APPLICATION OF REVENUE SHARING CONTRACT IN TELECOMMUNICATIONS INDUSTRY SUPPLY CHAINS

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Abstract: *Revenue sharing contracts have been used in a number of industries and play an important role in management of supply chains. This paper analyses possibility of application of revenue sharing contracts in telecommunications industry. The telecommunications industry is characterized by complex supply chain, with frequent services and tariffs introduction. In this fiercely competitive industry, new technologies and new services require high capital investments in order to provide emerging services to the customers. Other important issues in telecommunications industry are uncertainty of demand and service life cycle shortening. In such dynamic environment, supply chain management is essential. Telecommunications supply chain in delivering content from Content Provider, through Service Providers to the customers, is observed. The goal of the analysis is formulation of revenue sharing mechanism that reduces provider's incentives to increase retail price and stimulates improvement of customer base and market share.*

Keywords*: Revenue sharing, contract, telecommunications industry, supply chains*

1. INTRODUCTION

The telecommunications industry is characterized by rapid development of new technologies and new services. Large capital investments are needed in order to make content available. Market players often introduce new services and tariffs to increase their market share. Considering fierce competition, these systems need to be effective, flexible and scalable to efficiently manage an increasingly complex service portfolio. Telecommunications industry market includes residential customers, small businesses and big corporate customers, according to Gupta (2008). In the residential customers market, competitors rely heavily on retail prices to increase their customer base. Success depends on reputation and investment in billing solutions. The corporate market has different features in comparison with residential customers. Mainly, big corporate customers are less price sensitive when value added services are being considered. Telecommunications industry supply chains are very complex, dynamic systems and in general involve many different types of players and deliver different outputs by Agrell et al (2004). The roles and responsibilities in the supply chain are often changed due to the uncertainty of demand.

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Coordination of these supply chains can be achieved applying revenue sharing contracts. The main objective of this paper is obtaining the appropriate revenue sharing contract that reduces providers' incentives to increase retail prices and improves providers' market position.

The paper is organized as follows. After introductory remarks, Section 2 gives brief overview on revenue sharing coordination of supply chains. Two types of revenue sharing contracts are presented in Section 3. In this Section, we introduce two relevant parameters, provider's reputation factor and customer's willingness to pay. Numerical example is presented in Section 4. Finally, concluding remarks are given in Section 5.

2. COORDINATION OF SUPPLY CHAINS BY REVENUE SHARING CONTRACTS

Coordination of supply chains can be pursued by centralized or decentralized decision-making approach according to Giannoccaro and Pontrandolfo (2004). If there is a unique decision maker within the supply chain, decision-making approach is centralized. Decentralized decision-making approach occurs when there are several independent actors at the different stages of supply chain. Supply chain contracts are a useful tool to make several actors of a decentralized approach to behave coherently among themselves. In a centralized control mechanism, a unique decision maker possesses all relevant information on the whole supply chain and contractual power to implement such decisions. The centralized control assures the system efficiency. However, centralized control is often considered as not realistic. In such conditions, decentralized control is more convenient. It includes several decision makers, pursuing different objectives, possibly conflicting among each other. Locally appropriate behaviour is often globally inefficient. Hence, coordination mechanisms are needed in order to have local decision-makers pursue channel coordination. Such coordination mechanisms include the supply chain contracts, which control transactions between actors in supply chain. In particular, the risk and the revenue, arising from different sources of uncertainty and channel coordination respectively, are shared by all actors of supply chain. Different models of supply chain contracts have been developed, including quantity flexibility contracts, the backup agreements, the buy back or return policies, the incentive mechanisms, the revenue sharing contracts, the allocation rules and the quantity discounts by Giannoccaro and Pontrandolfo (2004). Revenue sharing contracts have an important role in the supply chains management by Krishnan and Winter (2011). These contracts can be applied to industries where their demand is uncertain, forecasting demand does not follow a well-defined trend and distributors can easily control retailer's profit. Revenue sharing contracts in which retailers pay specified amount of revenue to suppliers are widely adopted, especially in the video distribution and movie industry. According to these agreements, a retailer purchases a product from a supplier for a fixed price and shares a portion of the revenue with a supplier. The supplier offers the purchase price for the product to the retailer who defines the quantity of the product to be ordered by Parsule-Desai (2013). Considering content delivery from Content Provider (CP) to Service Providers (SPs), due to the characteristics of telecommunications supply chain, short service life cycle, and the absence of inventory, there is no difference between purchase and demand. Schematic presentation of telecommunication supply chain is shown in Figure 1. A major Electronics Manufacturing Services Provider (EMS) may support many of the Original Equipment Manufacturers (OEMs), such as Nokia, Ericsson, Alcatel, etc. Global operators often choose different OEMs to supply different countries and use more than one supplier within a country. Second and third tier suppliers are supplying not only the next step in the supply chain, but also companies downstream.

