ISSN (Print) 0473-453X
Discussion Paper No. 1127
ISSN (Online) 2435-0982

LEASE OR SALE: WHEN A DURABLE GOODS MONOPOLIST CAN CHOOSE SUPPLY CHAIN'S OPENNESS

Hiroshi Kitamura
Noriaki Matsushima
Misato Sato

March 2021

The Institute of Social and Economic Research
Osaka University
6-1 Mihogaoka, Ibaraki, Osaka 567-0047, Japan

Lease or sale: When a durable goods monopolist can choose supply chain's openness*

Hiroshi Kitamura† Noriaki Matsushima‡ Misato Sato§

March 30, 2021

Abstract

We construct a two-period model of the supply chain's openness in a durable goods market by introducing two marketing modes: leasing and selling. Given a marketing mode, at the beginning of the first period, an incumbent supplier and the downstream monopolist choose one of the trading modes: (i) a two-period exclusive supply chain or (ii) an open supply chain, allowing the downstream monopolist to trade with an efficient supplier in the second period. We show that the downstream monopolist always chooses the open supply chain in the leasing mode, although the exclusive supply chain is attainable in the selling mode if the incumbent supplier's efficiency is high. Moreover, when we allow the downstream monopolist to choose the marketing mode endogenously before the first period, it chooses the selling mode if the incumbent supplier's efficiency is low; otherwise, it chooses the leasing mode. Regardless of the chosen marketing mode, the open supply chain always occurs on the equilibrium path, implying that the recent advancement of ICT to enhance leasing may discourage choosing the exclusive supply chain.

JEL classification codes: L12, L41, L42, C72.
Keywords: Durable goods; Exclusive dealing; Vertical relation; Antitrust policy.

*We gratefully acknowledge the financial support from JSPS KAKENHI grant numbers JP15H05728, JP17H00984, JP17K13729, JP18H00847, JP18K01593, JP19H01483, JP20H05631 and JP20K13485, The Japan Center for Economic Research, and the program of the Joint Usage/Research Center for "Behavioral Economics" at the ISER, Osaka University. The usual disclaimer applies.

†Faculty of Economics, Kyoto Sangyo University, Motoyama, Kamigamo, Kita-Ku, Kyoto-City 603-8555, Japan. E-mail: hiroshikitamura@cc.kyoto-su.ac.jp

‡Institute of Social and Economic Research, Osaka University, 6-1 Mihogaoka, Ibaraki, Osaka 567-0047, Japan. E-mail: nmatsush@iser.osaka-u.ac.jp

§Graduate School of Humanities and Social Sciences, Okayama University, Tsushima-naka 3-1-1, Kita-Ku, Okayama 700-8530, Japan. E-mail: msato@okayama-u.ac.jp

1 Introduction

The recent advancement of information technology allows consumers to share durable goods with others. In daily life, we observe that the lease markets of those products flourish. Mobike, a Chinese-oriented bike-sharing operator, is a typical example to foster the lease market of bicycles. Mobike sets many parking slots of bicycles in cities, and customers easily search the locations of those parking slots through their mobile phones. Moreover, Toyota, a famous car manufacturer, has launched an automated car-lease service through customers' mobile phones.[1]

Along with the recent change of the technological environment, we also need to consider how those manufacturers form vertical relations with their suppliers in light of the research achievement on the relation between the property of durable goods and vertical chains (e.g., Desai, Koenigsberg, and Purohit, 2004; Arya and Mittendorf, 2006). In particular, we are interested in the openness of the supply chain in durable goods markets because researchers have emphasized the importance of supply chain management in many contexts (the exclusiveness of *keiretsu* in the Japanese automobile industry (e.g., Aoki and Lennerfors, 2013), channel coordination (e.g., Jeuland and Shugan, 1983; Coughlan, 1985, Gupta and Loulou, 1998; Gupta, 2008)).

As a flip side of supply chain openness, our argument is also on the discussion of exclusive contracts. In reality, we commonly observe exclusive contracts, currently regarded as lawful agreements, in many markets for durable goods such as industrial machinery/equipment and electronic and electric equipment (Heide, Dutta, and Bergen, 1998).[2] Moreover, we

[1] See the official announcement "Toyota Launches "Toyota Share" Car-Sharing Service and "Chokunori" Toyota Rent-a-Car Service for the Future Mobility Society in Japan" *Toyota Motor Corporation,* October 28, 2019 (`https://global.toyota/en/newsroom/corporate/30300778.html`.

[2] See also Mollgaard and Lorentzen (2004), who explore exclusive dealing in Eastern Europe's car component industry. Moreover, in the aviation industry, the Boeing Company and Airbus sometimes award exclusivity to one or two jet engine makers over the others. See "GE Unit Lands Exclusive Boeing Pact For Developing Commercial Jet Engine" *The Wall Street*

have also observed anticompetitive exclusive contracts in the market for durable goods such as aluminum (*the United States of America v. Aluminum Co. of America* in the U.S., 1945.), furniture (*Paramount Bed Case* in Japan, 1998), artificial teeth (*the United States of America. v. Dentsply International, INC.,* in the U.S., 2005), and CPU (*Intel Case* in the U.S., 2005).[3]

Despite these observations, most of the existing studies on exclusive contracts focus on perishable goods markets. More importantly, none of the studies focus on the relationship between the marketing mode and the likelihood of exclusive dealing. Therefore, this study aims to ascertain how the marketing mode affects the supply chain's openness, contributing to the literature on supply chain management and competition policy.

Using the framework in Kitamura, Matsushima, and Sato (2021), we construct a two-period model in which an incumbent supplier makes an exclusive offer to a downstream durable goods monopolist to deter the future entry of a more efficient entrant supplier. We use the demand system in Purohit (1995) to explore the downstream monopolist's marketing mode choice, leasing or selling. By endogenizing the marketing mode choice, we explore whether an incumbent supplier and a downstream durable goods monopolist choose one of the trading modes, exclusive or open supply chain.

We first investigate the trading mode choice, exclusive or open supply chain, in each of the two marketing modes. We show that the incumbent supplier and the downstream durable goods monopolist choose the open supply chain in the leasing mode. Conversely,

Journal, July 8, 1999 (https://www.wsj.com/articles/SB931391538252682453), and "Airbus selects Rolls-Royce Trent 7000 as exclusive engine for the A330neo" *Rolls-Royce,* July 14, 2014 (https://www.rolls-royce.com/media/press-releases/yr-2014/140714-a330neo.aspx).

