Managing sales return and channel coordination in dual channel supply chain
（二路線サプライチェーンの返品とチャネル調整の管理に関する研究）

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This dissertation deals with dual channel supply chain (hereinafter DCSC) is a modern business approach consisting of incumbent conventional stores and newly introduced online facility as the outlet channel for a central warehouse of a manufacturer. Its main purpose is to reach online market as the extension to the conventional offline business. Amid of its benefits, such kind of supply chain (SC) exploration also comes with its disadvantages. Two prominent challenges are sales return since online sales is incorporated in DCSC; and channel coordination because of internal competition between conventional store and online facility. These two problems are the main focuses of this dissertation in order to give theoretical and practical DCSC advancements.

Those two elicited problems of DCSC are presented into two parts in this dissertation. First part addresses the issue of managing sales return which is very prompt in almost all online sales. Three chapters are incorporated, namely the importance of product substitution, performing cross-channel return inlet, and resale in dual channel supply chain elaborated in chapter 2, 3 and 4 respectively. Second part explores the coordination problems in making the operation of DCSC becomes more effective and seamlessly. This part consists of the usage of profit sharing to coordinate DCSC and the role of coalition in such structure, each are discussed in chapter 5 and 6 respectively. In addition to give the main direction of the history, current advancement and future research direction of DCSC, chapter 1 describes a literature review result on numerous and various papers in the area of DCSC. Based on such outline, this dissertation incorporates both qualitative and quantitative approaches to counter DCSC sales return and coordination challenges.

Chapter 1 reviews a number of researcher efforts for various aspects of DCSC amelioration. These endeavors have been existed for more than a decade since DCSC introduction phase until recent expansion. Hence, it has been appropriately adequate to take a look back the history, measure current performance and predict the future trend. This chapter conducts a comprehensive paper review and presents the result in this work. It is started with a delineation of DCSC emergence and its metamorphosis. Then, two important properties are exploited. The first aspect is DCSC typical problem brought forward, either upstream or downstream SC problem. The second one is research model, either conceptual or analytical model. These properties are analyzed both individually and combinatorially and provide the result in a set of descriptive representations. Based on this result, a list of interesting but still not-yet researched DCSC topics are provided. By referring to this review, the dissertation author and other corresponding scholars might benefit in dealing with their future research topic to continue contributing the betterment of DCSC.

Chapter 2 considers the issue of managing sales-return in DCSC. The online-transaction in this structure still needs further investigation since its mismanagement may threaten the whole
channel's profitability. In responding to this issue, two models describing DSC structure altogether with return mechanism is composed. The first model, namely benchmark model, is composed based on a concept of considering sales returns as lost-sales. To defy this model, an online facility return model, which represents the availability of DSC chain to substitute online customer's return for better conformity, is also constructed. By comparing considered decision variables which provide the optimum value of total or partial profit within these two models under Bertrand and Stackelberg leader schemes, some fruitful and beneficial insights for managing DSC with its return functionality are gained. Leaning on this outcome, DSC managers will have a reliable theoretical grip in determining their DSC with consideration on sales return decisions.

Chapter 3 examines the financial benefit in performing two kind of sales return (online sales claim because of non-conformity) scenarios under dual sales channel structure. The first scenario mimics a strategy of meeting such claim through one designated online facility. The second one represents a re-fulfillment process involving a conventional store as channel counterpart (cross channel return) so that complaining customer preference might be accommodated better. In addition, two kind of pricing decision making processes are evaluated, namely Bertrand scheme for simultaneous process and Stackelberg leader scheme for leader-follower consideration one. The result shows that central warehouse and its online facility (leader) prefer to apply scenario 2 using Stackelberg leader scheme, while conventional store (follower) experiences better profit under first scenario and Bertrand scheme. However, the first scenario always performs better than the second one in the view point of total channel profit. Further fruitful management insights are also provided in the analysis section of this paper.

Chapter 4 proposes a dual sales channel supply chain scenario of primary-market resale. This strategy deals with re-offering sales return to the same market in which the original sales takes place. Such scenario defies the commonly used secondary market resale scenario which offers sales return to a different, low-price but high acceptance market. Undertaking primary market resale takes the opportunity to maximize the resale value even though the risk of original sales decrease comes along with it. In addition, to mimic the practical pricing process done by DCSC managers, our model is equipped with Bertrand scheme of simultaneous price and Stackelberg leader scheme of the opposite step-by-step procedures. The result shows that proposed scenario provides higher total profit. However, some settings may shift the scenario to become better one another.

Chapter 5 elaborates profit sharing in coordinating dual sales channel supply chain. Besides of its potential, DCSC also comes with its inner-competition between channels. This situation leads to the necessity of an effective coordination mechanism. This chapter proposes an approach of profit sharing based on an adjusted-Stackelberg-equilibrium result on DSC prices. The proposed approach is simply practical unlike the complicated full-coordination of Bertrand scheme but is able to offer higher total DSC profit than the original Stackelberg scheme. The numerical analysis has successfully shown that the profit sharing mechanism provides a "win-win solution" for both the leader and the follower in increasing their individual profits. This fact leads to the conclusion that this coordination mechanism is very promising to be applied in
finding a compromise solution between the dichotomies of global optimum but unpractical in *Bertrand* scheme and practical but still unsatisfactory result of *Stackelberg* scheme.

Chapter 6 views the role of coalition id DCSC. This chapter deals with a price-contract coalition under dual-channel supply-chain (DCSC) structure between a weaker conventional store and online/direct channel facility while leave the stronger conventional store outside the coalition. The objective is to leverage both individual and total channel profits based on common strategy under pure *Stackelberg* equilibrium. The experimental results show that our proposed method performs better than the common practice. In addition, it is also revealed that the win-win-solution can be obtained when the customer has balanced preference to shop online and online.

Chapter 7 wraps up the conclusion of this dissertation. Mainly it is described in two terms, namely theoretical contribution for academician utilization in performing their current/future researches and practical implication for DCSC managers in having underlying direction prior to their DCSC decisions.