Platform Logistics or Self-Logistics? Restaurants' Cooperation with Online Food-Delivery Platform Considering Profitability and Sustainability

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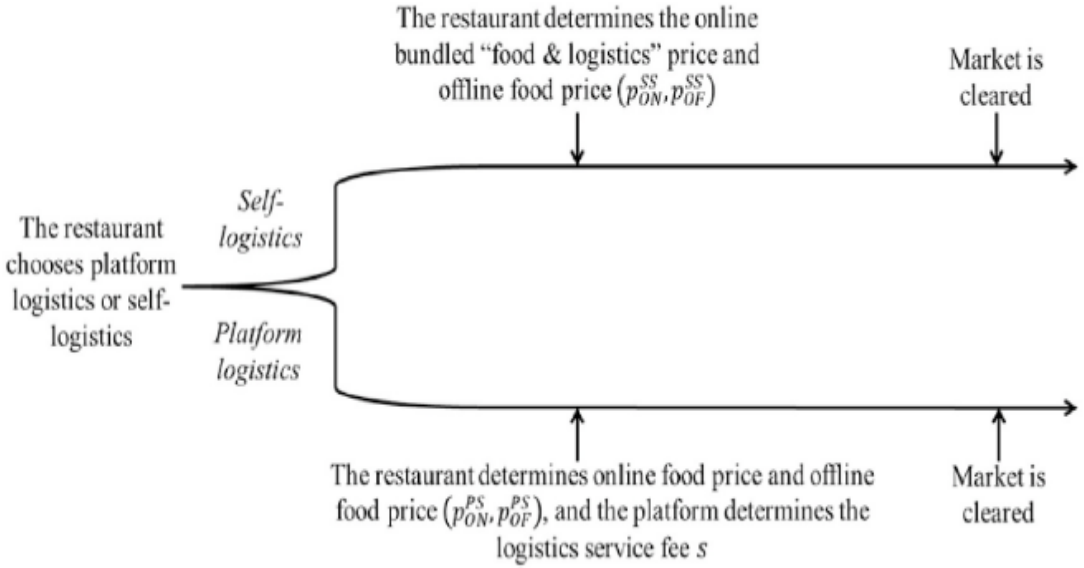
Motivation

-Among the food delivery platform strategy(PS) and its own strategy (Self Strategy, SS), it provides a strategy tailored to the restaurant, and it is important to know how to improve the environment.

Approach

-By comparing the platform strategy and its own strategy through mathematical modeling, it selects the appropriate strategy for the situation.



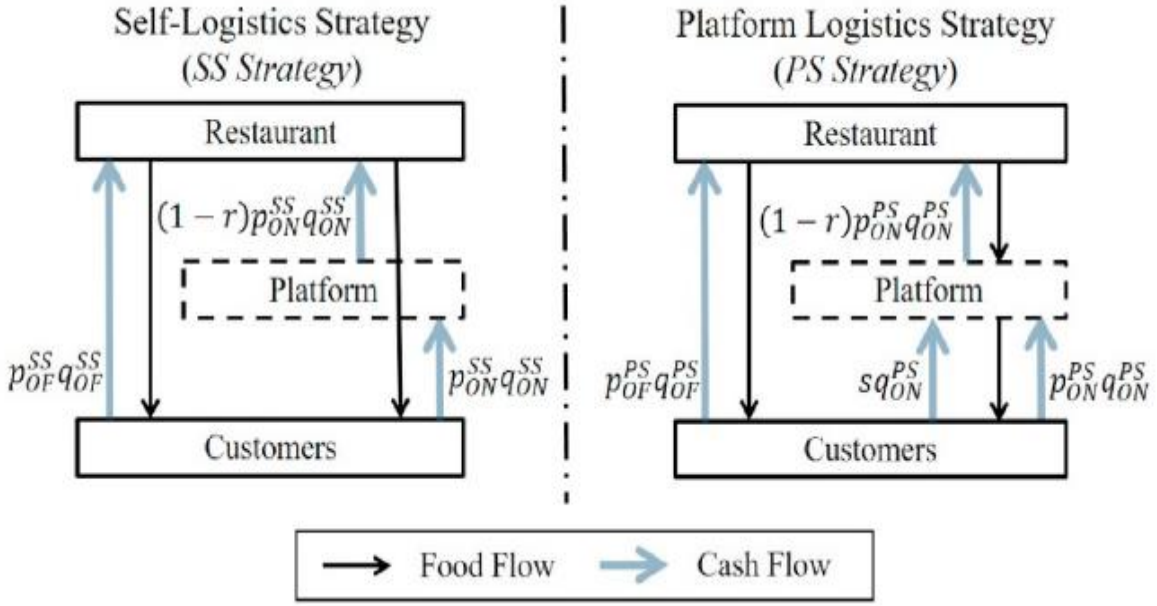


Table 1
Summary of the notations.

