



Optimizing Profits at Sea:

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Optimizing Profits at Sea: A Comprehensive Investigation of Dynamic Pricing's Impact on Liner Shipping Revenue Management

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ABSTRACT:

In the last few years, liner shipping companies have faced unstable freight prices due to a highly volatile market and increasing fuel prices. Dynamic pricing implementation emerged as an effective solution to balance extreme volatility in freight pricing. Our study aims to implement dynamic pricing in the liner shipping industry as well as we developed a two-staged model to examine the benefits of dynamic pricing on the profit margin of liner companies. For this, we used a perfect price discrimination policy to integrate the dynamic pricing concept with the pricing model. The outcomes of our model revealed that, by adopting perfect price discrimination policy liners may achieve higher profit, enhance market visibility, and provide superior service level to the customers. Finally, our results presented that, dynamic price implementation has an incredible contribution to disruption management of the liner shipping industry.

KEYWORDS:

Dynamic Pricing; Perfect Price Discrimination Policy; Game theory; Liner shipping industry; Revenue Management

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EXTENDED ABSTRACT:

- Motivation and Objectives:

Revenue Management techniques are well established in airline service sector whether, RM techniques are not so popular in liner shipping industry. Regarding this, report of AAU research identified some prerequisite business conditions for liner shipping companies to implement revenue management; such as determining proper segmentation of customers who are possibly willing to pay different freight prices for the same journey, identifying stochastic demand over booking period, controlling flexible vessel capacity, minimizing high fixed cost and small variable cost ([Pricing and Revenue Management in Liner Shipping \(aau.dk\)](#)). *Therefore, this study aims to explore how business strategies and business models, practiced in the area of pricing and revenue management (RM) initiated in Airline industries and Hotel industries, can be developed for container shipping services.*

Further, Dynamic pricing strategies for container liner shipping revenue management are rarely found in academics as well as business literature (Lee and Song, 2017). Difficulty to select real time freight prices and allocation of prices among shipping companies and freight forwarders are identified as the probable reason for that container liner shipping services cannot adopt dynamic prices for the slot capacity booking. Recently, after gradual abolition of conference system, liner shipping companies modify their freight rates at each stage before every voyage which represents dynamic pricing practice. Meng et al. (2019) presented that identification of customers' willingness to pay to the freight pricing policy of the liner services as one of the significant tasks of dynamic pricing implementation. The authors also suggested to explore the relationship between ship capacity demand and dynamic pricing strategy. Moreover, authors proposed to examine different consumers different reaction to changes in freight price strategy. In addition, authors motivated to study dynamic pricing policies integrated with the decision about the ship capacity control mechanism. *Therefore, this study aims to present how liner shipping companies can adopt dynamic pricing strategy in order to make higher revenue.*

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However, now a day's dynamic pricing strategy implementation has gained considerable attention in shipping service industries and becomes trending research topic. In this regard, few examples can be found such as, AAU with the collaboration of business partners Ange optimization and Maersk line conducted project research on pricing and revenue management of liner shipping from 2011 to 2014 and suggested to adopt dynamic pricing as tactical RM decisions and identified some prevailing business conditions ([Pricing and Revenue Management in Liner Shipping \(aau.dk\)](#)). Further, Emtec Digital presented detailed about importance of dynamic freight pricing in their blog series. The blog highlighted that increasing fuel price acts as a crucial dynamic factor that influence freight price highest. For example, Russian invasion in Ukraine significantly impact on international oil market. Therefore, volatile fuel price forces carrier services to hike freight price to maintain profit margins. Therefore, dynamic pricing adaptation has been chosen as an emerged solution to balance pricing across extreme volatile market ([The Dynamics of Dynamic Freight Pricing: What, Why, How \(emtec.digital\)](#)). *Therefore, this research article presented the dynamic pricing strategy implementation in liner shipping industry and examined how the flexible freight prices boost revenue for the shipping companies.* Further, the following research questions have been addressed in the present study:

1. Can liner companies charge different freight prices to the different customer segments (first-degree price discrimination) to implement a dynamic pricing strategy? And

