\tau_j$.

We need to show that $V_C$ and $V_R$ constitute bargaining problems. Equations (18)–(21) yield the unique maximizers $\tau_j^1$ of the divisional profit functions $P_{1,j}$. Since $P_{1,j}$ is strictly increasing and $P_{2,j}$ is strictly decreasing on the interval $D_{PE,j} := [\tau_j^2, \tau_j^1]$, we conclude that

\(^{20}\)A discussion on the choice of disagreement points is found in Section 5.

\(^{21}\)The comprehensive hull of $F \subseteq \mathbb{R}^n$ is $\text{compH}(F) = \{ x \in \mathbb{R}^n : \exists z \in F, x \leq z \}$. 

the Pareto-efficient profit allocations in $U_j$, denoted $\partial U_j$, uniquely correspond to the transfer prices in $D_j^{PE}$. Lemma 2 confirms that $V_j$ does constitute a bargaining problem.

**Lemma 2.** The sets $U_j$, $j \in \{C, R\}$, are closed and convex, and $U_{j,0} := \{u \in U_j : u \geq 0\}$, $j \in \{C, R\}$, are bounded. More precisely, $\partial U_j$ can be represented as the graph of a strictly concave and continuous function on the compact interval $[P_{1,j}(\tau_j^2), P_{1,j}(\tau_j^1)] \subset R_{++}$.

**Proof.** Define $\xi_j : D_j^{PE} \rightarrow \mathbb{R}_{++}^2$ with $\xi_j(\tau_j) = (\xi_{1,j}(\tau_j), \xi_{2,j}(\tau_j)) := (P_{1,j}(\tau_j), P_{2,j}(\tau_j))$. Recall that, due to Proposition 4, $P_{i,j}(\tau_j) > 0$ holds for all $\tau_j \in D_j$. $\xi_j$ is a parametrization of the Pareto boundary $\partial U_j$. Note that we can rewrite $U_j$ as

$$U_j = \text{compH} \left( \{ \xi_j(\tau) \mid \tau \in D_j^{PE} \} \right),$$

because the transfer prices in $D_j^{PE}$ yield Pareto-efficient profit allocations. The sets $U_j$ are certainly closed, since $P_{i,j}$, $i \in \{1, 2\}$, $j \in \{C, R\}$, are continuous, the intervals $D_j^{PE}$ are compact, and the comprehensive hull of a closed set is closed. By Lemma 1 we know that each $P_{i,j}$ has a unique maximum, which shows that $U_{j,0}$ is bounded. To show convexity of $U_j$, we have to verify that $\xi_{2,j}(\tau_j)/\xi_{1,j}(\tau_j) \geq \xi_{2,j}(\tau_j)/\xi_{1,j}(\tau_j)$ holds for all $\tau_j, \tau_j' \in D_j^{PE}$ with $\tau_j < \tau_j'$. The ratios reflect the slope of the Pareto boundary at points $\xi_j(\tau_j)$ and $\xi_j(\tau_j')$. Noting that $\xi_{2,j}(\tau_j)/\xi_{1,j}(\tau_j) = P_{1,j}'(\tau_j)/P_{1,j}(\tau_j)$ is valid, the relation follows from part 3 of Lemma 1. The lemma shows that even the strict inequality holds implying that the Pareto boundary is representable as the graph of a positive, strictly concave, and continuous function on $[P_{1,j}(\tau_j^2), P_{1,j}(\tau_j^1)]$. Note also that, due to strict monotonicity of $P_{i,j}$ in $D_j^{PE}$, the parametrization $\xi_j$ is a bijection onto $\partial U_j$.

With the aid of Lemma 2, we obtain a property of the corporate profit analogous to property 1 of Lemma 1.

**Corollary 3.** Each corporate profit function $P_{0,j}$, $j \in \{C, R\}$, possesses a unique maximizer $\tau_j^0 \in D_j^{PE} \setminus \{\tau_j^1, \tau_j^2\}$.

**Proof.** Clearly, any profit allocation that maximizes corporate profit has to be Pareto efficient, hence obtained by a transfer price in $D_j^{PE}$. According to Lemma 2, the sets $U_j$ are strictly convex and therefore there is a unique profit allocation that maximizes the sum of profits. Since the above discussed parametrization is a bijection, there is a unique transfer price $\tau_j^0$ that maximizes the corporate profit in scheme $j$. $\tau_j^0 \notin \{\tau_j^1, \tau_j^2\}$ follows directly from $\xi'_{1,j}(\tau_j^0) = 0$, $\xi'_{1,j}(\tau_j^{3-i}) \neq 0$ (strict quasi concavity) and $\xi'_{1,j}(\tau_j^0) = -\xi'_{3-i,j}(\tau_j^0)$. 

