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How to Coordinate Supply Chain Under O2O Business Model When Demand Deviation Happens

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Abstract

In this paper, a supply chain consisting of one supplier and multiple O2O retailers is studied. The supply chain is coordinated under the revenue-sharing contract in the static case. Disruptions make the price sensitivity coefficient change after the production plan is formulated. In centralized supply chain, the supplier only needs to adjust the retail price if the disruption is in a certain range. When the disruption is large enough, what the supplier needs to do is adjust the retail price and the production quantities. In decentralized decision, the supply chain cannot be coordinated. This means that the original revenue-sharing contract cannot coordinate the disrupted supply chain. An improved revenue-sharing contract is used to coordinate the disrupted supply chain. The research shows that the improved contract can coordinate the original supply chain and the disrupted supply chain, which means that the contract has robustness when facing demand deviation.

Key words: Supply chain coordination; O2O business model; Sales channel; Demand deviation; Revenue-sharing contract

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INTRODUCTION

The e-commerce market grows rapidly in recent years. E-commerce market in Europe is a mature market and evolves constantly. The "e" in e-commerce is disappearing. Differences between online retail and shopping at bricks-and-mortar shops disappear because all purchases will be realized by omni-channel retailing (Amanda, 2013). According to some statistics, e-commerce transactions in China will be $540 billion in 2015 and Chinese e-commerce market will be larger than those of the US, Britain, Japan, Germany, and France combined in 2020 (Snoek, 2014).

O2O (Online to Offline/Offline to Online) business model, a new kind of business model, is put forward by some innovative enterprises. However, O2O business model is not well defined in the academic world and different e-commerce companies may have different ideas about the business model. Many manufacturers and retailers begin to integrate their supply chains by constructing their own online shops and offline experience shops. For example, Metersbonwe, a fashion manufacturer in China, improves consumer's shopping experience by constructing his online and offline shops. Tmall, an e-retailer subordinated to Alibaba, begins to cooperate with Yintai Department Store in 2013. Many e-retailers in China become O2O retailers when they improve their customers' shopping experience and communicate with their customers. E-commerce companies such as Taobao, Tmall, Jingdong Shopping Center and Suning Easy-shopping are O2O retailers.

However, disruptions such as natural disasters, terrorism attacks, major public health events, financial crisis, machine faults and strikes may affect business operation and supply chain management. An originally-coordinated supply chain cannot be coordinated because of some disruptions, and the survival of the supply chain members can be influenced by other disruptions. For example, a large number of airports in the United States were forced to close because of "9 • 11" terrorism attacks. Raw material supply in many companies all over U.S.A. was delayed because of the accident. Some supply chains are almost damaged due to this disruption and it results in a heavy loss. Large companies like Ford are also influenced by disruptions. Supply of engines and drive parts of Ford suspends for a long time due to the slow response of its procurement system, which makes five companies affiliated with Ford in North America close temporarily.

Disruptions will make market demand change greatly. For example, the spread of foot-and-mouth disease makes the demand for beef in Europe decrease dramatically, which affects the operation of the beef supply chain in Europe. The demand for tents and moving shelters increases dramatically in the disaster areas after the Wenchuan Earthquake, 2008, and a lot of enterprises manufacturing tents have to work overtime in order to meet the demand, which affects the operation of their supply chain system. Recently, with the development of e-commerce, online shopping is widely spread all over China. Customers buy what they want online and evaluate the products after they receive them offline. According to some statistics, total sales volume in Tmall is about 57 billion RMB in 11th November, 2014, which has great impact on the online and offline supply chain system. The O2O retailers need to preorder a large number of products in order to meet the coming huge demand and the logistics system is greatly influenced by logistics activities such as purchasing, storing, transporting and distributing.

As can be seen above, supply chain members' behavior, total supply chain profit and the survival of enterprises in supply chains can be affected by disruptions. The impact is so serious that it is necessary to study the strategy about how to coordinate supply chains when facing disruptions and this has been paid much attention by many companies and academic world.

A supply chain consisting of one supplier and multiple O2O retailers is studied in this paper. The rest of this paper is organized as follows. The related researches are reviewed in Section 2. Benchmark model is established in Section 3. Section 4 coordinates the centralized supply chain with demand deviations. How to coordinate the decentralized supply chain with demand deviations is studied in Section 5 and an improved revenue-sharing contract is presented in this section. Section 6 concludes this paper and some possible research opportunities in the future are also discussed.

