The Strength of Weak Commitments: A Theory of Price Preannouncements

Xi Li
Faculty of Business and Economics, The University of Hong Kong, Hong Kong.
Email: xili@hku.hk

Yan Xiong
Faculty of Business and Economics, The University of Hong Kong, Hong Kong.
Email: yanxiong@ust.hk

Abstract

Manufacturers often preannounce reference prices for products that have not yet been produced or even developed. These prices are rarely binding, meaning that the manufacturers can make price adjustments in the future, possibly at a cost. In this paper, we argue that price preannouncements can serve as a weak price commitment that, we find, helps the manufacturers secure better deals from their suppliers, thereby lowering their procurement costs and improving their profit. Surprisingly, even an extremely weak price commitment can substantially improve a manufacturer's profit. On the other hand, when the price commitment is credible enough, the manufacturer forgoes the price preannouncement. Collectively, these results underscore the strategic effects that price preannouncements can have on firms' marketing decisions.

Keywords: price preannouncement, commitment, pricing, distribution channel.

1 Introduction

It is not uncommon for manufacturers to preannounce prices for their products before they have been produced or, in some cases, even developed. In 2014, Boeing marketed its new 777X aircraft at a list price of $320 million, even though commercial delivery of the aircraft will begin only in 2025. Likewise, in 2015, Light, an American digital photography company, announced that their new Light L16 Camera would be priced at $1,299 when the camera will not be available until another year later (*Phogotraphy*, 2015). In 2017, Lucid Motors announced that its Lucid Air electric luxury car would be priced at $52,500 before its facility construction (Krok, 2017) while, in June 2022, Chinese car manufacturer JiDU announced its new car ROBO-01 to be priced at $30,000 even though this model was only at its conceptual stage (Hope, 2022). At times, the promises made are even grander: In 2011, Space Adventures, an American space tourism company, announced that it planned to offer $150 million tourism missions around the moon, a project that is still under development today (Dillow, 2011).

At first glance, such price preannouncements seem to restrict a manufacturer's pricing flexibility. In the early stages, actual production costs and/or demand are often uncertain, and a manufacturer may need to revoke its price commitment when faced with an unexpected cost and/or demand. For instance, while the Lucid Air was announced to be priced at $52,500, the car was actually introduced to the market in Q4 2022 at $87,400 (Ramos, 2022). In 2014, Amazon announced that Echo, its new voice-driven home assistant, will be priced at $199 (Machkovech, 2014). However, when the product was introduced to market one year later, it was sold at $179 (*Phys*, 2015). When a price preannouncement is made early, it becomes costly to make price adjustments in the future, which naturally becomes a burden to the manufacturer, especially since, as noted by Hoxmeier (2000) and Sorescu et al. (2007), a firm's reputation suffers if it cannot deliver on its preannouncement promise. With such constraints placed on manufacturers' strategy space, it seems natural to assume that price preannouncements negatively affect firms' profitability (Kuksov and Wang, 2014). And still, price announcements are industry practice, which raises the question: Why are manufacturers willing to take what appears to be an obvious risk?

Preannouncing prices has several potential benefits. For instance, preannouncements can help firms advertise their products and better manage consumers' expectations while helping them plan for future purchases (*KrASIA*, 2024). In addition, preannouncements can influence the behaviors of competitors in setting their prices or deter their market entry altogether (i.e., predatory pricing). Preannouncements can further induce consumers to wait to purchase the preannounced product. In certain industries, price preannouncements can also attract pre-orders and letters of intent from consumers. This paper offers a new rationale for why manufacturers may consider preannouncing their prices. We consider a model with an upstream supplier from whom a downstream manufacturer sources an input at a marginal price, converts it into a final product, and sells it to end consumers. We depart from classic distribution channel literature by making the critical assumption that, before contracting with the supplier, the manufacturer can preannounce a retail price at which the product will eventually be sold to consumers. In line with typical practice, we assume that price preannouncements serve as credible but flexible commitments. That is, a manufacturer can later revoke the preannounced price at a cost (e.g., reputation damage and legal costs).