[3] For each case, see the United States of America v. Aluminum Co. of America, 148 F.2d 416 (1945, https://law.justia.com/cases/federal/appellate-courts/F2/148/416/1503668/); Blair and Sokol (2015); United States of America. v. Dentsply International, INC., 399 F.3d (2005, https://www.leagle.com/decision/2005580399f3d1811565); Advanced Micro Devices, INC., a Delaware corporation, and AMD International Sales & Services, LTD., a Delaware corporation, v. Intel Corporation, a Delaware corporation, and Intel Kabushiki Kaisha, a Japanese corporation, Civil Action No. 05-441-JJF (2005, https://www.amd.com/system/files/amd-intel-full-complaint.pdf), respectively.

they choose the exclusive supply chain in the selling mode if this supplier's efficiency is not high, similar to Kitamura, Matsushima, and Sato (2021). To understand those results, consider the effect of an efficient supplier's future entry. As in the Chicago School argument in the 1970s (Posner, 1976; Bork, 1978), the entry into the upstream market benefits the downstream monopolist, restraining the incumbent supplier from offering an acceptable exclusive contract to the downstream monopolist. However, in the selling mode, an efficiency improvement in the future exacerbates the time inconsistency problem in the durable goods market, reducing the contracting party's joint profit. Such a problem is significant when the incumbent supplier's efficiency is high because the expected wholesale price in the subsequent period matches the incumbent supplier's marginal cost in the open supply chain. In this case, the incumbent supplier and the downstream monopolist establish the exclusive supply chain, which mitigates the time inconsistency problem. Conversely, the time inconsistency problem does not exist in the leasing mode; the efficiency gain from the efficient supplier's entry becomes a dominant effect. Thus, the downstream monopolist chooses the open supply chain.

We next endogenize the downstream monopolist's marketing mode choice. The downstream monopolist chooses the leasing mode if the incumbent supplier's efficiency is high; otherwise, it chooses the selling mode. For the marketing mode decision, choosing the leasing mode has two benefits: (i) eliminating the time inconsistency problem and (ii) using a final product twice. However, the twice use of final products also has a negative effect of boosting the initial wholesale price in the leasing mode, which becomes significant when the incumbent supplier's efficiency is low because the initial wholesale price becomes considerably high. Besides, the time inconsistency problem is not significant in the selling mode when the incumbent supplier's efficiency is low. Therefore, the downstream monopolist chooses the selling mode if the incumbent supplier's efficiency is low.

The results here provide several important implications for the vertical relationship in

the advanced information society. The recent progress of information and communication technology allows a firm to lease its durable goods to consumers more easily. First, from the viewpoint of marketing strategy, such technological progress does not necessarily facilitate leasing; we can observe both selling and leasing in the advanced information society. Second, from a supply chain management perspective, the technological change to enhance leasing may affect supply chain openness; the vertical relationship is less likely to establish the exclusive supply chain. Finally, from the standpoint of competition policy, the technological change that facilitates leasing may reduce the achievement of anticompetitive exclusive dealing in the upstream market for durable goods.

This study contributes to the literature on anticompetitive exclusive contracts that prevent a potential entrant's socially efficient entry. The literature starts from the Chicago School argument in the 1970s (Posner, 1976; Bork, 1978). They claim that rational economic agents never sign exclusive contracts for anticompetitive purposes. In rebuttals of this view, researchers show that welfare decreasing exclusion is achievable by focusing on scale economies (Rasmusen, Ramseyer, and Wiley, 1991; Segal and Whinston, 2000) and downstream competition (Fumagalli and Motta, 2006; Simpson and Wickelgren, 2007).[4] Existing models in the literature assume perishable goods markets. A companion work in Kitamura, Matsushima, and Sato (2021) is an exception that considers durable goods markets in the context of exclusive contracts when the downstream durable goods monopolist sells its product but does not lease it. Here, we provide a follow-up framework to clarify whether the marketing mode is crucial to attaining exclusive contracts in durable goods markets.

The remainder of this paper is as follows: Section 2 constructs the model. Section 3 analyzes the trading mode choices in the leasing mode, whereas Section 4 provides the results

[4] Other key factors of exclusion are a penalty for breach of contract (Aghion and Bolton, 1987) and the structure of the upstream market (Yong, 1996; Farrell, 2005; Fumagalli, Motta, and Persson, 2009; Fumagalli, Motta, and Rønde, 2012; Kitamura, Matsushima, and Sato, 2017, 2018).

on the trading modes in the selling mode. Section 5 introduces the analysis of marketing mode decisions. Section 6 offers concluding remarks. Appendix A provides the equilibrium outcomes in the selling mode. Appendix B presents the proof of Proposition 3.

2 Preliminary

We employ the framework of Kitamura, Matsushima, and Sato (2021), by introducing the demand system in Purohit (1995). The precise explanation for the modeling, including the justification of assumptions, is provided in Kitamura, Matsushima, and Sato (2021).

2.1 Market environment

We consider a two-period model with a downstream durable goods monopolist D, an incumbent input supplier U_I, and an entrant input supplier U_E. There is a common discount factor $\rho \in (0, 1)$ for all players who are active in two periods. The demand system follows that in Purohit (1995) (see also Bulow, 1982; Purohit and Staelin, 1994). We explain the detail of the demand system in the subsequent section. Our terminology to describe downstream and upstream players differs from that in Purohit (1995).[5]

D launches a durable good that endures for two periods. It needs one unit of input to produce one unit of durable goods. D incurs per unit wholesale price to procure its inputs. Except for the procurement cost, D does not incur any cost. We consider two marketing modes: (i) D leases the durable good to final consumers; (ii) it sells the goods to final consumers. The durable good is perfectly durable in the two-period model, and there is a perfectly competitive second-hand market in the selling mode.

In the upstream market, only U_I exists at the beginning of period 1, although U_E has a chance to enter the market at the beginning of period 2. U_I and U_E produce an identical

[5] He refers to upstream and downstream players as a supplier (or a monopolist) and a retailer, although we refer to them as a supplier(s) and a monopolist. We focus on the downstream durable goods monopolist.

input with the constant marginal costs c_I and c_E ($0 \leq c_E < c_I$). We assume that the difference between c_E and c_I is not large such that the existence of U_I restricts the pricing of U_E.

Consumers are forward-looking and rational. Taking into account the current price of the durable good, each consumer expects its future price. The expectations of consumers form consumers' willingness to pay for the durable good.

Timing In period 0, D chooses one of the marketing modes, leasing or selling. In period 1, only U_I exists in the upstream market. Period 1 consists of three stages. In period 1.1, U_I makes a two-period exclusive offer to D, with fixed compensation $x \geq 0$. The exclusive offer does not contain the term of wholesale prices as in the related papers.[6] Given the offer with the compensation x, D determines whether to accept it. If D accepts the offer, it immediately receives x. Let $\omega \in \{a, r\}$ be the result in period 1.1, where the script "a" ("r") represents that D accepts (rejects) the offer of the exclusive contract. In period 1.2, U_I offers a linear wholesale price to D. In period 1.3, D orders the input and markets the final good to consumers.[7]

At the beginning of period 2, U_E has a chance to enter the upstream market if D does not accept the exclusive offer in period 1. Period 2 contains three stages. In period 2.1, U_E determines whether to enter the market if possible.[8] We assume that U_E's fixed entry cost

[6] If contracting parties cannot describe concrete product characteristics in advance, commitment to trading terms is difficult in the stage of making exclusive offers (Rasmusen, Ramseyer, and Wiley, 1991; Segal and Whinston, 2000).