1. LITERATURE REVIEW

Present studies in O2O e-commerce model mainly focus on recommendation system and how to improve network service. Tsai (2013) finds that O2O business model helps retailers to learn more about their customers through present social network data. Chen (2013) shows that the service improvement in recommendation system can increase the number of online consumer and consumers can buy products containing more service in offline channel. Hsieh (2014) puts forward a BP neural network algorithms based on location, time, budget and other factors, which are used to match customer's demand under O2O business model.

Other researches related to O2O business model come from researches in marketing. Hong (2013) examines how to promote agricultural production and marketing by utilizing Quanzhou Agricultural O2O E-Commerce Platform. O2O business model in Wanda Group, a company in China, is analyzed by Zhao (2014). Du (2014) studies how to improve offline service quality under Chinese O2O business model.

Another kind of study related to this paper is known as disruption management. The concept "disruption management" is firstly put forward by Clausen (2001). It is used to solve the operations of Continental Airlines when it faces emergency. A two-stage supply chain with demand disruption is studied by Qi (2004) and Huang (2006), and quantity discount contract is used to coordinate the supply chain. Giannoccaro (2004) studies a three-stage supply chain coordination by using revenue-sharing contract. Xu (2006) studies a kind of supply chain coordination problem when the production cost function is a convex function. Xiao (2005, 2008) studies a supply chain with one-manufacturer and two-retailers when the demand disruption occurs and extends the study of a more complex problem in which there exists competition between the two retailers. Lei (2012) examines how to coordinate a two-stage supply chain under asymmetric information with a linear contract when demand and cost disruptions happen.

Compared with previous studies, there are some differences in this paper. Firstly, it analyzes a supply chain under O2O business model, a new kind of supply chain. Secondly, the discussion in this paper is different from Qi (2004) and Huang (2006). We analyze the impact of the price sensitivity coefficient on a more complex supply chain. Thirdly, this paper examines the role of the revenue-sharing contract to supply chain coordination.

2. BENCHMARK MODEL

This paper studies a supply chain consisting of one supplier (she) and multiple O2O retailers, in which the supplier is the price leader and the O2O retailers are the price followers. The transaction between the supplier and the retailers is done under symmetric information. It means that the supplier knows each retailer's cost structure and profit function, and vice versa. The supplier sells a kind of short-life-cycle product to each retailer according to the production plan which is based on market forecast. Each retailer sells the product online and customers receive the product offline. The retailers decide whether or not to buy the product according to the revenue-sharing contract with the supplier offers.

Suppose that p_i is the retail price and the demand function that the i-th O2O retailer faces is an exponential function, i.e., $d_i = D_i e^{-k_i p_i}$ (i = 1, 2,...,N). D_i is the market scale in the i-th market and c is the supplier's unit production cost. Each retailer's unit cost of using his e-commerce platform and his unit distribution cost are zero. p_i is the unit retail price in the i-th market and $k_i(k_i>0)$ is the price sensitivity coefficient in the i-th market. Q_i is the real demand at the retail price p_i. Then, the demand function is $Q_i = D_i e^{-k_i p_i}$ and the retail price is $p_i = \frac{1}{k_i}\ln\frac{D_i}{Q_i}$. The number of O2O retailers is N. The total profit of the supply chain system is

$$f^T = \sum_{i=1}^{N} Q_i(\frac{1}{k_i}\ln\frac{D_i}{Q_i} - c) \ . \tag{1}$$

From the first-order condition, we obtain that the optimal retail price in each market is

$$\overline{p}_i = c + \frac{1}{k_i} \ , \tag{2}$$

the optimal production quantity in each market is

$$\overline{Q}_i = D_i \exp\{-(1+ck_i)\}, \tag{3}$$

and the optimal supply chain profit is

$$f^T_{\max} = \sum_{i=1}^{N} \frac{1}{k_i} D_i e^{-(1+ck_i)} \ . \tag{4}$$

Lemma 1. *If $f_s(Q)=(1-\phi)\cdot f^T_{\max}$ with $0<\phi<1$ or $f_r(Q)=(1-\phi)\cdot f^T_{\max}$ with $0<\phi<1$, the supply chain system composed of one supplier and N O2O retailers can be coordinated under the revenue-sharing contract, where $f_s(Q)$ is the optimal total profit of the supplier and $f_r(Q)$ is the optimal total profit of the N O2O retailers.*

