

2007

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# **VIRTUAL TRANSFER PRICING MECHANISMS IN GLOBAL SUPPLY CHAIN**

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## **ABSTRACT**

Increasingly global firms establish plants across their national borders while utilizing their home country suppliers in diverse locations. In view of complex risk factors including political uncertainty, tax rate differences, exchange risks and labor condition changes, the issues of optimizing profits through their global operations have received much attention from both academic researchers and executives. Yet, little attention has been paid in regard to virtual transfer pricing in the global supply chain. In this paper, a virtual transfer pricing model is proposed by using contract bundle within a global supply chain to lower the risks and maximize the profit potentials.

Key words: Virtual Transfer Pricing; Contract Bundle Pricing; Profit Optimization; Global Supply Chain

## **1. INTRODUCTION**

The increasing globalization drives many firms to pursue growing business opportunities through countries that provide large market potential and labor cost advantages. Fedows (1989) describes three primary strategic reasons for establishing plants in a foreign country, i.e., low cost production advantage, proximity to market, and available local technological resources[10]. In practice these global firms utilize their supply chain that enables them to either directly handle or indirectly entrust their subsidiaries to manage product flows with other countries. Supply Chain is a network system from suppliers to manufacturer and to marketers (wholesaler and retailer). Supply chain network involves multiple sets of value flows (e.g., material, information, knowledge and profit). In this paper we focus on the profit flow mechanism in supply chain through contract and transfer pricing.

Contract specifies product flows in terms of their essential nature, methods of delivery and financial details. Contract is a practical and legitimate means to allocate profits for the participating entities within a supply chain. Optimizing the level of total profit is possible through coordinating value-enhancing activities while reducing wastes in the supply chain. Profit sharing contract terms may consider the impacts of risks. Since the nature and extent of risks are different within the supply chain, profit sharing contract is to prevent one member in the supply chain from assuming unnecessary high risks related to the local conditions.

Traditionally, multinational companies have used transfer pricing as a way to effectively manage exchange risk, minimize total transnational tax amount and optimize profits [26]. A transfer price is the cost of transferring product or service from one country to another country within a

multinational corporation [1]. Transfer pricing is allowed with the legitimate flows of product and services from one country and another country.

However, both two-party contracts and transfer pricing usually focus on partial profit maximization. In a global supply chain a manufacture often invests in another country using their own partner suppliers both in the home and foreign country. Very little research attention has been paid to how contracts and transfer pricing may be useful in maximizing total profit of the value chain as a whole. This article presents a model of allocating profits with supply chain through coordinating contracts with suppliers. After a brief review of literature on sharing profits in supply chain and profit maximization of a global supply chain a research model and propositions are introduced.

## **2. LITARATURE REVIEW**

Virtual organization is a network of diverse entities that combine their competences organically and take advantage of new business opportunities [8]. A virtual organization views the participating entities as an unbounded system which provides collaborative advantages [12] [14]. Virtual organization is a structural innovation in response to environmental changes and high level of competition [17]. In a supply chain, a manufacture with its partner suppliers may also operate as a virtual organization if the above characteristics are carefully considered.

Supply chain is a complex system that allows profit flow to occur. Stakeholders share the profit or loss through the chain network. In return to their value creation and delivering activities, participating entities in a supply chain receive their share of profit allocation. Profit sharing is to increase the total profits by sharing cost savings. Participating entities may save costs of production and management through collaborative saving activities. Profit sharing is a win-win strategy for all participants who engage in eliminating wastes within the supply chain [5] [6]. Profit sharing involves securing business relationships and profit allocation among the participating entities. Fair share of profits may motivate each participant to do their share of increasing profit potential and assuming risks [22].

In the context of advanced communication technologies, participants in the supply chain may coordinate value generating and distributing activities through sharing vital and relevant information or knowledge. Such coordination mechanisms have two dimensions i.e., division of supply chain and methods of integration. Supply chain is approached either from supply side [11], demand side [2] or throughout the whole supply chain [7] [20].

