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# Strategic transfer pricing in a marketing–operations interface with quality level and advertising dependent goodwill <sup>☆</sup>

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## ABSTRACT

Determining an appropriate transfer price is of importance to a firm composed of divisional profit centers since it significantly affects decision-makings of each profit center and then the firm's profit. In this paper, we investigate the effects of negotiated and administered transfer pricing on the profits of each center and the firm based on a differential game involving an operations department and a marketing department within a firm. The operations department is responsible for the quality improvement of a particular product and sells this product to end customers through the marketing department who controls the retail price and advertising effort. Our results suggest that compared with the administered transfer price, the negotiation between the operations department and the marketing department leads to a higher transfer price, and then a higher retail price, lower advertising effort and higher quality improvement effort. What's more, the decentralized departments can be coordinated by a committed dynamic transfer price of the operations department, and both departments and the firm can benefit from this coordination.

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## 1. Introduction

In today's business world characterized by growing complexity of modern firms, decentralized decision-making has become a trend due to its distinct advantages in using available information directly and dealing with the unexpected shocks quickly and flexibly. Many firms have developed divisional organizations to exploit these benefits of decentralization, where some or all of the separate divisions are visually autonomous profit or cost centers [1]. When the goods and services are exchanged between divisional centers, transfer pricing comes into being, and the amount of money that the buying profit center pays to the selling profit center is referred to as transfer price. This internal price plays an important role in directing decision-makings and coordinating profits for each center and the firm as a whole.

As discussed in the accounting literature (e.g., [2–4]), the basic objectives of a proper transfer price are (1) to facilitate the evaluation of divisional management, (2) to channel divisional goals towards agreement with firm goals, and (3) to stimulate each profit center to increase its efficiency without losing autonomy. Generally, these objectives are difficult to simultaneously achieve and two common situations occur. On one hand, central management issues some

directives on transfer price so as to maximize the firm's profit. However, this pattern tends to go against the original intention of decentralized organizational structures in which central management relies on divisional centers to make decisions. Additionally, those directives may do harm to the interests of some divisional centers especially when the evaluation for each center's contribution to the firm depends on its own profit. On the other hand, providing autonomy in operations for divisional centers through decentralization may result in sub-optimal outcomes since the divisional centers aim at maximizing their respective profits. Hence, a choice must be made between a transfer price which guides each center towards optimal decisions yet abolishes the autonomy of the profit center, and another transfer price which motivates each profit center to improve its efficiency yet results in sub-optimization. For this reason, it is necessary to compare the firm's profits obtained by different ways of transfer pricing, and to design appropriate transfer prices to coordinate the decision-makings of profit centers with necessary divisional autonomy.

Modern transfer-pricing methods fall into two broad categories: negotiated and administered. The negotiated transfer pricing refers to a situation in which divisional centers are free to negotiate whether intra-firm transfers take place and the transfer payment, while the administered transfer pricing denotes a case in which central management of the firm governs transfer prices by specifying a set of rules [5]. As shown by Kaplan and Atkinson [6], negotiated transfer pricing has advantages over administered transfer pricing when a perfectly competitive market for the intermediate product does not exist externally, whereas the divisional centers may agree upon sub-optimal decisions

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from the firm's point of view. The objective of this paper is to evaluate the effects of both transfer-pricing methods on decision-makings and profits of the divisional centers and the firm.

To this end, we consider a firm composed of an operations department and a marketing department, in which the operations department sells a particular product to end customers through the marketing department. The operations department is responsible for the quality improvement (product innovation) of the product, while the marketing department controls the retail price and advertising effort. The quality level, which is improved by the operations department and positively contributes to goodwill and demand, is regarded as an intermediary linking the operations and marketing departments. We first analyze the centralized scenario as a benchmark, in which central management sets all the strategies. Then, we investigate the decentralized scenario where a differential game model is developed to explicitly display the effects of transfer price on other strategies and profits of each department and the firm. Moreover, we analyze the negotiated and administered transfer-pricing scenarios and compare the strategies and profits of both departments and the firm under both settings. What's more, a committed dynamic transfer price of the operations department is presented, which allows the decentralized departments to be coordinated, and to arbitrarily allocate the firm's profit to both departments. Based on the results of profits comparisons and the advantages of different management structures, central management of the firm can make profitable decisions.

Our research relates to three streams of literature: the transfer-pricing problem for divisional centers within a firm, the game in the marketing–operations interface and internal coordination, and the quality improvement activity as well as its effect on goodwill.