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We refer to the left diagram of Figure 4 for a sketch of the sets $U_C$ and $U_R$, the boundaries of which are indicated by thick lines. The two elliptic curves reflect the allocations of divisional profits $(P_{1,j}(\tau_j), P_{2,j}(\tau_j))$ for transfer prices $\tau_j \in D_j$.

### 4.2 Solution concepts

After the description of the bargaining problems $V_j$, we now analyze solution concepts. For this, we use techniques of axiomatic bargaining theory. That means, we do not explicitly model or postulate a specific bargaining process. We rather follow the normative approach of asking for properties or axioms a bargaining solution should satisfy in general, i.e., without respect to a specific bargaining problem. In our context, an interpretation of the axiomatic approach is that the divisions first agree on properties that a bargaining solution should satisfy and thereby select a solution concept. A final agreement is reached by applying this solution concept to the specific bargaining problem at hand.

We first state the standard axioms that any reasonable solution should satisfy by defining a bargaining solution on $\mathcal{U}$ as a mapping $\varphi : \mathcal{U} \to \mathbb{R}^2$ such that the following axioms are satisfied:

---

22The parameter setting for the left-hand side is $b = 2$, $d_1 = d_2 = 0.25$, $v_1 = 0.0747$, and $v_2 = 0.02$. For the right-hand side we have $b = 2$, $d_1 = d_2 = 0.25$, $v_1 = 0.1$, and $v_2 = 0.01$. 

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PE, IR: \( \varphi(V) \) is Pareto efficient in \( U \) and individual rational, i.e., \( \varphi(V) \geq d \) for all \( V \in U \).

SYM: Let \( \pi(U) := \{ (u_2, u_1) \mid (u_1, u_2) \in U \} \) and \( \pi(d) := (d_2, d_1) \) be the bargaining problem with interchanged roles. Then \( \varphi \) has to satisfy \( \varphi(\pi(U)) = \pi(\varphi(V)) := (\varphi_2(V), \varphi_1(V)) \) for all \( V \in U \).

COV: For any affine linear mapping \( L: \mathbb{R}^2 \to \mathbb{R}^2 \) with positive coefficients define \( L(V) := (L(U), L(d)) \).\(^{23}\) The solution should satisfy \( \varphi(L(V)) = L(\varphi(V)) \) for all \( V \in U \).

The axioms of Pareto efficiency (PE) and individual rationality (IR) do not call for further explanation. The symmetry axiom (SYM) says that the bargaining solution does not depend on how the parties are labeled, i.e., the solution treats them symmetrically. The axiom COV (covariance under positive affine transformations of utility) guarantees that the solution covaries with changes in the scale with which utilities—profits in the present case—are measured. A ready interpretation of COV in our context is that the taxation of divisional profits does not affect the bargaining solution.\(^{24}\) Note that we may also consider bargaining solutions on the class \( \mathcal{U}_0 \), which contains all bargaining problems in our context, with an appropriately adjusted COV axiom (no translations are allowed).

We discuss two specific, well-known bargaining solutions which were introduced in Nash (1950, 1953) and Kalai & Smorodinsky (1975). Besides different axiomatizations for the two solutions, they differ in the incorporated fairness concept.\(^{25}\) The Kalai-Smorodinsky bargaining solution—hereafter KS solution—of a bargaining problem \((U, 0)\) selects the unique Pareto efficient point in \( U \) which gives both parties the same fraction of their maximal utility achievable in \( U \). In our context of divisional profits, the KS solution of \( V_j \), \( j \in \{C, R\} \), is a mapping \( KS: \mathcal{U}_0 \to \mathbb{R}^2 \) that takes each \( V_j = (U_j, 0) \) to the Pareto-efficient profit allocation in \( U_j \), in which each division \( i \) obtains the share of its maximal achievable profit \( P_{i,j}(\tau^i_j) \).