Our analysis reveals several insights. First, we find that, when the manufacturer's input price is exogenously given, unsurprisingly, a price preannouncement weakly hurts the manufacturer's profit since it restricts pricing flexibility. Nonetheless, when the input price is endogenously priced by the upstream supplier, the manufacturer can strategically use the price preannouncement as a tool to sway the supplier's pricing decision and lower procurement costs. Specifically, when the cost of revoking the commitment is not too high, the manufacturer preannounces a low retail price. Observing this price, the supplier becomes willing to charge a low input price, which induces the manufacturer to deliver on its commitment so that the supplier can benefit from a low retail price and high consumer demand.

Second, we compare equilibrium outcomes with and without price preannouncements and find that the manufacturer benefits from making a preannouncement when it is flexible enough (i.e., when the cost of revoking it is not too high). Interestingly, even an extremely weak commitment can substantially improve the manufacturer's profit, and the price preannouncement also benefits consumers without hurting the supplier, thereby leading to Pareto-improvement.

Lastly, we consider a scenario in which the manufacturer can decide its own cost to revoke. When consumer demand is linear, at the chosen cost, the manufacturer enjoys a 100 percent profit improvement over the benchmark (i.e., no price preannouncement), and consumer surplus and social welfare also increase by 300 and 71.4 percent, respectively. Additionally, the total channel profit is equal to that of a centralized channel, indicating that the double marginalization problem is fully resolved.

Collectively, our results demonstrate the surprising effect of price preannouncements on channel coordination.

2 Related Literature

This paper contributes to the marketing literature on preannouncements, the formal and deliberate communication that a firm issues before undertaking a specific marketing action such as developing a new product (Bayus et al., 2001; Sorescu et al., 2007). Preannouncements have been conceptualized as a market signal made by a firm to influence the behavior of one or more of its stakeholders, including customers, competitors, channel members, and investors (Farrell and Saloner, 1986; Eliashberg and Robertson, 1988; Robertson et al., 1995; Gerlach, 2004; Choi et al., 2005; Sorescu et al., 2007; Ofek and Turut, 2013; Warren and Sorescu, 2017; Rao and Turut, 2019). One dominant motivation for preannouncement is preemption. For instance, industry analysts interpreted Boeing's preannouncement of the 787 as preemption of a product/market position, namely within the market for the 650-passenger aircraft (*Business Week*, 1993; Robertson et al., 1995). Eliashberg and Robertson (1988) have shown that product preannouncements benefit firms through preemption and if their new products require substantial consumer learning. Robertson et al. (1995) also investigate the role of preemption in product preannouncements and analyze how incumbents respond to new product preannouncements from rivals. Ofek and Turut (2013) show that, to discourage rival entries, an incumbent can make strategic preannouncement decisions depending on its forecasting capabilities as well as the demand-side benefits. Meanwhile, Farrell and Saloner (1986) find that, in the presence of the network effect, an entrant can use product preannouncements to induce consumers to wait to purchase its product. Similarly, Gerlach (2004) and Choi et al. (2005) demonstrate that, in the presence of switching costs or quality uncertainty, an entrant can make product preannouncements to encourage consumers to wait. Sorescu et al. (2007) study the effects of preannouncements on shareholder value and show that the financial returns on such announcements are significantly positive over the long run. Warren and Sorescu

(2017) study stock market reactions to a new product announcement and identify several factors that affect a firm's stock performance. Rao and Turut (2019) consider how preannouncing an unavailable product influences consumers' reference points when they compare various products. The above-mentioned studies, however, focus primarily on product preannouncements (e.g., preannouncing the launch date of new products) without rationalizing price preannouncements. Our present research contributes to the literature by offering such a rationale.

Our research also relates to the literature on strategic commitment, which has well-established that agents often benefit from committing to future decisions. For instance, the Coase conjecture suggests that a durable goods monopolist can improve its profit by committing to not cutting prices in the future (Coase, 1972). Under market competition, a firm can benefit from committing to information disclosure policies (Li, 2025) and not selling in certain markets (Bulow et al., 1985). A firm may also benefit from committing to not collecting consumer data for behavior-based pricing (Fudenberg and Villas-Boas, 2006; Li et al., 2020). An upstream supplier can also be better off when committing to charging higher prices to competing downstream manufacturers (McAfee and Schwartz, 1994). While the above papers demonstrate the power of credible commitments, we focus on both the credibility and flexibility of those commitments. In our model, the manufacturer's profit is maximized when its price commitment maintains a balance of credibility and flexibility.