PROOF. When $W=\phi\cdot c$ $(0<\phi<1)$, the supplier's profit function under the revenue-sharing contract (W, ϕ) is shown below, where $f_{si}(Q_i)$ is the profit from the i-th O2O retailer and $f_{ri}(Q_i)$ is the i-th O2O retailer's profit.

$$f_s(Q) = \sum_{i=1}^{N} f_{si}(Q_i) = \sum_{i=1}^{N}(1-\phi)p_i Q_i + (W-c)\sum_{i=1}^{N} Q_i = \sum_{i=1}^{N}(1\text{-}\phi)(p_i\text{-}c)Q_i = (1\text{-}\phi) f^T_{\max}.$$

The corresponding O2O retailers' profit function is also obtained.

$$f_r(Q) = \sum_{i=1}^{N} f_{ri}(Q_i) = \sum_{i=1}^{N}\phi p_i Q_i - W\sum_{i=1}^{N} Q_i = \sum_{i=1}^{N}\phi(p_i - c)Q_i = \phi f^T_{\max} \ .$$

Hence, the revenue-sharing contract (W, ϕ) can coordinate the supply chain (Cachon, 2005).

3. DECISION-MAKING IN CENTRALIZED O2O SUPPLY CHAIN WITH DEMAND DEVIATIONS

Some disruptions happen in the O2O supply chain after the supplier's production plan is formulated. It makes the price sensitivity coefficient change. The deviations are captured by the terms of Δk_i if and only if $k_i+\Delta k_i>0$, which ensure it has real meaning. Hence, the discussions followed are based on the conditions mentioned above.

After the deviations occur, the demand function is $d_i = D_i e^{-(k_i+\Delta k_i)p_i}$. The corresponding market scale is $Q_i = D_i e^{-(k_i+\Delta k_i)p_i}$ and the retail price is $p_i = \frac{1}{k_i+\Delta k_i}\ln\frac{D_i}{Q_i}$. To simplify the discussions followed, we put forward the following assumptions. b_1 and b_2 are the marginal costs related to the change of the market scale and $(x)^+=\max\{0,x\}$. $b_1(b_1>0)$ is the extra increased unit cost in each market due to increasing production plan and $b_2(b_2>0)$ is the extra unit disposal cost in each market due to selling the remained products in secondary market at the price lower than the supplier's marginal production cost when the supply is greater than the demand. The impact of the deviation on each market every O2O retailer faces is consistent, which means that each market reacts consistently to the deviation. That is to say, if disruption makes any market scale increase, then every market scale and the total market scale increase. If disruption makes any market scale decrease, then every market scale and the total market scale decrease. Thus, the corresponding total supply chain profit function is written as

$$f^T(Q) = \sum_{i=1}^{N} Q_i(\frac{1}{k_i+\Delta k_i}\ln\frac{D_i}{Q_i} - c) - b_1(\sum_{i=1}^{N} Q_i - \sum_{i=1}^{N}\overline{Q}_i)^+ - b_2(\sum_{i=1}^{N}\overline{Q}_i - \sum_{i=1}^{N} Q_i)^+ \ . \tag{5}$$

In order to further examine the impact of the deviations mentioned above on the original production plan, we put forward Lemma 2 below.

Lemma 2. *If the deviation of the price sensitivity coefficient occurs, we assume that Q^*_i is the optimal production quantity which maximizes the supply chain profit function shown in Equation (5). The following results hold: if $-k_i<\Delta k_i<0$, $Q^*_i \geq \overline{Q}_i$; if $\Delta k_i>0$, $Q^*_i \leq \overline{Q}_i$.*

According to Lemma 2, if $\Delta k_i<0$, then $Q^*_i \geq \overline{Q}_i$. Thus, optimizing the total supply chain profit function $f^T(Q)$ is equal to optimize the strictly concave function

$$f^T_1(Q) = \sum_{i=1}^{N} Q_i(\frac{1}{k_i+\Delta k_i}\ln\frac{D_i}{Q_i} - c) - b_1(\sum_{i=1}^{N} Q_i - \sum_{i=1}^{N}\overline{Q}_i) \ , \tag{6}$$

subject to $Q^*_i \geq \overline{Q}_i$.