2. What is the impact of dynamic pricing on revenue of container shipping companies?

- Methodology and data:

In this study, we focused on developing revenue model by considering implementation of dynamic pricing policy in both contractual and spot market. Hence, we start our analysis by estimating entire profit of liner before implementing price discrimination strategy in contractual market. Further, we determined profit from spot market for practicing price discrimination. Then, we presented the scenario for liners to implement price discrimination in contractual market like spot market. Afterward, we estimate overall payoff of liner for both contractual and spot market after implementing price discrimination (where liner charges different customers different prices for the same set of products (for liner companies' "product"

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is fleet capacity offered for shipping commodities)). Finally, we presented the impact of dynamic pricing on disruption management. Figure 1 presented the research methodology of the present study.

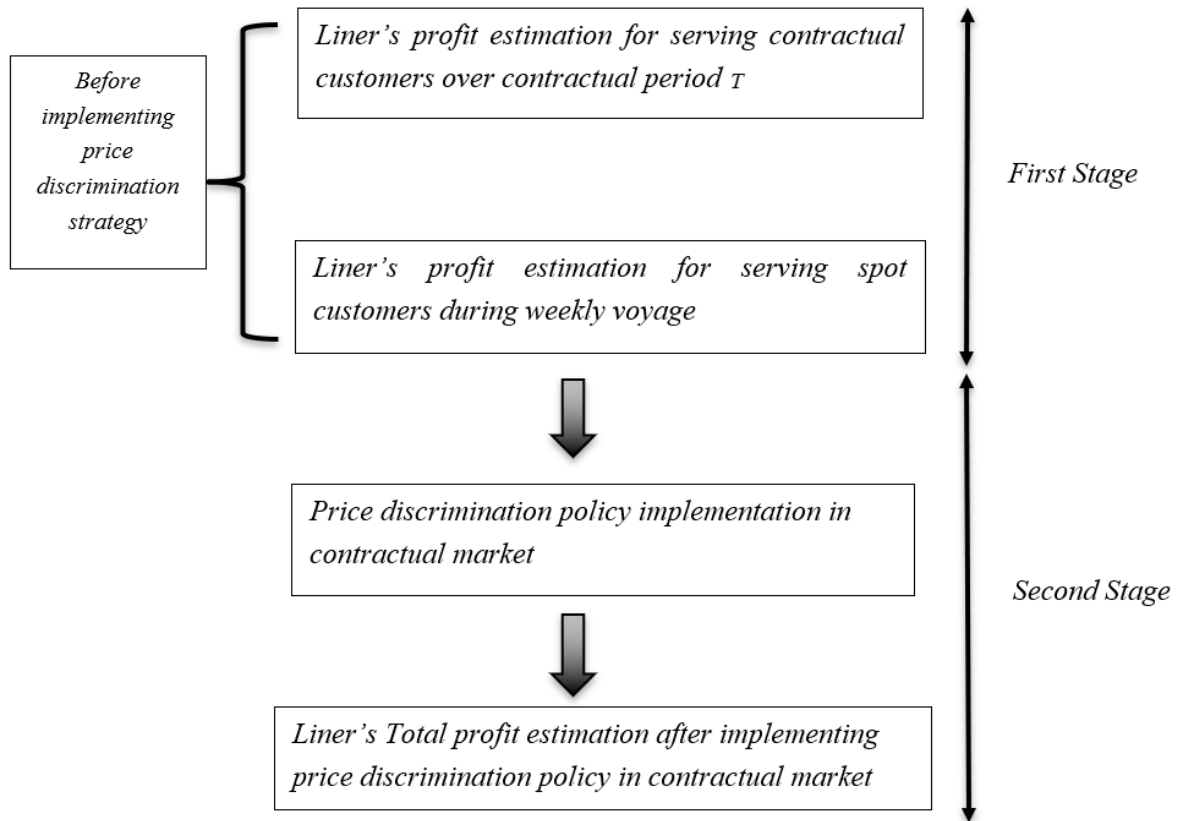


Figure 1: Research Methodology of the study

In this first stage, before implementing price discrimination policy, we employed Monte Carlo simulation in order to estimate the weekly profit generated from contractual segment. For the contractual period, freight price and total shipping quantity were pre determined but weekly shipping quantity from contractual segment is uncertain. Hence, Monte carlo technique has been used to estimate weekly profit while shipping quantity is unknown to liner companies. Again, we assumed dynamic pricing has already been used in spot market and accordingly estimate profit.