The first stream concentrates on the transfer pricing for divisional centers within a firm. Since the seminal paper [7], transfer price problem has been studied in a series of papers [1–5,8–13]. Among these, the following papers are related to our work. Schjelderup and Sørsgard [8] examine the case where a multinational firm sets the price that applies to intra-firm trade between the firm's affiliates at a central level, but delegates decisions about national prices (or quantities) to national affiliates. Incorporating private divisional information, Vaysman [5] develops a model of negotiated transfer pricing in the setting where decentralization is most compelling. Gabrielsen and Schjelderup [12] investigate the transfer pricing strategies in the integrated structure and ownership structure when two upstream firms sell inputs to their jointly owned downstream firm. Considering a constant transfer price in a dynamic marketing–operations interface, Erickson [13] identifies the optimal transfer price by maximizing the total firm's profit under certain parameter conditions. Dockner and Fruchter [1] introduce a dynamic transfer pricing scheme as coordination device of production and marketing, and evaluate the coordinating outcomes in the open-loop and closed-loop environments, respectively. The results reveal that in case divisions are able to pre-commit, there exists a dynamic transfer price which fully coordinates both divisions, while in the closed-loop setting, strategic externalities can only partially be offset using dynamic transfer prices. Our research has a primary difference with the above studies, that is, we investigate the effects of different ways of transfer pricing on the decisions and profits of each department and the firm.

The second stream focuses on the game of the marketing–operations interface and internal coordination [1,13–20]. Among this stream of literature, the following papers are particularly related to ours. Abad and Sweeney [14] develop an interdependent marketing–production planning model and identify centralized optimal marketing–production plan as a reference point to measure the efficiency of decentralization. Their results suggest that in some cases almost no coordination is necessary, in some cases the use of a transfer price leads to good decentralized planning, and in other cases centralized planning must be employed to achieve good results. Balasubramanian and Bhardwaj [16] model a duopoly where two firms compete on price and quality

dimensions and the manufacturing and marketing managers within each firm bargain with each other before arriving at compromise decisions regarding price and quality. They show a surprising result that the firm's profits in the scenario of conflict can be higher than those obtained in the perfectly coordinated scenario. Pekgün et al. [17] analyze the inefficiencies created by the decentralization of the price and leadtime decisions in a marketing–production interface and the coordination result can be achieved by a transfer price contract with bonus payments. A review paper by Tang [19] classifies various marketing–operations interface models and discusses some topics for potential future researches. Erickson [20] presents a differential game model of the marketing–operations interface and analyzes the feedback Nash equilibrium strategies for price, advertising and production. This work is extended by Erickson [13] in which a constant transfer price is entered into the objective functionals for marketing and operations and set by maximizing the firm's profit. Different from these papers, we provide a novel mechanism for the internal coordination problem—a committed dynamic transfer price. This transfer price is capable not only to coordinate the divisional departments but also to arbitrarily allocate the firm's profit.

Another stream of related literature studies the quality improvement activity and its effect on goodwill [21–30]. Kouvelis and Mukhopadhyay [21] state that the quality level is the cumulative effect of all changes in the addition of features or enhancement of existing ones in the product platform. As an extension, a non-cooperative dynamic game is formulated by El Ouardighi and Kim [22], in which a monopolist supplier respectively collaborates in improving the design quality with two manufacturers who compete for the final demand on both sale price and design quality. Chenavaz [23] assumes that the demand depends on price and quality and analyzes the dynamic relationships between price and quality. Considering quality- and advertising-based goodwill, Nair and Narasimhan [24] develop a generalized competitive model. The results suggest that as goodwill level increases the advertising rate decreases whereas the rate of quality effort increases. To address the question of whether the manufacturer should shift from an operational strategy of quality improvement to embrace a marketing strategy of advertising support, De Giovanni [25] views quality improvement as an important influential factor on the goodwill and production cost. Specifically, the increasing quality improvement positively promotes goodwill, whereas it also incurs operational inefficiency and thus increases the production cost. The literature on innovation including product innovation and process innovation, and product design also analyzes the dynamics of quality (e.g., [23,26–30]). The main difference between this stream of literature and ours is that the design quality related with its matching service is a goodwill-building factor and positively affects the goodwill.

The remainder of this paper is organized as follows. Section 2 develops a differential game model involving an operations department and a marketing department within a firm. Section 3 studies the centralized scenario where the operations department and the marketing department are under the complete control of central management. Section 4 analyzes the decentralized scenario in which central management delegates operations and marketing decisions to divisional departments. The decentralized departments are coordinated by a committed dynamic transfer price of the operations department in Section 5. Some numerical analysis is carried out to gain more managerial insights in Section 6. Conclusions are drawn in Section 7.

## 2. Model development

We consider a firm (F) consisting of an operations department (O) and a marketing department (M). The operations department is responsible for the quality improvement (product innovation) of a

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