[7] In the leasing mode, this study's analytical procedure differs from that of the rental case in Purohit (1995,§3.2). In Purohit (1995,§3.2), first, he solves the optimal quantities of the downstream firm in periods 1 and 2. Second, considering the quantities that depend on the first- and second-period wholesale prices, he derives the optimal wholesale prices in periods 1 and 2. The procedure implies that the upstream supplier can commit to the second-period wholesale price at the beginning of the game in the rental case.

[8] The result does not change if we consider the possibility that U_I makes exclusive offers in period 2 given that D rejects the exclusive offer in period 1. In such a case, we can apply the Chicago School argument; U_I cannot make exclusive offers to compensate D in period 2 profitably.

is sufficiently small such that U_E can earn positive profits. In period 2.2, active suppliers offer linear wholesale prices to D. When U_E has entered, U_I and U_E become competitors of homogeneous input. We assume that if their trading terms are equally attractive for D, the efficient supplier U_E supplies its input to D. In period 2.3, D orders the input and markets the final good to consumers.

Let $\pi^{\omega}_{i|t}$ $(i \in \{I, E\})$ be U_i's profit in period t in case $\omega \in \{a, r\}$. Also, let $\pi^{\omega}_{D|t}$ be D's profit in period t in case $\omega \in \{a, r\}$. The objectives of U_I and D are $\pi^{\omega}_{I|1} + \rho\pi^{\omega}_{I|2}$ and $\pi^{\omega}_{D|1} + \rho\pi^{\omega}_{D|2}$ respectively. The objective of U_E is $\rho\pi^{\omega}_{E|2}$, when it enters in period 2.

2.2 Design of exclusive contracts

Exclusion is achievable if and only if the equilibrium compensation x^* must satisfy the following two conditions simultaneously.

First, D must gain from the exclusive contract. That is,

$$\pi^{a}_{D|1} + x^* + \rho\pi^{a}_{D|2} \geq \pi^{r}_{D|1} + \rho\pi^{r}_{D|2} \quad \text{or} \quad x^* \geq \pi^{r}_{D|1} + \rho\pi^{r}_{D|2} - (\pi^{a}_{D|1} + \rho\pi^{a}_{D|2}). \tag{1}$$

Second, U_I must also gain from the exclusive contract. That is,

$$\pi^{a}_{I|1} + \rho\pi^{a}_{I|2} - x^* \geq \pi^{r}_{I|1} + \rho\pi^{r}_{I|2} \quad \text{or} \quad x^* \leq \pi^{a}_{I|1} + \rho\pi^{a}_{I|2} - (\pi^{r}_{I|1} + \rho\pi^{r}_{I|2}). \tag{2}$$

From the two conditions, an exclusion equilibrium exists if and only if the inequalities in (1) and (2) simultaneously hold. The condition is equivalent to the following inequality:

$$\pi^{a}_{I|1} + \rho\pi^{a}_{I|2} + \pi^{a}_{D|1} + \rho\pi^{a}_{D|2} \geq \pi^{r}_{I|1} + \rho\pi^{r}_{I|2} + \pi^{r}_{D|1} + \rho\pi^{r}_{D|2}. \tag{3}$$

Condition (3) implies that an exclusion equilibrium is attainable if such an exclusive contract increases the two-period joint profits of U_I and D. It is sufficient to focus on the two-period joint profits of U_I and D.

3 Leasing

This section considers the situation in which D chooses the leasing mode in stage 0. It produces q_1 units of the good in period 1 and q_2 units of the good in period 2. Because of the no depreciation assumption, D can lease q_1+q_2 units of the goods in period 2. Following the formulation in Purohit (1995,§3.2), we set the lease prices of the good in periods 1 and 2, l_1 and l_2, as follows:

$$\begin{aligned} l_1 &= \alpha - \beta q_1, \\ l_2 &= \alpha - \beta(q_1+q_2), \end{aligned}$$

where α and β are positive constants. To simplify the exposition, we assume that c_I is not too large:

Assumption 1.

$$c_I < \frac{(3+\rho)\alpha}{3+2\rho}. \tag{4}$$

Condition (4) simplifies the exposition of the results but does not change the property of the results.[9]

From now on, we solve the game by backward induction. We consider D's optimal production level in period 2.3, given the linear wholesale price w_2. Considering the constraint $q_2 \geq 0$, D chooses q_2 to maximize the second period profit:

$$q_2^*(w_2, q_1) \equiv \underset{q_2 \geq 0}{\operatorname{argmax}} \; l_2(q_1+q_2) - w_2 q_2.$$

The profit maximization problem leads to

$$q_2^*(w_2, q_1) = \begin{cases} \dfrac{\alpha - 2\beta q_1 - w_2}{2\beta} & \text{if } w_2 \leq \alpha - 2\beta q_1, \\ 0 & \text{if } w_2 \geq \alpha - 2\beta q_1, \end{cases} \tag{5}$$

$$\pi_{D|2}^*(w_2, q_1) = \begin{cases} (\alpha - \beta q_1)q_1 + \dfrac{(\alpha - 2\beta q_1 - w_2)^2}{4\beta} & \text{if } w_2 \leq \alpha - 2\beta q_1, \\ (\alpha - \beta q_1)q_1 & \text{if } w_2 \geq \alpha - 2\beta q_1. \end{cases}$$

[9] The results in which (4) does not hold is available upon request.

In the following subsections, we consider two trading modes: an exclusive supply chain and an open supply chain.

3.1 Exclusive supply chain

In this case, U_I is the upstream monopolist in both periods.

In period 2.2, anticipating D's reaction (5), U_I chooses w_2 to maximize its second period profit:

$$w_2^{a*}(q_1) \equiv \underset{w_2 \geq c_I}{\operatorname{argmax}} \ (w_2 - c_I) q_2^*(w_2, q_1).$$

The profit maximization problem leads to

$$w_2^{a*}(q_1) = \begin{cases} \dfrac{\alpha + c_I - 2\beta q_1}{2} & \text{if } \beta q_1 \leq (\alpha - c_I)/2, \\ c_I & \text{if } \beta q_1 \geq (\alpha - c_I)/2. \end{cases} \tag{6}$$

From (5) and (6), given q_1, we obtain the production level in period 2

$$q_2^{a*}(q_1) = \begin{cases} \dfrac{\alpha - c_I - 2\beta q_1}{4\beta} & \text{if } \beta q_1 \leq (\alpha - c_I)/2, \\ 0 & \text{if } \beta q_1 \geq (\alpha - c_I)/2. \end{cases} \tag{7}$$

In period 2.1, nothing happens due to the achievement of the exclusive contract.