To compute \( KS(V_j) \), we look for the transfer price \( \tau^j_{KS} \in D^PE_j \), \( j \in \{C, R\} \), that satisfies \( P_{1,j}(\tau^j_{KS})/P_{1,j}(\tau^1_j) = P_{2,j}(\tau^j_{KS})/P_{2,j}(\tau^2_j) \), and consequently, we have \( KS(V_j) = (P_{1,j}(\tau^j_{KS}), P_{2,j}(\tau^j_{KS})) \). Note that, due to Lemma 2, the transfer price \( \tau^j_{KS} \in D^PE_j \) is uniquely determined.

---

\(^{23}\) \( L \) is of the form \( L(x_1, x_2) = (\alpha_1 x_1, \alpha_2 x_2) + z \) with \( \alpha_i > 0 \) and \( z \in \mathbb{R}^2 \).

\(^{24}\) For this interpretation of COV the taxation has to be affine in divisional profits which may be a simplification of real taxation systems.

\(^{25}\) The Nash solution is uniquely determined by the foregoing axioms in addition to the IIA axiom (independence of irrelevant alternatives), whereas the Kalai-Smorodinsky solution is the only bargaining solution that satisfies all above axioms and a specific monotonicity axiom.
In the present context, the Nash bargaining solution is described by the mapping $N: \mathcal{U}_0 \to \mathbb{R}^2$ that takes each $V_j = (U_j, 0)$ to the Pareto-efficient profit allocation in $U_j$, the product of divisional profits of which is maximal. This allocation corresponds to the transfer price $\tau_j^N \in D_j^{PE}$, $j \in \{C, R\}$, satisfying $P_{i,j} (\tau_j^N) P_{2,j} (\tau_j^N) = \max_j P_{i,j} (\tau_j) P_{2,j} (\tau_j)$. The Nash solution relies on a different fairness consideration: Suppose there were two (Pareto-efficient) profit allocations $x, y \in U_j$ under concern. W.l.o.g. we may assume $x_1 > y_1$, i.e. $x$ is more favorable for division $D_1$. To choose between the two points, both divisions argue with their relative gains and losses from switching. Hence, we compare $D_1$’s relative gain from switching from $y$ to $x$, which is $(x_1 - y_1)/y_1$, with $D_2$’s relative gain from going from $x$ to $y$, which amounts to $(y_2 - x_2)/x_2$. $D_1$ has a better argument to select $x$ instead of $y$ than $D_2$ to select $y$ instead of $x$, if $D_1$’s relative gain is higher than the one of $D_2$. We obtain that $(x_1 - y_1)/y_1 > (y_2 - x_2)/x_2$ holds, if and only if $x_1 \cdot x_2 > y_1 \cdot y_2$ is true. Therefore, the profit allocation with the highest product of profits provides the best arguments. And this allocation is exactly the Nash bargaining solution. The left diagram of Figure 4 illustrates the construction of the KS as well as the Nash solution.

4.3 Application of the solution concepts

In the following propositions, we state how the transfer prices that correspond to the different solution concepts look like for each of the two schemes. We also determine the efficient transfer prices $\tau_j^0$. Proposition 5 starts with the KS solution.

**Proposition 5.** The Kalai-Smorodinsky transfer prices $\tau_j^{KS}$, $j \in \{C, R\}$, are given by

\[
\begin{align*}
\tau_j^{KS} & = \mathcal{I}_C + \frac{\eta}{\eta - 1} (v_1 + v_2), \\
\tau_j^{KS} & = \mathcal{I}_R + \frac{b \cdot v_2}{(b-1) \cdot v_1 + b \cdot v_2},
\end{align*}
\]

where the constants $\eta$ and $\zeta$ are defined as

\[
\begin{align*}
\eta & := \frac{(1 - d_2)^{1-d_2} \cdot (b - 1 + d_1)^{b-1+d_1}}{(b - d_2)^{b-d_2} \cdot d_1^{d_1}}, \\
\zeta & := (1 + \frac{(b + d_2 - 1)^{b+d_2-1} \cdot (1 - d_2)^{1-d_2}}{(b - d_1)^{b-d_1} \cdot d_1^{d_1}})^{-1}.
\end{align*}
\]

Surprisingly, we get the following result for the Nash solution.