In the second stage, perfect price discrimination strategy has been developed in contractual segment. Further, total profit has been determined after implementing new pricing

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policy in the contractual segment. Henceforth, the contribution of this article to the literature is as follows:

First, this study determined freight price for both contractual and spot customers by considering different types of containers; *Second*, freight price for dynamic pricing policy has been formulated considering customers' willingness to pay ; *Third*, customers' sensitivity to the freight pricing has been considered; *Fourth*, this study also considered dynamics of demand for shipping amount. Finally, how dynamic pricing implementation can reduce the negative impact on operational, strategic, and tactical decisions of liners during disruption have been presented.

- Key findings and implications:

The analysis of this article presents that, in the presence of dynamic pricing strategy liner companies make higher profit by implementing first degree price discrimination. However, it can be seen, from the outcome that the liner services who unable to implement first degree price discrimination also got benefits from other's dynamic pricing strategy implementation. While, major numbers of liner services adopt new pricing strategy (dynamic), entire market intends to change according to them for absorbing maximum surplus. Again, this study presented that, for the first-degree price implementation contractual customers lose their bargaining power. Further, it can be observed that first-degree price discrimination can upsurge the freight price for both contractual and spot customer segments and endogenously improve revenue management of entire container liner shipping sector.

In our study, we presented perfect price discrimination (PPD) as dynamic pricing strategy implementation in contractual market in order to improve tactical revenue management. Conventionally, monopolist uses PPD in order to achieve higher revenue. However, in our study we tried to implement PPD for oligopoly market condition. We developed a two-stage model in order to seek our research question. In the first stage, we formulated the scenario before implementing perfect price discrimination in contractual market and in the second stage we formulated the scenario while a single liner in oligopoly system intended to implement PPD in contractual customer segment. During the first stage, we formulated payoff function of liner in contractual customer segment by following oligopoly market pricing decision and payoff

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function of spot market by following PPD policy (as PPD has already been practiced in spot market). Later, we compared payoff generated from contractual market and spot market at the end of first stage and the result revealed that spot market generates more profit for liner for weekly voyage. Motivated from this outcome, in the second stage we presented the scenario while liner tried to implement PPD in contractual market likewise spot market. Finally, at the end of the second stage we presented comparison between entire payoff generated before and after implementing PPD in contractual market. Finally, we focused on seeking answer of our second research question.

In the first stage of the model, we found spot market generates higher profit than contractual market for weekly voyage. However, this outcome leads to PPD implementation in contractual market in the second stage of the model. In the second stage, we divide contractual customer segment into three following segments: loyal contractual customers, contractual customers who prefer to book other liners service and switch contractual customers who prefer low booking rate. We formulated freight price under PPD policy by considering willingness to pay of all three contractual customers segment. We found some interesting insights from the outcomes. First, liners who are able to identify loyal contractual customer segment should implement PPD policy; Second, even small loyal contractual customer segment size generates enough profit for liners; Third, after implementing PPD policy in both contractual and spot market liner earns higher profit than before; Fourth, PPD policy practicing liner become barometric price leader of the market; Fifth, pricing of entire shipping market has become uplifted; Sixth, we have found liner may successfully implement PPD policy in oligopoly contractual market in the presence of loyal customer segment in order to answer the first research question. Finally, we can conclude with our final findings (answer of second research question) that by implementing PPD in both contractual and spot market segment liner companies may easily cope up with the adverse situation during disruptions with the raised freight price structure.

Outcome of our research will support liners to set freight price in the context of dynamic pricing. Perfect price discrimination is a pricing strategy that will help liners to fix right price for the right customers based on their willingness to pay. Therefore, our research will guide

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liner companies to incorporate PPD policy in their pricing model in order to implement dynamic pricing.

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