Contract and bidding are two obvious ways of sharing profit. Bidding is used for selecting the most efficient bidder in terms of costs, quantity and order size. Contracts are widely used to allocate profit between manufacturer and supplier. Power plays a key role in the contract which mainly determines the extent of profit sharing between manufacturer and suppliers [13]. Manufacturer and buyers negotiate or even bid to decide an acceptable price with various incentives [19] [23]. Revenue sharing is implemented by using contracts [3] [27]. Supply profit sharing involves making use of contracts [15] and partnership that combines the strengths of collaborating entities [16].

Supply chain alignment is another form of profit sharing mechanism [16]. Gjerdrum et al (2002) propose a model that illustrates how to optimize the profit through ensuring fair rewards to each participant through supply alignment that ensures sufficient supply capacity for demand fulfillment. Supply alignment allows both manufacturer and suppliers to accommodate capacity issues even in case of inaccurate forecasting of demands. In that way, participating entities in supply chain reduce the level of pains and rather increase the extent of mutual gains [24].

A transfer price is the cost plus reasonable profits for transmitting product or service from one country to another country within the multinational corporation [1]. Transfer price is important in determining taxable income and thus profit of the company and impacts the profit distribution of the divisions in different countries within a company. Transfer price is used for flows of material, product or service. Vidal and Goetschalckx (2001) introduce a model to maximize profit of a multinational corporation by using transfer price and transportation costs as decision variables [26].

### **3. MODEL, PROPOSITIONS AND IMPLEMENTATIONS**

In business situations, manufacturers expand from home country to a foreign country because of higher profit potential through larger sales or lower cost. Dyer et al. (1998) suggested a segmentation of suppliers into two categories: arm's length relationships and strategic partnership. Arm's length relationship fits best for activities related to non-core competence. Higher degree of product complexity requires greater capability to manage supplier selection process [9]. The complexity in technology, design or manufacturing increase the need for establishing partnership relationship or strategic alliance with suppliers for better exploitation of their capabilities. This involves an intensive collaborative working relationship with the prospective partners [18]. When a manufacturer establishes a plant in a foreign country, it often asks its partner suppliers to invest into the foreign country as a way of securing the quality requirements of its product. Our model is based on the assumption that the manufacturer and its partner supplier(s) invest in both the home country and at least one foreign country (Figure 1). A and B are different entities in form; in substance they may behave as one-linked entity (i.e., virtual organization). With the same supplier, virtual transferring profit is possible in that it may behave as partnering firm entity. In order to compare effects of global supply chain profit optimization with local supply chain profit optimization, a benchmark scenario is that the manufacturer deals with two different suppliers in two countries: supplier D in country 1 while supplier E in country 0.

For the simplicity of presentation we first consider a scenario of one manufacture A and one supplier B in a home country 0, and a foreign country 1. In country 1, the manufacturer forms a joint venture J with a local company C.

Table 1: parameters of the model

Parameter	Definition
$R_i$	Revenue function of manufacturer in country $i = 0, 1$
$p_i$	Contract price in country $i = 0, 1$
$q_i$	Sales quantity in country $i = 0, 1$
$t_i$	Company income tax rate in country $i = 0, 1$
$c_j$	Unit production cost of company $j = A, B$ or $J$
$\gamma$	Share of A in J
$\lambda$	A's bargaining power
$\beta$	Exchange rate risk discount factor from country 1 to country 0

A multinational company has to maximize global profit through different profit generating configurations, e.g., exchange rates, tax rates, tariffs, wage rates, sales price, risk factors, etc. The total profit of A and B in both country 0 and country 1 are  $\Pi_A$  and  $\Pi_B$  respectively, and profit of C is  $\Pi_C$ . Each company decides the contract prices in country 0 and country 1 ( $p_0, p_1$ ) to maximize their own profit.