**Proposition 6.** The Nash transfer prices $\tau_j^N$, $j \in \{C, R\}$, are given by

\[
\begin{align*}
\tau_j^N & = \mathcal{I}_C + \frac{1 + d_1 - d_2}{2 \cdot (b-1)} \cdot (v_1 + v_2) = \frac{\tau_j^1 + \tau_j^2}{2}, \\
\tau_j^N & = \mathcal{I}_R + \frac{1}{2} \cdot \frac{(1 + d_1 - d_2) \cdot v_2}{(b-1) \cdot v_1 + b \cdot v_2} = \frac{\tau_j^1 + \tau_j^2}{2}.
\end{align*}
\]
Thus, the Nash transfer price can be calculated very simply by taking the average of the “best” transfer prices for $D_1$ and $D_2$. Finally, we compute the transfer prices that maximize corporate profits.

**Proposition 7.** The transfer prices $\tau^0_j$, $j \in \{C, R\}$, that maximize corporate profit are

\[
\tau^0_C = \tau_C + \gamma_1 + \frac{\sqrt{\gamma_1^2 - 4 \gamma_0 \gamma_2}}{2 \gamma_2} (v_1 + v_2), \tag{30}
\]

\[
\tau^0_R = \tau_R + \eta_1 + \frac{\sqrt{\eta_1^2 + 4 \eta_0 \eta_2}}{2 \eta_2} \frac{v_2}{(b - 1) v_1 + b v_2}, \tag{31}
\]

where the constants $\gamma_i, \eta_i$, $i \in \{1, 2, 3\}$, are defined by

\[
\begin{align*}
\gamma_0 &= k_1 d_1, \quad \gamma_1 = k_1 (b - 1) (1 - d_2) - k_2 (b - 1 - d_1), \quad \gamma_2 = -(b - 1) (k_1 (b - 1) + k_2), \\
\eta_0 &= b k_2 d_1 v_2, \quad \eta_1 = ((b - 1) v_1 + b v_2) k_2 (1 - d_2) - k_2 (b + d_1), \\
\eta_2 &= ((b - 1) v_1 + b v_2) k_1 - k_2 v_2.
\end{align*}
\]

**Example 1.** For the parameter setting $b = 2$, $d_1 = d_2 = 0.25$, $v_1 = 0.0747$, and $v_2 = 0.01$ (see also Figure 4) we obtain:

<table>
<thead>
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<th>scheme</th>
<th>transfer price</th>
<th>profit allocation</th>
<th>corporate profit</th>
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<tr>
<td>$C$</td>
<td>$\tau^KS_C = 0.1146$</td>
<td>$KS(V_C) = (0.1367, 0.4272)$</td>
<td>0.5640</td>
</tr>
<tr>
<td></td>
<td>$\tau^N_C = 0.1171$</td>
<td>$N(V_C) = (0.1397, 0.4192)$</td>
<td>0.5589</td>
</tr>
<tr>
<td></td>
<td>$\tau^0_C = 0.1046$</td>
<td>$N(V_C) = (0.1190, 0.4557)$</td>
<td>0.5747</td>
</tr>
<tr>
<td>$R$</td>
<td>$\tau^KS_R = 0.8400$</td>
<td>$KS(V_R) = (0.4052, 0.1337)$</td>
<td>0.5388</td>
</tr>
<tr>
<td></td>
<td>$\tau^N_R = 0.8416$</td>
<td>$N(V_R) = (0.4137, 0.1310)$</td>
<td>0.5448</td>
</tr>
<tr>
<td></td>
<td>$\tau^0_R = 0.8587$</td>
<td>$N(V_R) = (0.4736, 1.101)$</td>
<td>0.5747</td>
</tr>
</tbody>
</table>

We pause to make three important observations:

1. Since both solution concepts select Pareto-efficient profit allocations, there is no “dominant” solution concept. In the above example $D_1$ is in both schemes better off in the Nash solution than in the KS solution (and vice versa for $D_2$). This shows the importance of agreeing on a solution concept regarding its properties without considering the actual bargaining problem.

2. In the Example neither solution dominates the other in terms of corporate profit. Given scheme $C$, HQ would prefer the KS over the Nash solution, and vice versa for scheme $R$. 

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3. From HQ’s perspective the discussed solution concepts yield the efficient transfer price $\tau^0_j$ at best accidentally, because the criterion of maximizing corporate profit does not enter fairness considerations. Thus, we have a confirmation of a often mentioned drawback of negotiated transfer prices: inefficiency.