Notations	Definitions
π_j	Supply chain party j's profit ($j \in \{R,P\}$)
p_i	i store's food price ($i \in \{ON,OF\}$)
q_i	i store's sales quantity ($i \in \{ON,OF\}$)
s	Unit logistics service fee under the PS strategy
c	Unit logistics cost under the SS strategy
θ	Online market potential
γ	Substitutability of the online and the physical store
r	Platform's commission rate
Subscripts	**Definitions**
i	$i \in \{ON,OF\}$, ON and OF represent the online and the physical stores, respectively
j	$j \in \{R,P\}$, R and P represent restaurant and platform, respectively
Superscripts	**Definitions**
PS	Platform logistics
SS	Self-logistics

SS strategy:

$$q_{ON} = \theta - (1+\gamma)p_{ON} + \gamma p_{OF};\ q_{OF} = 1 - (1+\gamma)p_{OF} + \gamma p_{ON}.$$

PS strategy:

$$q_{ON} = \theta - (1+\gamma)(p_{ON}+s) + \gamma p_{OF};\ q_{OF} = 1 - (1+\gamma)p_{OF} + \gamma(p_{ON}+s).$$

SS strategy:

$$\pi_R^{SS} = \left[(1-r)p_{ON}^{SS} - c\right]q_{ON}^{SS} + p_{OF}^{SS}q_{OF}^{SS};\ \pi_P^{SS} = rp_{ON}^{SS}q_{ON}^{SS}.$$

PS strategy:

$$\pi_R^{PS} = (1-r)p_{ON}^{PS}q_{ON}^{PS} + p_{OF}^{PS}q_{OF}^{PS};\ \pi_P^{PS} = \left(rp_{ON}^{PS} + s\right)q_{ON}^{PS}.$$

Results & Findings

1) If the market potential is high, the SS strategy is preferred

-When the market potential is high, food prices increase, order quantities decrease, and overall revenues suffer.

-ex) Starbucks online market potential high -> As sales quantities increase, commission rate (r) and service fee (s) burden increases -> Self logistics processing is cheap -> Select SS strategy

2) If the market potential is low, the PS strategy is preferred

- When the market potential is low, food prices are low, order quantities are high, and logistics costs are high.

-ex) Neighborhood Chinese restaurant online market potential low -> Low price -> Large order quantities -> Increased burden of self-logistics-> Select PS strategy

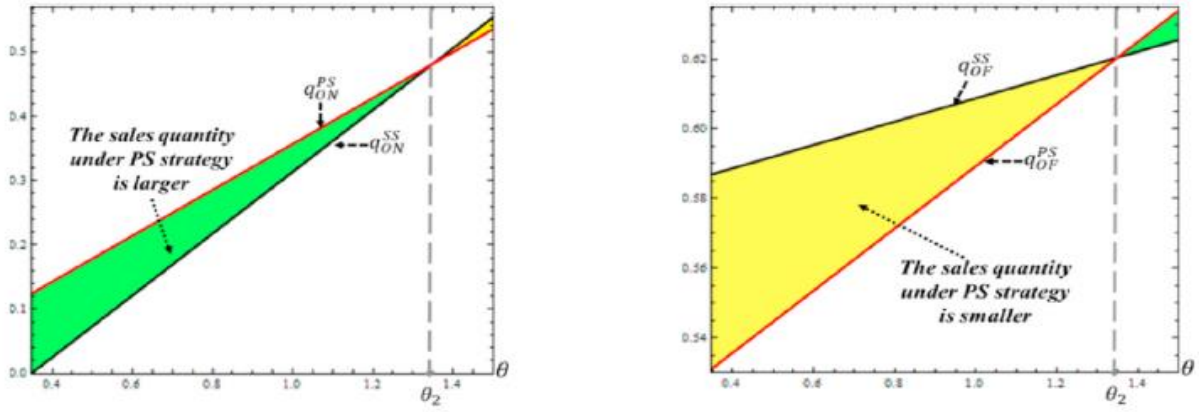
3) When the market potential is high and low, online sales volume improves a restaurant's profitability but worsens both environmental performance

-Requires Offline activation -> Environmentally beneficial

-When only thinking about delivery, need to think about ways to increase sustainability seriously

4) Subsidies given by the platform to customers drive down the price of online food to encourage ordering

- In the PS strategy, the platform actually raises logistics service fees, essentially offsetting them.
- For restaurants, it is better to handle online delivery themselves.



(a) Online store (b) Physical store

Fig. 3. The comparison of the restaurant's sales quantities in two stores ($r = 0.2, \gamma = 1, c = 0.1$).

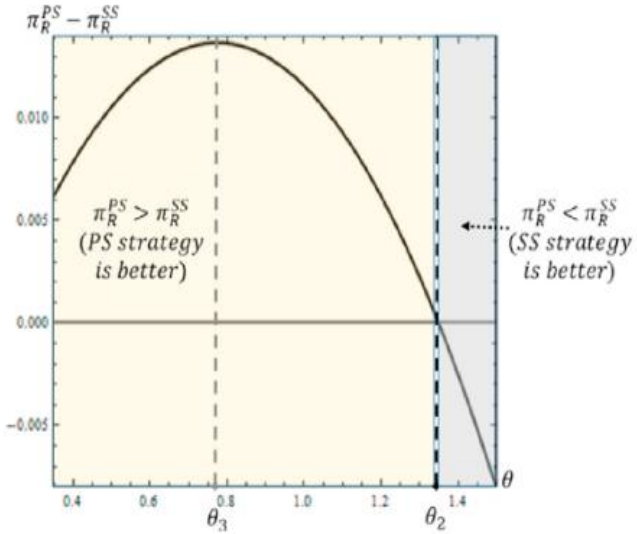


Fig. 4. Restaurant's profit difference under the PS and SS strategies ($r = 0.2$, $\gamma = 1, c = 0.1$).

Discussion

-It is important to configure a strategy suitable for restaurants, and offline activation is necessary to improve environmental problems.

Further Study

-In this paper, only the direction is presented with the market potential as the focus.

->When the commission rate (r) is set as the decision variable, it would be nice to see the restaurant's position change when the commission rate changes.

-Considering environmental issues, it seems that the closed loop chain model can be applied.

->A model in which the platform recovers courage in the PS strategy

->A model in which the restaurant recovers the container in the SS strategy