In period 1.3, given that U_I offers w_1, D chooses q_1 to maximize the overall profit

$$\begin{aligned} q_1^{a*}(w_1) \ \equiv \ & \underset{q_1}{\operatorname{argmax}} \ (a - \beta q_1 - w_1) q_1 \\ & + \rho(\alpha - \beta(q_1 + q_2^{a*}(q_1)))(q_1 + q_2^{a*}(q_1)) - \rho w_2^{a*}(q_1) q_2^{a*}(q_1). \end{aligned}$$

The profit maximization problem leads to

$$q_1^{a*}(w_1) = \begin{cases} \dfrac{(4 + 3\rho)\alpha + \rho c_I - 4w_1}{2\beta(4 + 3\rho)} & \text{if } w_1 \geq (1 + \rho) c_I, \\ \dfrac{(1 + \rho)\alpha - w_1}{2\beta(1 + \rho)} & \text{if } w_1 \leq (1 + \rho) c_I. \end{cases} \tag{8}$$

From (6), (7), and (8), we obtain $w_2^{a*}(q_1^{a*}(w_1))$ and $q_2^{a*}(q_1^{a*}(w_1))$ respectively:

$$w_2^{a*}(q_1^{a*}(w_1)) = \begin{cases} \dfrac{2w_1 + (2 + \rho) c_I}{4 + 3\rho} & \text{if } w_1 \geq (1 + \rho) c_I, \\ c_I & \text{if } w_1 \leq (1 + \rho) c_I, \end{cases}$$

$$q_2^{a*}(q_1^{a*}(w_1)) = \begin{cases} \dfrac{w_1 - (1+\rho)c_I}{\beta(4+3\rho)} & \text{if } w_1 \geq (1+\rho)c_I, \\ 0 & \text{if } w_1 \leq (1+\rho)c_I. \end{cases}$$

In period 1.2, by anticipating this reaction, U_I chooses w_1 to maximize its overall profits:

$$w_1^{a*} \equiv \underset{w_1}{\text{argmax}}\ (w_1 - c_I)q_1^{a*}(w_1) + \rho(w_2^{a*}(q_1^{a*}(w_1)) - c_I)q_2^{a*}(q_1^{a*}(w_1)).$$

The profit maximization problem leads to

$$w_1^{a*} = \begin{cases} \dfrac{(4+3\rho)^2\alpha + (16+8\rho-5\rho^2)c_I}{16(2+\rho)} & \text{if } c_I \leq \dfrac{(4+3\rho)\alpha}{4+7\rho}, \\ (1+\rho)c_I & \text{if } \dfrac{(4+3\rho)\alpha}{4+7\rho} \leq c_I \leq \dfrac{(1+\rho)\alpha}{1+2\rho}, \\ \dfrac{(1+\rho)\alpha + c_I}{2} & \text{if } \dfrac{(1+\rho)\alpha}{1+2\rho} \leq c_I. \end{cases} \tag{9}$$

The resulting profits, excluding the fixed compensation x^*, are summarized as follows.

$$\pi_{I|1}^{a*} + \rho\pi_{I|2}^{a*} = \begin{cases} \dfrac{(4+3\rho)^2\alpha^2 - 2(16+8\rho+5\rho^2)\alpha c_I + (16-8\rho+17\rho^2)c_I^2}{64\beta(2+\rho)} & \\ \qquad\qquad \text{if } c_I \leq \dfrac{(4+3\rho)\alpha}{4+7\rho}, & \\ \dfrac{\rho(\alpha - c_I)c_I}{2\beta} \quad \text{if } \dfrac{(4+3\rho)\alpha}{4+7\rho} \leq c_I \leq \dfrac{(1+\rho)\alpha}{1+2\rho}, & \\ \dfrac{((1+\rho)\alpha - c_I)^2}{8\beta(1+\rho)} \quad \text{if } \dfrac{(1+\rho)\alpha}{1+2\rho} \leq c_I. & \end{cases} \tag{10}$$

$$\pi_{D|1}^{a*} + \rho\pi_{D|2}^{a*} = \begin{cases} \dfrac{(64+144\rho+92\rho^2+19\rho^3)\alpha^2}{256\beta(2+\rho)^2} & \\ \quad -\dfrac{2(64+80\rho+28\rho^2+7\rho^3)\alpha c_I}{256\beta(2+\rho)^2} & \\ \quad +\dfrac{(64+16\rho+28\rho^2+43\rho^3)c_I^2}{256\beta(2+\rho)^2} \quad \text{if } c_I \leq \dfrac{(4+3\rho)\alpha}{4+7\rho}, & \\ \dfrac{(1+\rho)(\alpha - c_I)^2}{4\beta} \quad \text{if } \dfrac{(4+3\rho)\alpha}{4+7\rho} \leq c_I \leq \dfrac{(1+\rho)\alpha}{1+2\rho}, & \\ \dfrac{((1+\rho)\alpha - c_I)^2}{16\beta(1+\rho)} \quad \text{if } \dfrac{(1+\rho)\alpha}{1+2\rho} \leq c_I. & \end{cases} \tag{11}$$

3.2 Open supply chain

In this case, competition in the upstream market occurs in period 2.2, which differs from the previous case.

In period 2.2, the wholesale price becomes $w_2^{r*} = c_I$ because of the upstream competition (we have assumed that U_E is not so efficient such that it cannot be an upstream monopolist without any constraint on its pricing). U_I earns nothing in period 2.

From (5) and $w_2^{r*} = c_I$, D chooses the following production level in period 2:

$$q_2^{r*}(q_1) = \begin{cases} \dfrac{\alpha - c_I - 2\beta q_1}{2\beta} & \text{if } \beta q_1 \leq (\alpha - c_I)/2, \\ 0 & \text{if } \beta q_1 \geq (\alpha - c_I)/2. \end{cases} \tag{12}$$

In period 1.3, given that U_I sets w_1, D chooses q_1 to maximize its overall profits:

$$\begin{aligned} q_1^{r*}(w_1) \equiv \underset{q_1}{\text{argmax}} \; & (a - \beta q_1 - w_1)q_1 \\ & + \rho(\alpha - \beta(q_1 + q_2^{r*}(q_1)))(q_1 + q_2^{r*}(q_1)) - \rho c_I q_2^{r*}(q_1). \end{aligned}$$

The profit maximization problem leads to

$$q_1^{r*}(w_1) = \begin{cases} \dfrac{\alpha + \rho c_I - w_1}{2\beta} & \text{if } w_1 \geq (1+\rho)c_I, \\ \dfrac{(1+\rho)\alpha - w_1}{2\beta(1+\rho)} & \text{if } w_1 \leq (1+\rho)c_I. \end{cases} \tag{13}$$