4.4 Cost- or revenue-based transfer pricing?

So far we have assumed the transfer pricing scheme to be predetermined at time 1, so that the bargaining problem on the divisions’ table at time 2 is either $V_C$ or $V_R$. Here, we discuss an extension of the bargaining problem so that the specification of the transfer pricing system is fully negotiated by the divisions. Consequently, we endogenize the choice of the transfer pricing scheme by, roughly spoken, considering $V_C$ and $V_R$ at the same time. To be precise, let now the set of possible profit allocations be $U := U_C \cup U_R$. The disagreement point remains $d = 0$. Clearly, the Pareto boundary $\partial U$ of $U$ is a subset of $\partial U_C \cup \partial U_R$. Yet, $U$ is in general not convex and thus the classical approaches from bargaining theory are not applicable. However, there are versions of the KS and the Nash bargaining solution for the nonconvex case as well.

For the extension of the KS solution, denoted by $\tilde{KS}$, we refer to Hoogaard & Tvete (2003). In our context, one computes those points on $\partial U$ that maximize the smaller fraction of obtained to maximal profit in $U$ among the divisions. To be precise, let $\tilde{KS} : U_0 \times U_0 \to 2^{\mathbb{R}^2}$ be the function that assigns the set

$$\tilde{KS}(V_C, V_R) := \arg\max_{x \in U} \left( \min_{i \in \{1, 2\}} \left( \frac{x_i}{\beta_i(U)} \right) \right) \cap \partial U$$

(32)

to any pair $(V_C, V_R)$ of bargaining problems arising from a cost-based and revenue-based transfer pricing scheme. $\beta_i(U) := \max_{j \in \{C, R\}} P_{ij}(\tau^i_j)$ denotes the maximal profit for $Di$ in $U$. Obviously, $\tilde{KS}(V_C, V_R)$ is nonempty. The idea behind this extension is already found in Rawls’ theory of distributive justice: One tries to “help the one who is worst off”, where worst off is measured in fractions of maximal possible profit. A closer inspection of (32) in connection with the right hand side of Figure 4 reveals how to determine $\tilde{KS}(V_C, V_R)$. First, one computes both divisions’ maximal profits and thereby determines the “bliss point” $\beta := \beta(U)$. Then one determines the intersection of the line connecting the disagreement point 0 and $\beta$ with $U_C$ and $U_R$, respectively. In case the intersection point for $U_j$ is not Pareto efficient, one takes the unique Pareto-efficient point in $U_j$ dominating the intersection point. Call these points $x_j \in \partial U_j$, $j \in \{C, R\}$. In view of (32), the set $\tilde{KS}(V_C, V_R)$ contains either $x_C$ or $x_R$ or both. Therefore, in contrast to the KS solution in the convex case, the $\tilde{KS}$ solution may select a set of Pareto-efficient points. This is formally asserted in Lemma 3.
Lemma 3. There is at most one $\tau_C \in D^\text{PE}_C$ and at most one $\tau_R \in D^\text{PE}_R$ satisfying $(P_{1,j}(\tau_j), P_{2,j}(\tau_j)) \in \tilde{K}S(V_C, V_R)$, $j \in \{C, R\}$. Thus, $\tilde{K}S(V_C, V_R)$ either contains one or two elements.

Proof. Suppose there were profit allocations $x, y \in \tilde{K}S(V_C, V_R)$, $x \neq y$, that are generated using the same scheme $j$ with different transfer prices. Define $z := (x+y)/2$. Clearly, $z_i > \min(x_i, y_i)$, $i \in \{1, 2\}$ and since $U_j$ is convex, we have $z \in U_j$. Therefore, we obtain $\min_i (z_i/\beta_i(U)) > \min_i (x_i/\beta_i(U)) = \min_i (y_i/\beta_i(U))$, which contradicts $x, y$ being maximizers in (32).

Since any profit allocation in $\tilde{K}S(V_C, V_R)$ is Pareto efficient, there is a corresponding scheme $j \in \{C, R\}$ and transfer price $\tau_j$ that generates it. Thus, in the case that the extension $\tilde{K}S$ produces a single profit allocation, it does not only determine the transfer price but also the scheme.\textsuperscript{26} Therefore, applying $\tilde{K}S$ as a solution concept may at most result in a conflict over which scheme to choose. However, for each scheme there is at most one price to be taken. Let therefore $A_i \subseteq \{C, R\}$ be the set of schemes that provide the maximal profit to $Di$, i.e., $A_i := \arg\max_{j \in \{C, R\}} P_{i,j}(\tau_j)$. Proposition 8 characterizes the situation in which there remains a conflict over the choice of the scheme. In case there are two solutions, any solution is obtained by taking division $i$’s less preferred scheme—in terms of maximal possible profit—and agree on its most preferred transfer price.