There is an economic literature on partial commitment, i.e., a commitment that may be revoked later, that is related our study. The reversibility of commitments dates back to Judd's (1985) critique of product proliferation literature, in which he argues that high exit costs are critical in making product proliferation credible. Muthoo (1996) studies a bargaining game in which players can partially commit to a share of the whole they want to get, which can be revoked at a cost in the future; he shows that a player's payoff increases with the cost of revoking. Caruana and Einav (2008) model a dynamic game in which players can make weak commitments and change their minds as often as they wish at a switching cost, and then they derive the equilibrium strategy. Kovrijnykh (2013) analyzes a lender-borrower model that assumes lending contracts are imperfectly enforced and shows that an increase in the degree of enforcement can lower social welfare. Min (2021) considers a Bayesian persuasion game, assuming that the sender's commitment to an information structure binds with a probability less than one. He finds that the sender's profit weakly increases with its commitment power. Lohmann (1992) is most similar to our study. He analyzes policymakers' commitments to monetary policies that can be overridden in the future at a cost and shows that a moderate cost is most beneficial.

Lastly, our paper also contributes to the large body of literature on distribution channel management. It is well-established that a decentralized distribution channel suffers from the issue of double marginalization (Jeuland and Shugan, 1983; Tirole, 1988). Prior studies have also offered various ways to alleviate this problem such as by using nonlinear contracts (Jeuland and Shugan, 1983; Moorthy, 1987), offering pull price discounts (Gerstner and Hess, 1995), carrying strategic inventories (Anand et al., 2008; Li et al., 2022), adopting in-store media (Dukes and Liu, 2010), offering low-price guarantees (Jiang and He, 2021), and advance selling (Li and Li, 2023). Our research contributes to extant literature by showing that a simple price preannouncement can alleviate the double marginalization problem and even coordinate the channel.

3 The Model

Consider a manufacturer that procures an input (e.g., components, patent, software, hardware, license) from an upstream supplier and converts it into a final product that is then sold to end consumers. Consumer demand for the product is $D(p) = 1 - p$, where p is the retail price. We use Π to denote the supplier's profit and π to denote the manufacturer's profit. The manufacturer and supplier are contracted through a linear price, and the unit price is denoted by c. We normalize the manufacturer's and supplier's manufacturing costs to zero. Linear wholesale prices are commonly used in practice, and their rationalization has been extensively studied in the literature (e.g., Cui et al. 2007, Ho and Zhang 2007, Carroll 2015, and Li and Liu 2021) and is beyond the scope of the present paper.

We depart from classic channel literature by assuming that the manufacturer can make preannouncements of its retail price $p = p_c$ before contracting with its supplier. In line with industry practice, we assume that the price preannouncement is non-binding, meaning the manufacturer can revoke it later at a cost F, e.g., reputation damage, legal consequences, additional price advertising, and new contracts (Muthoo, 1996; Sorescu et al., 2007). In this sense, we view price preannouncements as flexible price commitments — also known as partial commitments in the literature (Lohmann, 1992) — that can be revoked later at a cost. In the extreme case that $F = 0$, the price preannouncement is not credible at all in that the manufacturer can break its commitment at no cost, rendering the preannouncement nothing more than cheap talk. In the other extreme case that $F = \infty$, the price preannouncement is not flexible at all in that the manufacturer cannot afford to break its commitment. We are interested in the general case in which F is neither nil nor prohibitively high, thus accommodating both credibility and flexibility.[1] In Section 5.2, we show that our main results continue to hold when the cost of revoking arises from consumers' reference effects.

In our basic model, we assume that the manufacturer incurs the revoking cost if it ultimately charges a retail price that is lower or higher than the preannounced price. In Section 5.1, however, we show that our main results continue to hold when the manufacturer only incurs a cost when it raises its price from the preannounced level.