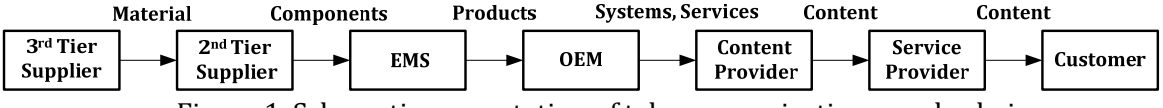


Figure 1. Schematic presentation of telecommunication supply chain

The uncertainty on the telecommunications market and the short service life cycle make reliable forecasts of supply chain characteristics more difficult. The reason lies in the uncertainty of demand, new operator emergence and introduction of new technologies.

3. PROBLEM STATEMENT

Let us consider telecommunications supply chain as shown on Figure 1. Emphasis of our research is the analysis of the last segment of supply chain, consisting of CP, SP and customer and their mutual relations. Assume that total customer population, denoted as X, is fixed during observed time interval. SPs compete on the common retail market for provisioning the same content from CP. Total number of SPs is denoted by N. Assume that contracts are being agreed among providers for a single content. Quality of Service (QoS) is assumed to be satisfactory and all SPs offer the same service class. In order to obtain appropriate revenue sharing contract among CP and SPs, such that provide market stability and ensure customers protection by reducing incentives of SPs to increase their retail prices, we analyse two types of contracts, static and dynamic. The aim of dynamic revenue sharing contract is to stimulate providers to improve their market share, to strengthen market position and thus increase their revenue, rather than by price enhancement. Relevant parameters in these contracts are customers' willingness to pay specific content by the given SPs' retail price, and SPs' reputation. Customers' willingness to pay refers to the portion of total customers' population that are able to afford themselves observed content by the retail price, p_i. Regarding to the price sensitivity, two types of customers can be distinguished, more and less price sensitive. Thus, customers' willingness to pay mathematically can be expressed as follows:

$$w_i = \begin{cases} \frac{\alpha - \beta p_i}{N}, & for\ more\ price\ sensitive\ customers \\ \frac{\rho p_i^{-\varphi}}{N}, & for\ less\ price\ sensitive\ customers \end{cases}, \quad w_i \in (0,1) \qquad (1)$$

Parameters in this equation (1), α, β, ρ and φ depend on socioeconomic structure of customers, target groups, but also on substitutability and popularity of content delivering from CP, through SPs, to the customers. Willingness to pay is inversely proportional to the total number of SPs at the market.

Figure 2 presents customers' willingness to pay for arbitrary chosen values for parameters and price. Less price sensitive customers are less flexible in terms of price variation, and the slope of their willingness to pay has slow decay in comparison with more price sensitive customers.

Figure 2. Price dependence of customers' willingness to pay

Price reduction leads to enhancement of customers' willingness to pay specific content for both types of customers. As a result, number of SPs' end customers will increase. Thus, one of the most important providers' business goals, improved market share, will be satisfied. Another important parameter in proposed models is SPs' reputation SP_i's reputation is denoted by $r_i, r_i \in (0,1)$. This value is established on the basis of long term business existence of SP_i on the market, and $\sum_{i=1}^{N} r_i = 1$. This means that value for SP's reputation is normalized and sum of the values for all SPs equals 1. We assume that reputation of all SPs on the market is known. Higher

reputation is reason why a number of customers are willing to pay content at higher price rate, although QoS requirements are satisfied by all SPs. Static revenue-sharing contract defines fixed, predetermined, portion of generated SP's revenue from provisioning CP's content on retail market that must be paid to CP. Thus, CP always obtains the same portion of revenue from contracts with SPs for the given content. Revenue of SP_i from provisioning content to the customers and CP's revenue in accordance with the static revenue sharing contract can be, respectively, written as follows:

$$R_i^{\ s} = \left(1 - \Phi_i^s\right) p_i w_i r_i X, \tag{2}$$

$$R_{CP}^s = \sum_{i=1}^{N} \Phi_i^s p_i w_i r_i X \tag{3}$$

where Φ_i^s, $\Phi_i^s \in (0, 1)$ presents fixed portion of revenue that, by the contract, SP_i pays to CP under static revenue sharing contract. Dynamic revenue-sharing contract defines flexible portion of revenue that SP pays to the CP, depending on SP's retail price. Portion of SP_i's revenue paid to CP under dynamic revenue sharing contract can be expressed as follows:

$$\Phi_i^d = \left(1 + \Delta p_i\right) \cdot \Phi_i^s \tag{4}$$

In this equation (4), Δp_i presents variation of SP_i's retail price p_i. Thus, revenue of SP_i from provisioning content to the customers and CP's revenue under dynamic revenue sharing contract can be, respectively, written as follows:

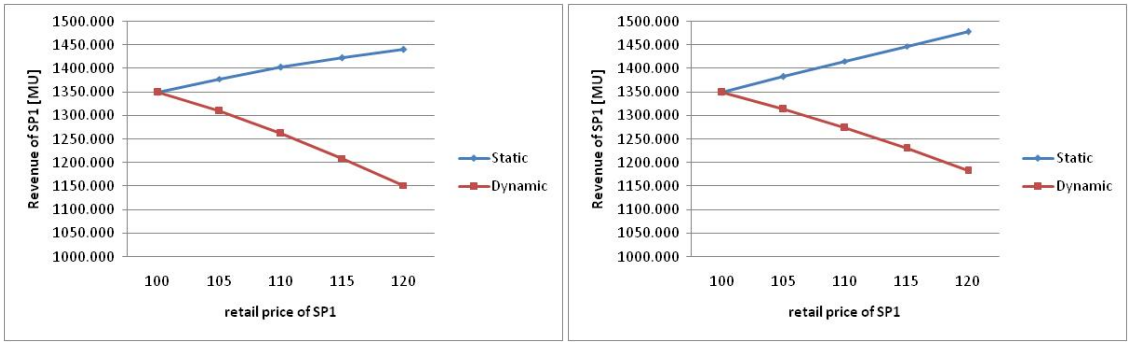
$$R_i^{\ d} = \left(1 - \Phi_i^d\right) p_i w_i r_i X, \tag{5}$$

$$R_{CP}^d = \sum_{i=1}^{N} \Phi_i^d p_i w_i r_i X \tag{6}$$

4. NUMERICAL EXAMPLE

Let us consider the situation in which revenue sharing contracts have been applied to a single CP and two SPs on the retail level. CP offers a single content and negotiates with SPs on the portion of revenue that has to be paid on the revenue sharing basis. We assumed that one SP is new entrant in the observed market, thus having lower reputation factor than other. Regarding customers' price sensitivity, we assumed two scenarios. The first scenario refers to the situation when SP1 increases its price up to the level of SP2's retail price, while SP2 remains retail price. The second scenario describes price reduction by the SP's offering higher retail price. This situation is common when promotions and discounts are being applied. Values for parameters in the expression for customers' willingness to pay are specified according to assumed market situation. We assumed that values of relevant factors for calculation of revenues are the following: $X = 200000$, $\Phi_i^s = \Phi^s = 0.5$, $p_1 = 100, p_2 = 120$, $r_1 = 0.3$, $r_2 = 0.7$. All obtained revenues are expressed in monetary units [MU].

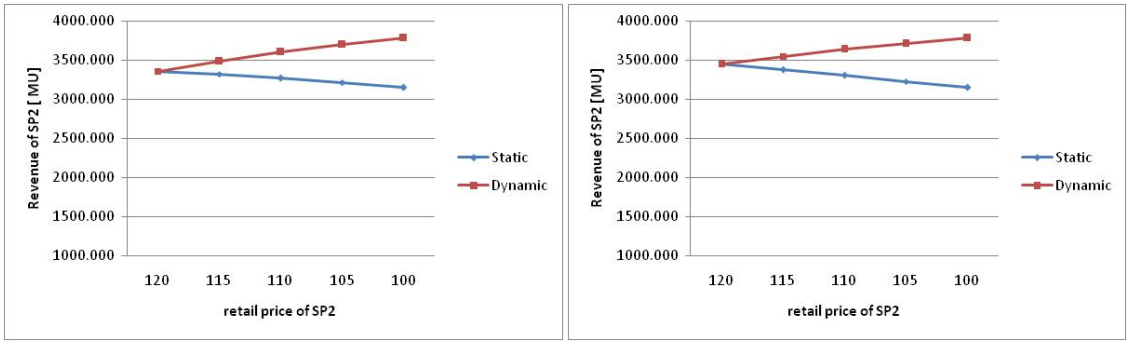
Figure 3 presents revenues of SP1 under static and dynamic revenue sharing contracts, for more sensitive customers, when SP1 increases its retail price, while SP2 remains its price at the same level. Maintaining SP2's retails price keeps its revenue the same. It can be noted that static revenue sharing increases SP1 revenue, while dynamic reduces for both more and less price sensitive customers. Hence, under dynamic revenue sharing contract, SP1 has no incentive to increase its retail price.