Proposition 8. Suppose the set $\tilde{K}S(V_C, V_R)$ contains two elements. Then the following properties hold:

1. $A_1 \cap A_2 = \emptyset$.

With $A_1 := \{j\}$ and $A_2 := \{k\}$ we have

2. $\tilde{K}S(V_C, V_R) = \{(P_{1,j}(\tau_j^1), P_{2,j}(\tau_j^2)) ; (P_{1,k}(\tau_k^1), P_{2,k}(\tau_k^2))\}$;

3. $\frac{P_{1,k}(\tau_k^1)}{P_{1,j}(\tau_j^1)} = \frac{P_{2,j}(\tau_j^2)}{P_{2,k}(\tau_k^2)}$.

Proof. Denote by $x, y \in \partial U$ the two elements in $\tilde{K}S(V_C, V_R)$. W.l.o.g. we assume $x_1 > y_1$, which implies $x_2 < y_2$. Since $x$ and $y$ are both maximizers in (32), we conclude that $y_1/\beta_1(U) = x_2/\beta_2(U)$ are the minimal fractions. By Lemma 3 we may assume $x \in U_j$ and $y \in U_k$ for $k \neq j$. Suppose there was a point $z \in U_k$ with $z_1 > y_1$ (and $z_2 < y_2$). Then

\textsuperscript{26}It may occur, that the profit allocation in $\tilde{K}S(V_C, V_R)$ can be generated by both schemes. However, both divisions are indifferent between the two schemes.
we can find \( \varepsilon \in [0, 1] \) small enough, so that the point \( w := (1-\varepsilon) \cdot y + \varepsilon \cdot z \), which is by convexity in \( U_k \), satisfies \( x_1 > w_1 > y_1 \) and \( x_2 < w_2 < y_2 \). Hence, \( w_1/\beta_i(U) > y_1/\beta_i(U) \) and \( w_2/\beta_2(U) > x_2/\beta_2(U) \), which contradicts \( x \) and \( y \) maximizing (32). Therefore, any point \( z \in U_k \) satisfies \( z_1 \leq y_1 \). Since \( x_1 > y_1 \) and \( x \in U_j \), this shows \( A_1 = \{j\} \).

With the same arguments we get \( A_2 = \{k\} \). Moreover, \( y = (P_{1,k}(\tau_k^1), P_{2,k}(\tau_k^1)) \), because it is the Pareto efficient point in \( U_k \) with maximal first coordinate. Similarly, we get \( x = (P_{1,j}(\tau_j^2), P_{2,j}(\tau_j^2)) \), which shows part 2. Part 3 follows by using (32), \( \beta_1(U) = P_{1,j}(\tau_j^1) \), and \( \beta_2(U) = P_{2,k}(\tau_k^2) \).

To summarize, only in the case that maximal divisional profits satisfy property 3 of Proposition 8, the KS extension may suggest two profit allocations that stem from the application of different transfer pricing schemes. In other words, if this property is not met then the KS extension proposes exactly one transfer pricing scheme and price. Similarly, if both divisions obtain maximal possible profits by the same scheme, then by property 1 of Proposition 8 \( KS(V_C, V_R) \) contains a single allocation. So, if there is a consensus that a “fair” distribution of profits should go for the largest possible minimal share of maximal profits, then the extended KS solution generically provides a unique answer to which scheme and what transfer price to choose.

An extension of the Nash bargaining solution, as it is discussed in Kaneko (1980) is fairly straightforward, as one still maximizes the product of divisional profits (see Herrero (1989) for a different approach). Clearly, as above, the extended solution does not necessarily single out exactly one point in \( U \). However, having determined the Nash solutions for \( V_C \) and \( V_R \) separately, one simply has to pick the one, the product of profits of which is the highest. Observe for this that \( \max_{x \in U_C \cup U_R} \{x_1 \cdot x_2\} = \max(\max_{x \in U_C} \{x_1 \cdot x_2\}, \max_{x \in U_R} \{x_1 \cdot x_2\}) \). Thus, unless the case that the products \( P_{1,C}(\tau_C^N) \cdot P_{2,C}(\tau_C^N) \) and \( P_{1,R}(\tau_R^N) \cdot P_{1,R}(\tau_R^N) \) are equal, the Nash extension picks a single allocation and determines the transfer pricing scheme as well as the price endogenously.