$$\Pi_A = \max_{p_0, p_1} [\beta \gamma (1-t_1) R_1(q_1) - c_J + p_1 q_1 + (1-t_0) R_0(q_0) - p_0 + c_A q_0] \quad (1)$$

$$\Pi_B = \max_{p_0, p_1} [\beta (1-t_1) p_1 - c_B q_1 + (1-t_0) p_0 - c_B q_0] \quad (2)$$

$$\Pi_C = \max_{p_1} [(1-t_1)(1-\gamma)(R_1(q_1) - (c_J + p_1)q_1)] \quad (3)$$

If each country only maximizes its only profit independently, then the above profit functions show the incentive conflicts among the three companies. C wants to pay B a price  $p_1$  as low as possible; B wants both prices  $p_1$  and  $p_0$  as high as possible; while A should want both prices  $p_1$  and  $p_0$  as low as possible. However, since A and B negotiate the supply contracts in both countries, then according to Nash bargaining equilibrium, assume that A's bargaining power is  $\lambda$ ,

and B's bargaining power is  $1-\lambda$ , thus the optimal contract is  $\max_{p_0, p_1} \lambda \Pi_A + (1-\lambda) \Pi_B$ , which is,

$$\begin{aligned} \Pi_A + \Pi_B = & \lambda (1-t_1) \beta R_1(q_1) - \lambda c_J q_1 + \lambda p_1 q_1 + (1-\lambda) \gamma (1-t_0) R_0(q_0) - (1-\lambda) p_0 q_0 \\ & + (1-\lambda) p_1 q_1 - (1-\lambda) c_B q_1 + (1-\lambda) p_0 q_0 - (1-\lambda) c_B q_0 \end{aligned} \quad (4)$$

Therefore in this setup, Equation (4) suggests that firm A and B can both be better off if A pays a high price  $p_1$  to firm B in country 1 and a lower price  $p_0$  in country 0. Comparing with the scenario that A deals with two independent suppliers D and E at the two countries, and the prices are  $p_0 = \lambda c_B + (1-\lambda) c_A$ , Profits are  $\Pi_D$  and  $\Pi_E$ , A's total profit from both country is  $\Pi_A$ , C's total profit is  $\Pi_C$ .

If A deals with B supplier only, which is a global company in both countries, A's total profit is  $\Pi'_A$ . B's total profit is  $\Pi'_B$ . C's profit is  $\Pi'_C$ . We have the following conclusions:

Proposition 1: A global manufacturer A can its supplier B which co-exists with A in both countries can be both better off through virtual price transferring pricing:  $\Pi'_A > \Pi_A$ ,  $\Pi'_B > \Pi_D + \Pi_E$ . The local company loses from this activity  $\Pi'_C < \Pi_C$  even though the participation condition can still be satisfied.

From analyzing the impact of parameters on company profits, we can get insights on what are the best strategies for each company, including the manufacturer, the supplier and the local company, to collaborate and how to manage the global supply chain.

#### 4. CONCLUSIONS AND DISCUSSIONS

Greater level of profits may flow through global supply chain through price discrimination and cost differentiation. However, in this paper, our main concern is how to transfer largest possible profits with given profit level. This is through virtual transfer pricing. Virtual transfer pricing provides a mechanism for a manufacturer to better control the profit flow and accordingly optimize its profit in a global setting. Our initial model addresses issues with the illustration of two simple cases. All participants in our model strive to optimize their overall profits. The partner supplier is assured of stable market order opportunities by their investment in a foreign country with the manufacturer. Although it looks as if the manufacturer deprived the local joint venture owner from business opportunities, the local company also has an access to business opportunities to invest along with the manufacturer and claim their entitled profits. This would be satisfactory for all the participants.

This model is related to supply chain management practices in terms of supplier selection, virtual supplier network, and global optimization concept. For supplier selection manufacturers persuade some suppliers in advance to invest along with them in a global market. This should secure both quality of products in foreign country and profit maximization discussed in virtual transfer pricing model. In contact management, this model may also be considered as a choice. In our full paper we will present more complex models with multiple manufacturers and suppliers that utilize virtual transfer pricing mechanisms. We also will discuss management implications from global supply chain perspective.

**References available upon request from Kun Liao at [liaok@cwu.edu](mailto:liaok@cwu.edu)**