From (12) and (13), we obtain $q_2^{r*}(q_1^{r*}(w_1))$:

$$q_2^{r*}(q_1^{r*}(w_1)) = \begin{cases} \dfrac{w_1 - (1+\rho)c_I}{2\beta} & \text{if } w_1 \geq (1+\rho)c_I, \\ 0 & \text{if } w_1 \leq (1+\rho)c_I. \end{cases}$$

In period 1.2, by anticipating this reaction, U_I chooses w_1 to maximize its overall profits:

$$w_1^{r*} \equiv \underset{w_1}{\text{argmax}} \; (w_1 - c_I)q_1^{r*}(w_1).$$

The profit maximization problem leads to

$$w_1^{r*} = \begin{cases} \dfrac{\alpha + (1+\rho)c_I}{2} & \text{if } c_I \leq \dfrac{\alpha}{1+\rho}, \\ (1+\rho)c_I & \text{if } \dfrac{\alpha}{1+\rho} \leq c_I \leq \dfrac{(1+\rho)\alpha}{1+2\rho}, \\ \dfrac{(1+\rho)\alpha + c_I}{2} & \text{if } \dfrac{(1+\rho)\alpha}{1+2\rho} \leq c_I. \end{cases} \tag{14}$$

U_I's profit is

$$\pi_{I|1}^{r*} + \rho\pi_{I|2}^{r*} = \begin{cases} \dfrac{(\alpha-(1-\rho)c_I)^2}{8\beta} & \text{if } c_I \le \dfrac{\alpha}{1+\rho}, \\ \dfrac{\rho(\alpha-c_I)c_I}{2\beta} & \text{if } \dfrac{\alpha}{1+\rho} \le c_I \le \dfrac{(1+\rho)\alpha}{1+2\rho}, \\ \dfrac{((1+\rho)\alpha-c_I)^2}{8\beta(1+\rho)} & \text{if } \dfrac{(1+\rho)\alpha}{1+2\rho} \le c_I. \end{cases} \tag{15}$$

Also, D's profit is

$$\pi_{D|1}^{r*} + \rho\pi_{D|2}^{r*} = \begin{cases} \dfrac{(1+4\rho)\alpha^2 - 2(1+3\rho)\alpha c_I + (1+\rho)^2 c_I^2}{16\beta} & \text{if } c_I \le \dfrac{\alpha}{1+\rho}, \\ \dfrac{(1+\rho)(\alpha-c_I)^2}{4\beta} & \text{if } \dfrac{\alpha}{1+\rho} \le c_I \le \dfrac{(1+\rho)\alpha}{1+2\rho}, \\ \dfrac{((1+\rho)\alpha-c_I)^2}{16\beta(1+\rho)} & \text{if } \dfrac{(1+\rho)\alpha}{1+2\rho} \le c_I. \end{cases} \tag{16}$$

3.3 Comparison

Using (10), (11), (15) and (16), we check whether condition (3) holds to explore the existence of an exclusion equilibrium. By calculating the difference between $\pi_{I|1}^{a*} + \rho\pi_{I|2}^{a*} + \pi_{D|1}^{a*} + \rho\pi_{D|2}^{a*}$ and $\pi_{I|1}^{r*} + \rho\pi_{I|2}^{r*} + \pi_{D|1}^{r*} + \rho\pi_{D|2}^{r*}$, we obtain the following proposition:

Proposition 1. *In the leasing mode, U_I and D do not choose an exclusive supply chain.*

Under the exclusive supply chain, anticipating the higher wholesale price in period 2, D needs to produce more in period 1 than in the open case. In fact, from (8) and (13), we find that $q_1^{a*}(w_1) > q_1^{r*}(w_1)$ holds if and only if $w_1 \ge (1+\rho)c_I$, which is the necessary and sufficient condition that the second-period production level is positive in both the exclusive supply chain and the open supply chain.[10] However, the monopoly power of U_I under the exclusive supply chain partially offsets the stronger incentive of D to produce more in period 1. Actually, w_1^{a*} in (9) is larger than w_1^{r*} in (14) if and only if $c_I < (4+3\rho)\alpha/(4+7\rho)$, which is the necessary and sufficient condition that the second-period production level is positive

[10] If $w_1 \le (1+\rho)c_I$, $q_1^{a*}(w_1) = q_1^{r*}(w_1)$ always holds.

under the exclusive supply chain.[11] As a result, the overall activity under the exclusion supply chain is lower than that in the open supply chain, preventing U_I from making an acceptable exclusive offer to D.

4 Selling

This section considers the situation in which D chooses the selling mode in stage 0. It produces q_1 units of the good in period 1 and q_2 units of the good in period 2. In contrast to the leasing mode, D sells q_2 units of the goods in period 2. By considering consumers' intertemporal purchase decision, we set the selling prices of the good in periods 1 and 2, p_1 and p_2, where

$$p_1 = l_1 + \rho p_2, \quad p_2 = l_2.$$

This marketing mode is similar to Kitamura, Matsushima, and Sato (2021). Here, we briefly introduce the results. See Appendix A for a precise derivation procedure of each trading mode's equilibrium outcomes D chooses the selling mode.

Under the exclusive supply chain, the profits of U_I and D, excluding the fixed compensation x^*, are

$$\begin{aligned}\pi_{I|1}^{aS} + \rho\pi_{I|2}^{aS} = \ & \frac{((128+184\rho+67\rho^2)\alpha - (128+56\rho-5\rho^2)c_I)((8+3\rho)\alpha-(8-5\rho)c_I)}{128\beta(8+5\rho)^2} \\ & + \rho\frac{((24+17\rho)\alpha-(24+25\rho)c_I)^2}{128\beta(8+5\rho)^2},\end{aligned} \tag{17}$$

$$\begin{aligned}\pi_{D|1}^{aS} + \rho\pi_{D|2}^{aS} = \ & \frac{((8+7\rho)\alpha-(8-\rho)c_I)((8+3\rho)\alpha-(8-5\rho)c_I)}{128\beta(8+5\rho)} \\ & + \rho\frac{((24+17\rho)\alpha-(24+25\rho)c_I)^2}{256\beta(8+5\rho)^2},\end{aligned} \tag{18}$$

and the equilibrium wholesale price in period 1 is

$$w_1^{aS} = \frac{(128+184\rho+67\rho^2)\alpha + (128+104\rho+5\rho^2)c_I}{32(8+5\rho)}, \tag{19}$$

[11] If $c_I \geq (4+3\rho)\alpha/(4+7\rho)$, $w_1^{a*} = w_1^{r*}$ always holds.

where the script "aS" represents accepting an exclusive offer in the selling mode.

