Using beta regression to explore the relationship between service attributes and likelihood of customer retention for the container shipping industry

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\textbf{A B S T R A C T}

This study segments container shipping market by analyzing the relationships between service attributes and likelihood of customer retention for the container shipping industry and find: (1) service quality, as a partitioned variable, separates the overall model into five sub-models having different functional relationships, (2) the attributes of price and discount, personal selling and customer relationship have significant impact on likelihood of customer retention, (3) satisfactory price and discounts are a necessary attribute to support the likelihood of customer retention, and (4) satisfactory personal selling is the most important attribute for increasing the likelihood of customer retention.

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\section{1. Background and objectives}

In order to achieve economies of scale and improve fuel efficiency, the construction of mega-vessels is a current trend for the container shipping industry. Most container carriers deploy this strategy by constructing ultra-large container vessels (ULCVs), having a capacity over 18,000 or 21,000 TEUs. The Boston Consulting Group predicts that there will be a 30% increase in container shipping capacity by 2019 (Dupin, 2015). In the meanwhile, the slow growth of the global economy since 2009 will exacerbate the container carriers’ business environment. As economic and regulatory incentives continue to encourage individual owners to invest in modernizing their fleets, this would lead to further global oversupply, continuing the downward pressure on the pressure on freight rates, even though older tonnage is continuously being decommissioned (UNCTAD, 2015). Since the early 2016, the container shipping market experiences a serious recession in terms of the freight rates at record low level. Consequently, in a survey covering 15 publicly traded carriers, a 3% revenue decrease was noted from 2012, and in 2014, industry revenue remained more than 16% below its 2008 peak of more than $200 billion (UNCTAD, 2015). In particular, Hanjin Shipping filed for bankruptcy protection Aug. 31, 2016. Freight forwarders also suffer from the price-cutting programs since they organize shipments for individuals or corporations and act as experts in the logistics network for a profit based on the shipping cost (Chen et al., 2009).

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In contrast, shippers are benefiting from rate wars as carriers cut their rates to fill the seemingly bottomless pit of capacity. Carriers and freight forwarders, however, are not getting the full benefit of lower slot costs unless they can fill the slots. Moreover, if container shipping companies and freight forwarders adopt unprofitable low-cost strategies such as lower investment in human capital, their market share will deteriorate even more dramatically. Instead of rate cutting, an alternative, that container carriers should consider, is to segment their market and to adopt integrated shipping marketing activities to create, communicate and deliver benefits, including products, service, personnel and image in order to retain their current customers (Kotler and Keller, 2012).

Segmenting market accurately is helpful for the container shipping companies to understand the needs of customers in each target markets and to make suitable marketing strategies to retain their customers. Customer retention can be defined as customers' stated desire for continuation of their business relationship with their current firm (Kotler and Keller, 2012). Customer retention is more important than acquiring new customers for the container shipping industry since it costs about 5 times more to acquire a new customer than it does to retain an existing one (Kingwill, 2015; Kotler and Keller, 2012) and firms are better at maintaining customers based on their profit potential than acquiring customers (Johnson et al., 2012). As a consequence, the container shipping companies should integrate their efforts to develop different marketing strategies to provide customer-tailed service in different market and thus reduce the risk of customer churn. Since carriers and freight forwarders are in the same situation in this environment, this paper analyzes exclusively the opinions of shippers, who regularly use the services of container shipping companies for their exporting and/or importing activities.

This paper employs a beta regression tree approach to segment container shipping market by exploring the relationships between the shipping marketing activities and the Likelihood of a customer Not Churning to a new service provider (LNC). Because the LNC should be restricted to the unit interval (0,1) and its distribution is likely to be asymmetric, thus ordinary least square regression (OLS) would not be a proper method for establishing a model to analyze the likelihood of LNC.

Instead, the logistic regression technique seems to be a good candidate for predicting the LNC. Karp (1999) and Mutanen (2006) have advocated using the logistic regression technique to predict customer retention. The logistic regression technique, however, requires the dependent variable to be binary, which may result in the loss of much information when the scale of a dependent variable is not binary. Reducing an ordinal or even metric variable to a dichotomy loses a great deal of information. Although an ordinal multinomial logistic regression model can consider ordinal dependent variable, it is difficult to be used to segment market and to deal with the problems of heteroscedasticity or the issue of heterogeneity between groups/clusters of observations. In contrast, the beta regression tree method can consider all the problems mentioned above. Consequently, the beta regression tree method will be employed in this paper.

To the best of the authors' knowledge, neither the application of beta regression tree nor the subject of consumer retention has been studied in transportation research, particularly in the container shipping industry. Based on the merits of the beta regression tree method, the relationships between service attributes and LNC are easily obtained for container shipping companies to develop appropriate policies for retaining their existing customers. It cannot only assist container shipping companies and marketing practitioners in developing their customer retention strategies and in setting marketing programs to target more specific groups of customers, but also can contribute to academic research on container shipping management by recognizing the breadth and interdependencies within the relationships between service activities and customer retention.

2. Theoretical background and hypothesis development

Market segmentation is the process of dividing a business market into sub-groups of consumers based on some type of shared characteristics. The contemporary marketing, using technological advancements allows marketers to communicate to individual consumers or very small groups. For improving the customer value perception to retain customers, attitude to service, e.g. price conscious or quality conscious, would be a good tool used to separate container shipping market. One approach to measure customer attitude to company is LNC (Chen et al., 2015). The increased competition mentioned in above section means that marketing divisions must understand customer value perception and adopt integrated marketing activities to prevent a higher risk of customer churn.

Although some B2B predictive customer churn models are apparent in literature (e.g., Gordinia and Veglio, 2016; Jahromi et al., 2014), there has little previous research on customer churn in the field of container shipping management, apart from Chen et al. (2015), though they focused primarily on the prediction of new customer acquisition. Integrated marketing means that the marketer devises marketing activities and assembles marketing programs to create, communicate, and deliver customer value, which can be defined as a set of benefits that satisfy customer needs (Kotler and Keller, 2012). With integrated marketing philosophy as the context, we can identify a specific set of marketing activities (or service attributes) that create customer value and support customer retention. Accordingly, this paper investigates how elements of (1) value creation including constructs of service activities and price and discount, (2) value communication includes constructs of customer relationship management (CRM), personal selling, advertising and word of mouth, and (3) value delivery including CRM affect LNC (Töytäri and Rajala, 2015). The relationship of service activities and customer value creation is presented in Table 1.

Customer value is a critically important marketing concept, and customer value perceptions increase with quality and service but decrease with price (Kotler and Keller, 2012). Before managing LNC, managers should understand what factors
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