If $\Delta k_i>0$, then $Q^*_i \leq \overline{Q}_i$. Thus, optimizing the total supply chain profit function $f^T(Q)$ is equal to optimize the strictly concave function

$$f^T_2(Q) = \sum_{i=1}^{N} Q_i(\frac{1}{k_i+\Delta k_i}\ln\frac{D_i}{Q_i} - c) - b_2(\sum_{i=1}^{N}\overline{Q}_i - \sum_{i=1}^{N} Q_i) \ , \tag{7}$$

subject to $Q^*_i \leq \overline{Q}_i$.

By using the methodology similar to Qi (2004) and Huang (2006), Theorem 1 is obtained which shows the optimal decisions in the centralized O2O supply chain when the demand deviation happens.

Theorem 1. *When disruptions make the price sensitivity coefficient change (the deviation of the parameters is* Δk_i*) and the demand function is* $d_i=D_i e^{-(k_i+\Delta k_i)p_i}$ *in each market, the supplier, the decision-maker in the centralized O2O supply chain, needs to adjust the optimal retail price and the optimal production quantities in order to optimize the total supply chain profit and realize supply chain coordination. According to different deviations, the optimal retail price* p_i^* *and the optimal production quantity* Q_i^* *are shown as follows:*

$$p_i^* = \begin{cases} \overline{p}_i + b_1 - \dfrac{\Delta k_i}{k_i(k_i+\Delta k_i)}, & if -k_i < \Delta k_i \le -k_i + \dfrac{ck_i}{c+b_1}; \\ \overline{p}_i - \dfrac{\Delta k_i(1+ck_i)}{k_i(k_i+\Delta k_i)}, & if -k_i + \dfrac{ck_i}{c+b_1} < \Delta k_i < -k_i + \dfrac{ck_i}{c-b_2}; \\ \overline{p}_i - b_2 - \dfrac{\Delta k_i}{k_i(k_i+\Delta k_i)}, & if\, \Delta k_i \ge -k_i + \dfrac{ck_i}{c-b_2}. \end{cases} \tag{8}$$

$$Q_i^* = \begin{cases} D_i \exp\{-[1+(c+b_1)(k_i+\Delta k_i)]\}, & if -k_i < \Delta k_i \le -k_i + \dfrac{ck_i}{c+b_1}; \\ D_i \exp\{-(1+ck_i)\}, & if -k_i + \dfrac{ck_i}{c+b_1} < \Delta k_i < -k_i + \dfrac{ck_i}{c-b_2}; \\ D_i \exp\{-[1+(c-b_2)(k_i+\Delta k_i)]\}, & if\, \Delta k_i \ge -k_i + \dfrac{ck_i}{c-b_2}. \end{cases} \tag{9}$$

Theorem 1 illustrates the following results. When disruptions make the price sensitivity coefficient in each market change, there exists robustness in the original production plan. When Δk is in a certain range, the original production plan in each market does not need to be changed but the retail price in each market needs to be adjusted in order to compensate for the extra cost derived from the disruptions. The retail price in each market is only influenced by the price sensitivity coefficient in each market. If Δk exceeds a certain range, the original production plan in each market needs to be adjusted and the retail price in each market also needs to be adjusted according to the change of the market scale. It is also shown that the original revenue-sharing contract cannot coordinate the supply chain when deviations happen and we need to adjust the contract in order to coordinate the supply chain.

4. COORDINATING DECENTRALIZED O2O SUPPLY CHAIN WITH DEMAND DEVIATIONS

In the centralized decision, when disruptions make the price sensitivity coefficient in each market change, the optimal strategy for *i*-th O2O retailer is to choose the retail price p_i^* and the procurement quantity Q_i^*. In decentralized decision, if the supply chain members sign an appropriate contract which makes each O2O retailer choose p_i^* and Q_i^*, then the decentralized supply chain obtains the optimal supply capacity which equals to the optimal supply capacity in the centralized O2O supply chain system. This means that the supply chain is coordinated in decentralized decision. The revenue-sharing contract is used to coordinate the decentralized supply chain system.