### 4.5 Two-step transfer prices

We close this section with a discussion of two-step transfer prices. Formally, this changes the bargaining problem at time 2. Suppose, the pricing scheme \( j \in \{C, R\} \) is fixed. Then the set of all possible profit allocations amounts to

\[
U'_j := \text{compH}(\{(P_{1,j}(\tau_j), P_{2,j}(\tau_j)) + \lambda_j \cdot (1, -1) | \tau_j \in D_j, \lambda_j \in \mathbb{R}\}).
\]  

Note that the pair \((U'_j, 0)\) satisfies all requirements for bargaining problems. Furthermore, it is well known that for such bargaining problems any reasonable axiomatic
bargaining solution, i.e., that satisfies the axioms PE, IR, SYM, and COV, assigns the unique Pareto-efficient profit allocation that yields the same profit for each division. Corollary 4 shows that the transfer price $\tau^0_j$ plays a crucial role.

**Corollary 4.** The Pareto boundary of $U'_j$, $j \in \{C, R\}$, is given by

$$\partial U'_j = \{(P_{1,j} (\tau^0_j), P_{2,j} (\tau^0_j)) + \lambda_j \cdot (1, -1) \mid \lambda_j \in \mathbb{R}\}$$

and we obtain $\partial U_j \cap \partial U'_j = \{(P_{1,j} (\tau^0_j), P_{2,j} (\tau^0_j))\}$.

**Proof.** Let $X$ be the set on the right-hand side of (34). Assume that there is $x \in X$ such that there is $y \in U'_j$ which Pareto dominates $x$. $y$ is w.l.o.g. of the form $(P_{1,j} (\tau'_j) + \lambda_j, P_{2,j} (\tau'_j) - \lambda_j)$ for some $\tau'_j \in D_j$ and exhibits $\sum_i y_i = \sum_i P_{i,j} (\tau'_j)$. From Corollary 3 we know that $\tau^0_j$ is the unique transfer price maximizing $P^0_{i,j} = \sum_i P_{i,j} (\tau^0_j)$, so that we have $\sum_i x_i = \sum_i P_{i,j} (\tau^0_j) \geq \sum_i P_{i,j} (\tau_j) = \sum_i y_i$ which is a contradiction to Pareto dominance of $y$. The second assertion easily follows from the foregoing arguments.

In other words, in order to reach a Pareto-efficient profit allocation the two divisions should agree on the transfer price $\tau^0_j$ and then carry out a (possibly negative) lump-sum payment from $D_2$ to $D_1$. To achieve a bargaining solution this payment amounts to $(P_{2,j} (\tau^0_j) - P_{1,j} (\tau^0_j))/2$. Thus, a negotiated two-step transfer price will always involve transfer prices that maximize corporate profits.

As for the one-step transfer prices, the decision which scheme to choose can easily be endogenized. From (33) it follows that $U'_C \subseteq U'_R$ holds, if and only if $\sum_i P_{i,C} (\tau^0_C) \leq \sum_i P_{i,R} (\tau^0_R)$ is valid. This means that the union $U'_C \cup U'_R$ (as we discussed in the previous subsection) is either equal to $U'_C$ or to $U'_R$ (or both). From this observation the decision on the scheme is apparent: The divisions agree on the scheme $j^0$ with the highest corporate profit. And this highest corporate profit is realized, as any Pareto-efficient allocation necessarily involves the transfer price $\tau^0_{j^0}$. This means that negotiated two-step transfer prices reconcile with the drawbacks of inefficiency pertaining to one-step transfer prices.