Conversely, under the open supply chain, the profits of U_I and D are

$$\pi_{I|1}^{rS} + \rho\pi_{I|2}^{rS} = \frac{(\alpha - (1-\rho)c_I)^2}{2\beta(4+\rho)}, \tag{20}$$

$$\begin{aligned}\pi_{D|1}^{rS} + \rho\pi_{D|2}^{rS} = {} & \frac{((2+4\rho+\rho^2)\alpha - (2+2\rho+\rho^2)c_I)(\alpha-(1-\rho)c_I)}{2\beta(4+\rho)^2} \\ & + \rho\frac{((3+\rho)\alpha - (3+2\rho)c_I)^2}{4\beta(4+\rho)^2},\end{aligned} \tag{21}$$

and the equilibrium wholesale price in period 1 becomes

$$w_1^{rS} = \frac{\alpha + (1+\rho)c_I}{2}, \tag{22}$$

where the script "rS" represents rejecting an exclusive offer in the selling mode.

Using (17), (18), (20) and (21), we check whether condition (3) holds to explore the existence of an exclusion equilibrium. By calculating the difference between $\pi_{I|1}^{aS} + \rho\pi_{I|2}^{aS} + \pi_{D|1}^{aS} + \rho\pi_{D|2}^{aS}$ and $\pi_{I|1}^{rS} + \rho\pi_{I|2}^{rS} + \pi_{D|1}^{rS} + \rho\pi_{D|2}^{rS}$, we obtain the following proposition:

Proposition 2. *In the selling mode, U_I and D choose an exclusive supply chain if*

$$c_I \leq \frac{768 + \rho\left(768 - 1156\rho - 865\rho^2 - 8(8+5\rho)\sqrt{(4+\rho)(208+133\rho)}\right)}{768 + \rho(512 - 6820\rho - 4425\rho^2)}\alpha. \tag{23}$$

The efficiency improvement through the entry in period 2 exacerbates the time inconsistency problem due to the expected retail price reduction in period 2. The negative effect of the second-period entry facilitates establishing an exclusive supply chain. More importantly, the entry's negative impact is significant when c_I is small because the expected wholesale price in period 2 is $w_2^{rS} = c_I$ due to the upstream competition in period 2. Therefore, when c_I is small, the entry of U_E is harmful to U_I and D; they establish the exclusive supply chain, which deters efficient future entry in the upstream market.

5 Leasing versus Selling

Using the above results, we now explore which marketing mode D chooses in period 0 and which trading mode U_I and D establish in period 1. By considering D's profit, we obtain

the following proposition:

Proposition 3. *If D chooses one of the marketing modes, leasing or selling, it chooses selling if and only if*

$$c_I \geq \frac{3+2\rho-\rho\sqrt{4+\rho}}{3+3\rho-\rho^2}\alpha. \tag{24}$$

On the equilibrium path, U_I and D always choose an open supply chain for any level of c_I.

Note that if (24) holds, (23) never holds; namely, the open supply chain always occurs when D chooses the selling mode. Conversely, if (24) does not hold, the open supply chain and leasing are chosen. Therefore, this proposition implies that the exclusive supply chain does not appear if we consider D's choice of the marketing modes.

Choosing the leasing mode eliminates the time inconsistency problem and allows D to use a final product twice. Those two effects are the benefits of choosing the leasing mode. However, the comparison between (19) and (22) implies that the first-period wholesale price in the leasing mode is higher than that in the selling mode for the higher marginal cost of U_I (i.e., $w_1^{r*} > w_1^{rS}$ holds for $c_I > \alpha/(1+\rho)$). The higher wholesale price stems from the twice leases of final products made in period 1. Moreover, the time inconsistency problem becomes not significant in the selling mode as c_I increases. Thus, when U_I is sufficiently inefficient, the negative effect of choosing the leasing mode becomes the dominant effect, and D chooses the selling mode and the open supply chain.[12]

6 Conclusion

This study constructs a two-period model in which an incumbent supplier and a downstream durable goods monopolist choose the supply chain's openness by focusing on the downstream monopolist's marketing mode choice between leasing and selling. Under the open supply chain, an efficient supplier's entry occurs in the second period. Using the demand system in

[12] The threshold value in (24) is larger than $\alpha/(1+\rho)$.

Purohit (1995), we first explore how the incumbent supplier and the downstream monopolist determine the supply chain's openness in each marketing mode. We then endogenize the downstream monopolist's marketing mode decision to investigate the relationship between the marketing mode and the supply chain's openness.

We show that in the leasing mode, the initially existing players choose an open supply chain, which allows the downstream monopolist to trade with the efficient entrant supplier in the future. Conversely, in the selling mode, the incumbent supplier and the downstream monopolist can establish a two-period exclusive supply chain to deter the efficient future entry if the incumbent supplier's efficiency is high; otherwise, they choose the open supply chain. More importantly, if we allow the downstream monopolist to choose one of the marketing modes endogenously, it chooses the selling mode if the incumbent supplier's efficiency is low; otherwise, the downstream monopolist chooses the leasing mode. Although the downstream monopolist chooses one of the marketing modes depending on the incumbent supplier's efficiency level, it always chooses the open supply chain on the equilibrium path.

The findings here provide several important implications. First, from the viewpoint of marketing strategy, the recent progress of information and communication technology, allowing a firm to lease its durable goods to consumers more easily, does not necessarily facilitate leasing. Second, from a perspective of supply chain management, the technological change to enhance leasing may affect the supply chain's openness; the vertical relationship is less likely to establish the exclusive supply chain in the advanced information society. Finally, from the competition policy perspective, as leasing spreads throughout society, the vertical relationship is less likely to engage in exclusive dealing for an anticompetitive purpose.

Despite these contributions, several concerns are requiring future works. First, we have assumed that the trading term between the downstream monopolist and a supplier follows a linear wholesale price contract. We can consider another trading term based on a two-part tariff contract. Second, there is concern about the generality of our results. Although the

analysis depends on a specific demand system, we could extend it to more general settings. We hope this study will assist future research in applying the model to these situations.

A Equilibrium Outcomes under Selling

This appendix considers the situation in which D chooses the selling mode in stage 0. For the sake of convenience in solving the game by backward induction, we consider D's optimal production level in period 2.3, given w_2. D chooses q_2 to maximize the second period profit:

$$q_2^S(w_2, q_1) \equiv \underset{q_2 \geq 0}{\operatorname{argmax}} \ (p_2 - w_2)q_2.$$

The profit maximization problem leads to

$$q_2^S(w_2, q_1) = \frac{\alpha - \beta q_1 - w_2}{2\beta}, \tag{25}$$

$$\pi_{D|2}^S(w_2, q_1) = \frac{(\alpha - \beta q_1 - w_2)^2}{4\beta}.$$

In the following subsections, we consider two trading modes: an exclusive supply chain and an open supply chain.

A.1 Exclusive supply chain

In this case, U_I is the upstream monopolist in both periods.