The sequence of events is as follows. In the first stage, the manufacturer preannounces its retail price, p_c. In the second stage, the supplier observes the manufacturer's price preannouncement and then decides on the input price c. In the third stage, the manufacturer observes the input price c and then decides on its final retail price p. If the manufacturer deviates from the preannounced price, it incurs a revoking cost F.[2] If the manufacturer fulfills its price commitment ($p = p_c$), it does not incur the cost. Lastly, consumers make their purchase decisions, and profits are realized. Figure 1 summarizes the model timing.

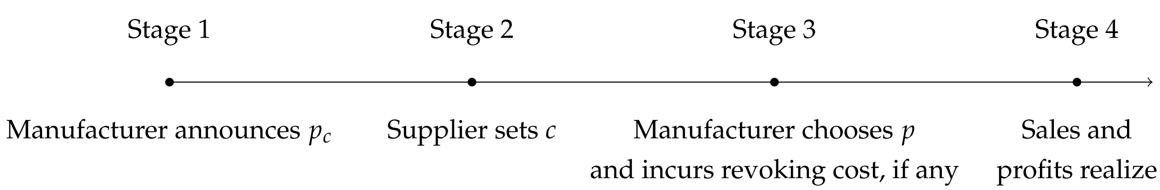


Figure 1: Timing of the model

While we consider a supplier-manufacturer relationship in our paper, our model has an alternative interpretation: A manufacturer sells its product at wholesale price c to a downstream

[1]Note that, because demand is normalized to $1 - p$, the cost of revoking is also a normalized cost that reflects the cost relative to market demand.

[2]Here, we assume that the manufacturer must incur the revoking cost even if it does not sell to consumers; however, our main insights do not change even when the manufacturer can avoid this cost by not selling to consumers. Please see Online Appendix for our detailed analysis.

retailer, who resells the product to consumers at retail price p. The retailer can make a preannouncement of its retail price in advance. All of our analysis remains consistent under this alternative interpretation.

4 Model Analysis

We use backward induction to solve for the subgame-perfect equilibrium. We consider cases in which the manufacturer makes and does not make price preannouncements and compare their equilibrium outcomes to investigate the profitability of price preannouncements.

4.1 No Price Preannouncements

First, consider a benchmark in which the manufacturer does not make any price preannouncements. In this case, the equilibrium simply replicates the standard double marginalization outcome, with the supplier charging the manufacturer an input price $c = \frac{1}{2}$ and the manufacturer charging consumers a retail price $p = \frac{3}{4}$. In equilibrium, the supplier's profit is $\Pi = \frac{1}{8}$ and the manufacturer's profit is $\pi = \frac{1}{16}$.

4.2 With Price Preannouncements

Next, consider a scenario in which the manufacturer preannounces its retail price in the first stage.

A Full Commitment Case

Before solving the full model, we consider a special case in which the manufacturer has full commitment power and always delivers on its commitment, i.e., it cannot revoke its preannounced price at a later date or choose not to sell.

If the manufacturer preannounces a high price $p_c \geq 1$, consumer demand is guaranteed to be zero. In this case, the supplier is indifferent about all input prices, and, in equilibrium, the market breaks down and both the manufacturer and supplier make zero profits.

If the manufacturer preannounces a low price $p_c < 1$, demand is $1 - p_c$ and the supplier's profit is $\Pi = c(1 - p_c)$, which increases with c. It follows immediately that the supplier can charge a very high price $c > p_c$, and the manufacturer makes a negative profit $\pi = (p_c - c)(1 - p_c) < 0$.

Following the above discussion, we find that, when the manufacturer has full commitment power, it is optimal for it to preannounce a price $p_c \geq 1$, and let the market break down. Unsurprisingly, the manufacturer does not benefit from its price preannouncement, which ultimately eliminates its pricing flexibility and allows the supplier to fully exploit it.

Manufacturer's Pricing Decision

Now, consider the general case in which the manufacturer's cost of revoking a price preannouncement is characterized by some $0 \leq F < \infty$. We solve the game using backward induction.