Finally, by Corollary 4 a two-step transfer pricing scheme could also be used to improve upon profit allocations that are selected by bargaining solutions as in Subsection 4.3. For example, have the two divisions agree on a revenue-based transfer price that yields the Nash solution of $V_R$. By switching from $\tau^N_R$ to $\tau^0_R$ and additionally making a lump-sum payment, they could both gain (e.g., equally) compared to the Nash solution. One may formulate this as a new bargaining problem with the Nash allocation (of profits) as disagreement point. However, from a theoretic point of view such solutions leave the ground of axiomatic foundation.
5 Conclusion

In this paper we examine the interactions of two divisions in a setting of interrelated specific investments which enhance the external demand of the final good. We consider the implementation of a (one-step) transfer pricing system in order to coordinate the divisional decisions on the investment levels and the sales price. Due to informational deficits of central management, we leave the decision on the specification of the system to the divisions. The divisions first negotiate over the transfer price which defines the setup for the simultaneous investments and subsequent pricing. In terms of coordination, we first show that the transfer pricing system never induces first-best decisions since each division fully bears its investment costs while sharing the associated return with the other division. Using concepts of bargaining theory, we model the underlying bargaining problems and determine “fair” transfer prices. Interestingly, divisional and corporate profits may strongly depend on the employed transfer pricing scheme. There are also parameter constellations in which one scheme dominates the other in terms of both divisional profits. Furthermore, an extension of the bargaining model allows us to analyze the problem of selecting the transfer pricing scheme as well as the transfer price. For this bargaining situation we may conclude that for specific parameter settings divisional and corporate profits vary significantly.

Since corporate profit maximization does not enter fairness considerations, negotiation results are typically not efficient in terms of corporate profit. That means that central management would choose different transfer prices, if it had full information about the bargaining problem and could stipulate the transfer price and, if required, the scheme. In terms of the decision, whether to implement a negotiated or an administered transfer pricing system, central management has the difficult task to weigh up the inefficiencies stemming from divisional negotiations on the one hand and those from a not perfectly informed central determination of the scheme and of the transfer price on the other hand.

Two-step transfer prices are capable to cope with these problems of inefficiency. With an additional allowance for a lump-sum payment the bargaining problem is altered: The coordinative effect exclusively arises from the quantity-dependent component of the transfer price, whereas the lump sum shifts the corporate profit between the divisions. Consequently, the divisions themselves pick that scheme and that transfer price yielding maximal corporate profit. This feature of two-step transfer prices carries over to any balanced transfer pricing scheme so that central management does not benefit from restraining or specifying the set of admissible schemes. It is important to note that in our context of negotiations the lump sum is a prerequisite of efficient transfer prices.

In the analysis we assume that corporate profit is given by the unweighted (or equivalently equally weighted) sum of divisional profits. For instance, in the case of taxing divisional profits or of divisions not fully owned by central management, corporate profit may given by an (unequally) weighted sum of divisional profits. Thanks to the covariance axiom, transfer prices corresponding to the bargaining solutions do not change. However, the objective function of central management differs in comparison to the unweighted case, so that the transfer price maximizing corporate profit changes. Hence, the efficiency result concerning two-step transfer prices does not hold anymore, because the divisions stick to the transfer price which maximizes the unweighted sum of divisional profits.

If one thinks of two divisions having different “importance”, e.g., divisions of significantly different sizes, one may want to switch to asymmetric bargaining solutions. The corresponding bargaining problems remain unaffected. For one-step transfer pricing, asymmetric solutions induce a shift of the transfer price and thus of profits in favor of the more important division. In two-step transfer pricing, the divisions still have an incentive to maximize corporate profit when agreeing on the quantity-dependent part of the transfer price. However, asymmetries in the solution are reflected by asymmetries in the distribution of (maximal) corporate profit among the divisions.

One may further think of a disagreement point other than zero. For example, the divisions’ outside options possibly shift the disagreement point into the positive orthant. In this case, the methodology remains unaltered. Bargaining solution concepts can easily be adjusted to the new situation. It is worth noting that the efficiency result of two-step transfer prices still applies, even if the profit allocation pertaining to the one-step transfer price maximizing corporate profit is not individually rational. Finally, the attempt of central management to manipulate the negotiation result towards maximizing corporate profit by dictating a (one-step) transfer price for the case negotiations fail also affects the disagreement point. Yet, informational deficits make it again hard for central management to succeed with this administrative course of action.

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<td>Stefan Wielenberg</td>
<td>Bedingte Zahlungsversprechen in der Unternehmenssanierung Juni 2004</td>
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<td>Sören Scholz</td>
<td>The Quality of Prior Information Structure in Business Planning: An Experiment in Environmental Scanning August 2004</td>
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<td>Ralf Wagner</td>
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<td>Claus-Jochen Haake</td>
<td>Negotiated Transfer Pricing in a Team-Investment Setting October 2004</td>
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