In period 2.2, anticipating D's reaction (25), U_I chooses w_2 to maximize its second period profit:

$$w_2^{aS}(q_1) \equiv \underset{w_2 \geq c_I}{\operatorname{argmax}} \ (w_2 - c_I)q_2^S(w_2, q_1).$$

The profit maximization problem leads to

$$w_2^{aS}(q_1) = \frac{\alpha + c_I - \beta q_1}{2}. \tag{26}$$

From (25) and (26), given q_1, we obtain the production level in period 2

$$q_2^{aS}(q_1) = \frac{\alpha - c_I - \beta q_1}{4\beta}, \tag{27}$$

which leads to the following price in period 2

$$p_2^{aS}(q_1) = \frac{3\alpha + c_I - 3\beta q_1}{4\beta}.$$

In period 2.1, nothing happens due to the achievement of the exclusive contract.

In period 1.3, given that U_I offers w_1, D chooses q_1 to maximize the overall profit

$$q_1^{aS}(w_1) \equiv \underset{q_1}{\text{argmax}}\ (a - \beta q_1 + \rho p_2^{aS}(q_1) - w_1)q_1 + \rho(p_2^{aS}(q_1) - w_2^{aS}(q_1))q_2^{aS}(q_1).$$

The profit maximization problem leads to

$$q_1^{aS}(w_1) = \frac{(8+5\rho)\alpha + 3\rho c_I - 8w_1}{(16+11\rho)\beta}. \tag{28}$$

From (26), (27), and (28), we obtain $w_2^{aS}(q_1^{aS}(w_1))$ and $q_2^{aS}(q_1^{aS}(w_1))$ respectively:

$$w_2^{aS}(q_1^{aS}(w_1)) = \frac{(4+3\rho)\alpha + 4(2+\rho)c_I + 4w_1}{(16+11\rho)\beta},$$

$$q_2^{aS}(q_1^{aS}(w_1)) = \frac{(4+3\rho)\alpha - (8+7\rho)c_I + 4w_1}{2(16+11\rho)\beta}.$$

In period 1.2, by anticipating this reaction, U_I chooses w_1 to maximize its overall profits:

$$w_1^{aS} \equiv \underset{w_1}{\text{argmax}}\ (w_1 - c_I)q_1^{aS}(w_1) + \rho(w_2^{aS}(q_1^{aS}(w_1)) - c_I)q_2^{aS}(q_1^{aS}(w_1)).$$

The profit maximization problem leads to (19). The resulting profits of U_I and D, excluding the fixed compensation, are (17) and (18).

A.2 Open supply chain

In this case, competition in the upstream market occurs in period 2.2, which differs from the previous case.

In period 2.2, the wholesale price becomes $w_2^{rS} = c_I$ because of the upstream competition. U_I earns nothing in period 2. From (25) and $w_2^{rS} = c_I$, given q_1, D chooses the following production level in period 2:

$$q_2^{rS}(q_1) = \frac{\alpha - c_I - \beta q_1}{2\beta}.$$

which leads to the following price in period 2

$$p_2^{rS}(q_1) = \frac{\alpha + c_I - \beta q_1}{2\beta}.$$

In period 2.1, U_E enters the upstream market.

In period 1.3, given that U_I sets w_1, D chooses q_1 to maximize its overall profits:

$$q_1^{rS}(w_1) \equiv \underset{q_1}{\text{argmax}}\ (a - \beta q_1 + \rho p_2^{rS}(q_1) - w_1)q_1 + \rho(p_2^{rS}(q_1) - c_I)q_2^{rS}(q_1).$$

The profit maximization problem leads to

$$q_1^{rS}(w_1) = \frac{2(\alpha + \rho c_I - w_1)}{(4+\rho)\beta}.$$

In period 1.2, by anticipating this reaction, U_I chooses w_1 to maximize its overall profits:

$$w_1^{rS} \equiv \underset{w_1}{\text{argmax}}\ (w_1 - c_I)q_1^{rS}(w_1).$$

The profit maximization problem leads to (22). The resulting profits of U_I and D are (20) and (21).

B Proof of Proposition 3

The leasing mode has three cases: (i) $c_I \leq \alpha/(1+\rho)$, (ii) $\alpha/(1+\rho) \leq c_I \leq (1+\rho)\alpha/(1+2\rho)$, (iii) $(1+\rho)\alpha/(1+2\rho) \leq c_I$. The threshold value of Proposition 2 in the selling mode, (23), is always lower than $\alpha/(1+\rho)$. Therefore, we consider four cases: (I) $c_I \leq \alpha/(1+\rho)$ and (23) holds, (II) $c_I \leq \alpha/(1+\rho)$ and (23) does not hold, (III) $\alpha/(1+\rho) \leq c_I \leq (1+\rho)\alpha/(1+2\rho)$, (IV) $(1+\rho)\alpha/(1+2\rho) \leq c_I < 3(1+\rho)\alpha/(3+2\rho)$.

For case (I) ($c_I \leq \alpha/(1+\rho)$ and (23) holds), the exclusive supply chain is chosen in the selling mode. In this case, the highest profit of D, including the fixed compensation x^*, becomes $\pi_{I|1}^{aS} + \rho\pi_{I|2}^{aS} + \pi_{D|1}^{aS} + \pi_{D|2}^{aS} - (\pi_{I|1}^{rS} + \rho\pi_{I|2}^{rS})$. By comparing the highest profit of D with $\pi_{D|1}^{r*} + \rho\pi_{D|2}^{r*}$ in the leasing mode, we have

$$\pi_{I|1}^{aS} + \rho\pi_{I|2}^{aS} + \pi_{D|1}^{aS} + \pi_{D|2}^{aS} - (\pi_{I|1}^{rS} + \rho\pi_{I|2}^{rS}) - (\pi_{D|1}^{r*} + \rho\pi_{D|2}^{r*}) = -\frac{\rho(\lambda_1\alpha^2 - 2\lambda_2\alpha c_I + \lambda_3 c_I^2)}{256\beta(4+\rho)(8+5\rho)^2},$$

which is negative for any c_I, where $\lambda_1 \equiv (256 + 256\rho + 244\rho^2 + 121\rho^3)$, $\lambda_2 \equiv (256 - 512\rho + 276\rho^2 + 465\rho^3)$, and $\lambda_3 \equiv (256 - 1280\rho + 5684\rho^2 + 4905\rho^3 + 400\rho^4)$. Thus, in case (I), D always chooses the leasing mode.

For case (Ⅱ) ($c_I \leq \alpha/(1+\rho)$ and (23) does not hold), the open supply chain is chosen in the selling mode. We compare $\pi^{rS}_{D|1} + \rho\pi^{rS}_{D|2}$ in the selling mode with $\pi^{r*}_{D|1} + \rho\pi^{r*}_{D|2}$ in the leasing mode.

$$\pi^{rS}_{D|1} + \rho\pi^{rS}_{D|2} - (\pi^{r*}_{D|1} + \rho\pi^{r*}_{D|2}) = -\frac{\rho(\alpha - (1-\rho)c_I)^2)}{16\beta(4+\rho)},$$

which is negative for any c_I. Hence, in case (Ⅱ), D always chooses the leasing mode.