Let $S(Q_i)=b_1(Q_i-\overline{Q}_i)^+ + b_2(\overline{Q}_i-Q_i)^+$. For a given revenue allocation ratio $\phi(0<\phi<1)$, the supplier offers retailer $i(i=1,2,\cdots,N)$ an improved revenue-sharing contract in which the retail price for each retailer is $W(Q_i)=\phi(c+\frac{S(Q_i)}{Q_i})$.

Theorem 2. *In the decentralized O2O supply chain, if the disruptions make the price sensitivity coefficient in each market change, the supply chain can be coordinated by the revenue-sharing contract (*$W(Q_i)$*,* ϕ*) and the optimal total supply chain profit can be allocated in any given ratio between the supplier and the N O2O retailers.*

PROOF. For a given revenue allocation ratio $\phi(0<\phi<1)$, the supplier's total profit function under the revenue-sharing contract ($W(Q_i)$, ϕ) is shown below.

$$\begin{aligned} f_s(Q) &= \sum_{i=1}^N f_{si}(Q_i) = \sum_{i=1}^N \left[(1-\phi)\frac{1}{k_i+\Delta k_i}Q_i \ln\frac{D_i}{Q_i} + W(Q_i)Q_i - cQ_i\right] - b_1(\sum_{i=1}^N Q_i - \sum_{i=1}^N \overline{Q}_i)^+ - b_2(\sum_{i=1}^N \overline{Q}_i - \sum_{i=1}^N Q_i)^+ \\ &= \sum_{i=1}^N \left[(1-\phi)\frac{1}{k_i+\Delta k_i}Q_i \ln\frac{D_i}{Q_i} + \phi(c+\frac{S(Q_i)}{Q_i})Q_i - cQ_i - b_1(Q_i-\overline{Q}_i)^+ - b_2(\overline{Q}_i-Q_i)^+\right] \\ &= \sum_{i=1}^N \left[(1-\phi)\frac{1}{k_i+\Delta k_i}Q_i \ln\frac{D_i}{Q_i} - (1-\phi)cQ_i - (1-\phi)\cdot S(Q_i)\right] \\ &= (1-\phi)\sum_{i=1}^N \left[\frac{1}{k_i+\Delta k_i}Q_i \ln\frac{D_i}{Q_i} - cQ_i - S(Q_i)\right] = (1-\phi)f^T(Q) \end{aligned}$$

We obtain the total profit function for those O2O retailers by using the similar method mentioned above.

$$\begin{aligned} f_r(Q) &= \sum_{i=1}^N f_{ri}(Q_i) = \sum_{i=1}^N \left[\phi\frac{1}{k_i+\Delta k_i}Q_i \ln\frac{D_i}{Q_i} - W(Q_i)Q_i\right] \\ &= \sum_{i=1}^N \left[\phi\frac{1}{k_i+\Delta k_i}Q_i \ln\frac{D_i}{Q_i} - \phi(c+\frac{S(Q_i)}{Q_i})Q_i\right] \\ &= \phi\sum_{i=1}^N \left[\frac{1}{k_i+\Delta k_i}Q_i \ln\frac{D_i}{Q_i} - cQ_i - S(Q_i)\right] = \phi f^T(Q) \end{aligned}$$

Thus, the supply chain is coordinated and the optimal channel profit can be allocated between the supply chain members in any given allocation ratio by adjusting the parameter ϕ. This means that the improved revenue-sharing contract ($W(Q_i),\phi$) can coordinate the decentralized O2O supply chain. Besides, if $\Delta k_i=0$, then $b_1=b_2=0$. The supply chain profit function in this scenario equals to $f^T(Q)$ and the wholesale price is $W=\phi\cdot c$, which means that the improved revenue-sharing contract ($W(Q_i),\phi$) can coordinate the supply chain when the deviations do not occur. In other words, there exists anti-disruption ability in the improved contract.