(a) (b)

Figure 3. Revenues of SP1 when retail price varies for (a) more sensitive customers, and (b) less sensitive customers

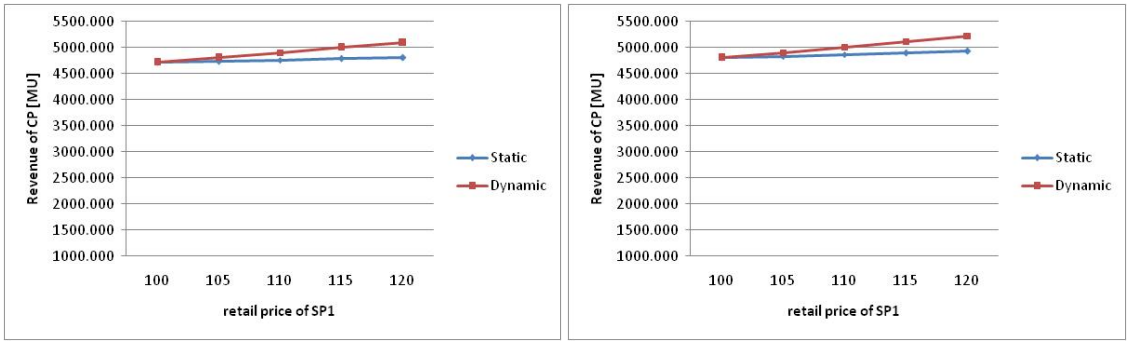
Figure 4 presents revenues of SP2 when its retail price decreases until it reaches level of SP1's retail price. For both more and less sensitive customers, dynamic revenue sharing contract enhance SP2's revenue. SP1 maintains its revenue, since there was no price variation.



(a) (b)

Figure 4. Revenues of SP2 when retail price varies for (a) more sensitive customers, and (b) less sensitive customers

Retail prices enhancement ensures greater revenue for CP. However, it leads to reduction of customers' willingness to pay and reduction of market share in long term. Also, price variation must be in accordance with price regulation in force. Dynamic revenue sharing contract ensures higher revenue in comparison with static, as shown in Figure 5.



(a) (b)

Figure 5. Revenues of CP when SP1 retail price increases for (a) more sensitive customers, and (b) less sensitive customers

SP2's price reduction leads to the reduction of CP's revenue for both static and dynamic revenue sharing contract, as well. This situation is shown in Figure 6 for both observed types of customers. Static contract ensures greater revenue in comparison with dynamic.

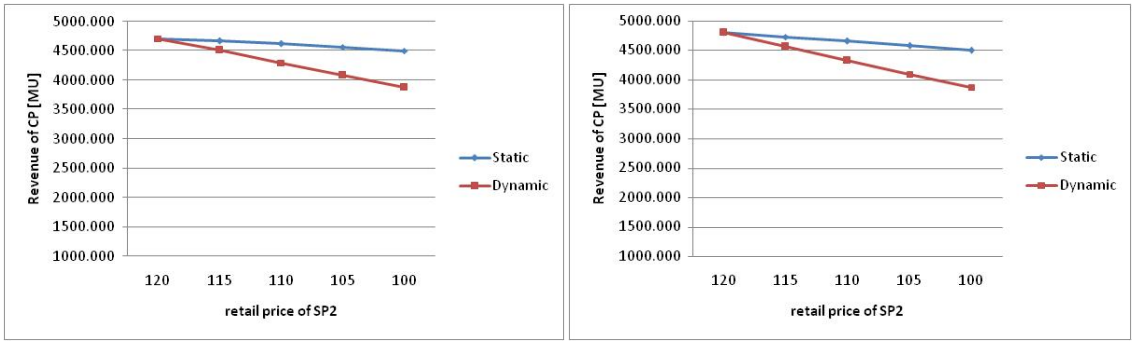


Figure 6. Revenues of CP when SP2 retail price decreases for (a) more sensitive customers, and (b) less sensitive customers

5. CONCLUSION

This paper analyses characteristics of telecommunications supply chains and possibility of application of revenue sharing contract for supply chain coordination between Content Provider and Service Providers on the given market. Two types of contracts are observed, static and dynamic. The former establishes fixed portion of revenue that Service Provider pays to Content Provider. The later depends on retail price and involves fixed portion of revenue that SP pays to CP, but involves variable part which reflects retail price variation. The aim of dynamic revenue sharing contract is to enlarge customer base by price reduction, and thus improve market position. Regarding price sensitivity, two types of customers are observed, more and less price sensitive. For all analysed scenarios, dynamic revenue sharing contract satisfies given goals. Our further research in this field will be directed towards introduction of competition at the Content Provider level, and introduction of content differentiation through content popularity distinction, as well.

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