For case (Ⅲ) ($\alpha/(1+\rho) \leq c_I \leq (1+\rho)\alpha/(1+2\rho)$), the open supply chain is chosen in the selling mode. We compare $\pi^{rS}_{D|1} + \rho\pi^{rS}_{D|2}$ in the selling mode with $\pi^{r*}_{D|1} + \rho\pi^{r*}_{D|2}$ in the leasing mode.

$$\pi^{rS}_{D|1} + \rho\pi^{rS}_{D|2} - (\pi^{r*}_{D|1} + \rho\pi^{r*}_{D|2}) = -\frac{(3+\rho)\alpha^2 - 2(3+2\rho)\alpha c_I + (3+3\rho-\rho^2)c_I^2}{4\beta(4+\rho)},$$

which is positive if and only if $c_I \geq (3+2\rho-\rho\sqrt{4+\rho})\alpha/(3+3\rho-\rho^2)$ as in (24). Thus, in this case, D chooses the selling mode if (24) holds; otherwise it chooses the leasing mode.

For case (Ⅳ) ($(1+\rho)\alpha/(1+2\rho) \leq c_I < 3(1+\rho)\alpha/(3+2\rho)$), the open supply chain is chosen in the selling mode. We compare $\pi^{rS}_{D|1} + \rho\pi^{rS}_{D|2}$ in the selling mode with $\pi^{r*}_{D|1} + \rho\pi^{r*}_{D|2}$ in the leasing mode.

$$\pi^{rS}_{D|1}+\rho\pi^{rS}_{D|2}-(\pi^{r*}_{D|1}+\rho\pi^{r*}_{D|2}) = \frac{(1+\rho)(11+3\rho)\alpha^2 - 2(1+\rho)(11+4\rho)\alpha c_I + (11+16\rho+8\rho^2)c_I^2}{16\beta(1+\rho)(4+\rho)},$$

which is positive for any $c_I (\geq (1+\rho)\alpha/(1+2\rho))$. Thus, in case (Ⅳ), D always chooses the selling mode. Q.E.D.

References

Aghion, P., and Bolton, P., 1987. Contracts as a Barrier to Entry. *American Economic Review* 77(3), 388–401.

Aoki, K., and Lennerfors, T.T., 2013. Whither Japanese *Keiretsu*? The Transformation of Vertical *Keiretsu* in Toyota, Nissan and Honda 1991-2011. *Asia Pacific Business Review* 19(1), 70–84.

Arya, A., and Mittendorf, B., 2006. Benefits of Channel Discord in the Sale of Durable Goods. *Marketing Science* 25(1), 91–96.

Blair, D., and Sokol, D.D., 2015. *The Oxford Handbook of International Antitrust Economics* Volume 2. Oxford: Oxford University Press.

Bork, R.H., 1978. *The Antitrust Paradox: A Policy at War with Itself.* New York: Basic Books.

Bulow, J., 1982. Durable-Goods Monopolists. *Journal of Political Economy* 90(2), 314–332.

Bulow, J., 1986. An Economic Theory of Planned Obsolescence. *Quarterly Journal of Economics* 101(4), 729–750.

Coase, R., 1972. Durability and Monopoly. *Journal of Law and Economics* 15(1), 143–149.

Coughlan, A.T., 1985. Competition and Cooperation in Marketing Channel Choice: Theory and Application. *Marketing Science* 4(2), 110–129.

Desai, P.S., Koenigsberg, O., and Purohit, D., 2004. Strategic Decentralization and Channel Coordination. *Quantitative Marketing and Economics* 2(1), 5–22.

Farrell, J., 2005. Deconstructing Chicago on Exclusive Dealing. *Antitrust Bulletin* 50, 465–480.

Fumagalli, C., and Motta, M., 2006. Exclusive Dealing and Entry, when Buyers Compete. *American Economic Review* 96(3), 785–795.

Fumagalli, C., Motta, M., and Persson, L., 2009. On the Anticompetitive Effect of Exclusive Dealing when Entry by Merger is Possible. *Journal of Industrial Economics* 57(4), 785–811.

Fumagalli, C., Motta, M., and Rønde, T., 2012. Exclusive Dealing: Investment Promotion may Facilitate Inefficient Foreclosure. *Journal of Industrial Economics* 60(4), 599–608.

Gupta, S., 2008. Channel Structure with Knowledge Spillovers. *Marketing Science* 27(2), 247–261.

Gupta, S., and Loulou, R., 1998. Process Innovation, Product Differentiation, and Channel Structure: Strategic Incentives in a Duopoly. *Marketing Science* 17(4), 301–316.

Heide, J.B., Dutta, S., and Bergen, M., 1998. Exclusive Dealing and Business Efficiency: Evidence from Industry Practice. *Journal of Law and Economics* 41(2), 387–408.

Jeuland, A.P., and Shugan, S.M., 1983. Managing Channel Profits. *Marketing Science* 2(3), 239–272.

Kitamura, H., Matsushima, N., and Sato, M., 2017. Exclusive Contracts and Bargaining Power. *Economics Letters* 151, 1–3.

Kitamura, H., Matsushima, N., and Sato, M., 2018. Exclusive Contracts with Complementary Inputs. *International Journal of Industrial Organization* 56, 145–167.

Kitamura, H., Matsushima, N., and Sato, M., 2021. Which is Better for Durable Goods Producers, Exclusive or Open Supply Chain? ISER Discussion Paper No.1115, Available at SSRN: `https://dx.doi.org/10.2139/ssrn.3773927`.

Mollgaard, H.P., and Lorentzen, J., 2004. Exclusive Safeguards and Technology Transfer: Subcontracting Agreements in Eastern Europe's Car Component Industry. *European Journal of Law and Economics* 17(1), 41–71.

Posner, R.A., 1976. *Antitrust Law: An Economic Perspective.* Chicago: University of Chicago Press.

Purohit, D., 1995. Marketing Channels and the Durable Goods Monopolist: Renting versus Selling Reconsidered. *Journal of Economics & Management Strategy* 4(1), 69–84.

Purohit, D., and Staelin, R., 1994. Rentals, Sales, and Buybacks: Managing Secondary Distribution Channels. *Journal of Marketing Research* 31, 325–338.

Rasmusen, E.B., Ramseyer, J.M., and Wiley Jr., J.S., 1991. Naked Exclusion. *American Economic Review* 81(5), 1137–1145.

Segal, I.R., and Whinston, M.D., 2000. Naked Exclusion: Comment. *American Economic Review* 90(1), 296–309.

Simpson, J., and Wickelgren, A.L., 2007. Naked Exclusion, Efficient Breach, and Downstream Competition. *American Economic Review* 97(4), 1305–1320.

Yong, J.S., 1996. Excluding Capacity-Constrained Entrants through Exclusive Dealing: Theory and an Application to Ocean Shipping. *Journal of Industrial Economics* 44(2), 115–129.