CONCLUSION

This paper studies how to coordinate one-supplier-multiple-O2O-retailer supply chain in centralized and decentralized decisions when some disruptions make the price sensitivity coefficient change. In centralized decision, the supply needs to increase the production quantities in order to meet the enlarged market demand when the disruptions make the market demand increase. In decentralized decision, the supplier needs to decrease the production quantities in order to meet the reduced market demand when the disruptions make the market demand decrease. There exists robustness in the original production plan when making decentralized decision. In another words, when the deviations of the price sensitivity coefficient satisfy a given condition, the original production plan does not need to be adjusted and the supplier only needs to adjust the retail price in order to compensate for the deviation cost originated from the disruptions. The production plan and the retail price need to be adjusted if the deviations of the price sensitivity coefficient exceed some critical value. An improved revenue-sharing contract is used to coordinate the decentralized supply chain, which can maximize the total supply chain profit. It is noted that the results derived in this paper also illustrate the generality of the revenue-sharing contract.

There are abundant opportunities in the future. For example, it is interesting to study more complex supply chain when the information of profit and cost between the participants is asymmetric. It is worth coordinating the same supply chain system when the demand disruption and the supplier's production cost disruption occur simultaneously another direction is to study the problem which the demand function the retailer face is a nonlinear and more complex function. More complex supply chain structure with other deviations is also worth studying.

REFERENCES

Amanda. (2013, March 13). China e-commerce market to reach 30 trillion yuan in 2020. *China Internet Watch.*

Cachon, G. P., & Larivere, M. A. (2005). Supply chain coordination with revenue sharing contracts: strengths and limitations. *Management Science, 51*(1), 30-44.

Chen, Y. C., & Hsieh, H. C., et al. (2013). *Improved precision recommendation scheme by BPNN algorithm in O2O commerce.* E-Business Engineering (ICEBE), 2013 IEEE 10th International Conference on. IEEE.

Clausen, J., Hansen, J., & Larsen, J., et al. (2001). Disruption management. *OR/MS Today, 28*(5), 40-43.

Dong, L., Li, J. B., & Liu, Z. X. (2012). Supply chain contracts under demand and cost disruptions with asymmetric information. *International Journal of Production Economics, 139,* 116-126.

Du, Y. S., & Tang, Y. C. (2014). Study on the development of O2O e-commerce platform of china from the perspective of offline service quality. *International Journal of Business and Social Science, 5*(4), 308-312.

Giannoccaro, I., & Pontrandolfo, P. (2004). Supply chain coordination by revenue sharing contracts. *International Journal of Production Economics, 89*(2), 131-139.

Hong, W. C. (2013). *Quanzhou agricultural e-commerce platform based on O2O modes*. 2013 International Workshop on Computer Science in Sports. Atlantis Press.

Hsieh, H. C., Chen, Y. C., & Lin, H. C. (2014). More precise: Stores recommendation under O2O commerce. *International Journal of Computing and Digital Systems, 3*(2), 91-99.

Huang, C. C., Yu, G., & Wang, S., et al. (2006). Disruption management for supply chain coordination with exponential demand function. *Acta Mathematica Scientia, 26B*(4): 655-669.

Qi, X., Bard, J. F., & Yu, G. (2004). Supply chain coordination with demand disruptions. *Omega, 32*(4), 301-312.

Snoek, J., & Rund, B. (2014). *European B2C E-commerce report 2014.* Available from http://www.adigital.org/sites/default/files/studies/european-b2c-ecommerce-report-2014

Tsai, T. M., & Yang, P. C., et al. (2013). *Pilot study toward realizing social effect in O2O commerce services. Social informatics* (pp.268-273). Springer International Publishing, 268-273.

Xiao, T., Yu, G., & Sheng, Z., et al. (2005). Coordination of a supply chain with one-manufacturer and two-retailers under demand promotion and disruption management decisions. *Annals of Operations Research, 135*(2), 87- 109.

Xiao T., & Qi, X. (2008). Price competition, cost and demand disruptions and coordination of a supply chain with one manufacturer and two competing retailers. *Omega, 36*(5), 741-753.

Xu, M., Qi, X., & Yu, G., et al. (2006). Coordinating dyadic supply chains when production costs are disrupted. *IIE Transaction, 38*(9), 765-775.

Zhao, S. X., & Zhang, X. W. (2014). *Research on the development of traditional retail trends based on O2O-Wanda group as an example.* 2014 International Conference of the Academy of International Business- U.S. Northeast Chapter. Atlantis Press.