In the third stage, given its price preannouncement p_c and the input price c, the manufacturer chooses between (1) fulfilling its price commitment, charging consumers a price $p = p_c$, and making a profit of $\pi_1 = D(p_c)(p_c - c) = (1 - p_c)(p_c - c)$, and (2) revoking the price commitment, charging consumers a price $p \neq p_c$, and making a profit of $\pi_2 = D(p)(p - c) - F = (1 - p)(p - c) - F$. π_2 is maximized to $\frac{(1-c)^2}{4} - F$ at $p = \frac{1+c}{2}$.[3] We compare these scenarios and summarize the manufacturer's optimal pricing strategy in the following lemma:

Lemma 1 *Given p_c and c, the manufacturer's optimal pricing decision is as follows:*

$$p = \begin{cases} \frac{1+c}{2} & \text{if } c \leq \underline{c} = 2p_c - 2\sqrt{F} - 1, \\ p_c & \text{if } \underline{c} < c \leq \bar{c} = 2p_c + 2\sqrt{F} - 1, \\ \frac{1+c}{2} & \text{otherwise.} \end{cases} \tag{1}$$

Figure 2 illustrates the manufacturer's optimal retail price.

The intuition for Lemma 1 is as follows. When the input price c is low enough (high enough), the preannounced retail price becomes comparatively too high (too low). As such, the manufacturer becomes willing to revoke its price commitment to charge consumers a lower (higher) price $p < p_c$ ($p > p_c$). When c is neither too low nor too high (i.e., $\underline{c} < c \leq \bar{c}$), the manufacturer delivers on its price commitment to save on F, the cost of revoking the price commitment.

[3] For simplicity, we allow $p > 1$ in the analysis. Restricting $p \leq 1$ does not impact our main results.

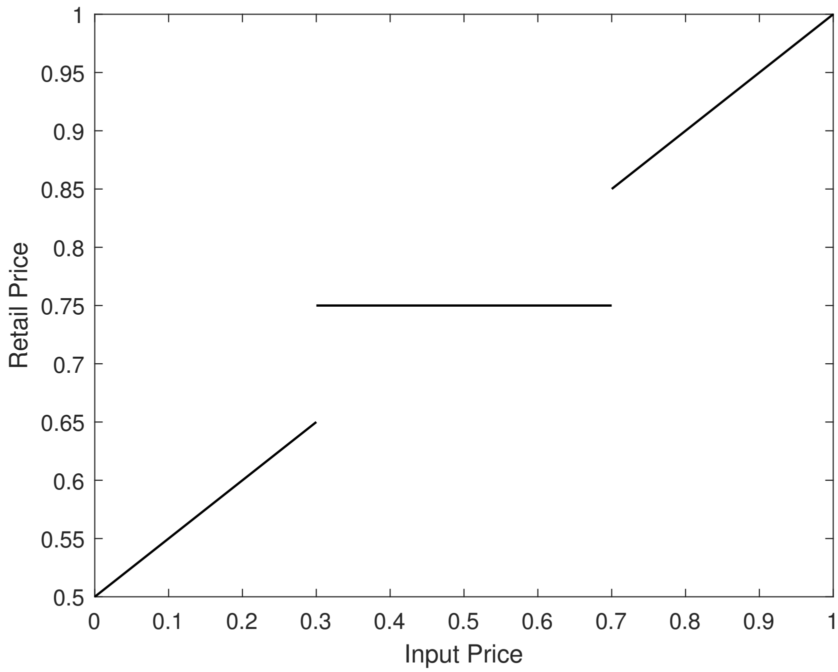


Figure 2: The manufacturer's optimal retail price ($p_c = 0.75, F = 0.01$)

Supplier's Pricing Decision

Consider next the supplier's decision in setting its input price c. Given p_c, the supplier chooses an input price c that maximizes its own profit $\Pi = D(p)c$, where p is given by (1). Following Lemma 1, the supplier chooses between three strategies: (1) Charging a low price $c \leq \underline{c}$ to induce the manufacturer to revoke its commitment and charge consumers a low retail price $p < p_c$, (2) charging a moderate price $\underline{c} < c \leq \bar{c}$ to induce the manufacturer to deliver on its commitment and charge consumers the preannounced retail price p_c, and (3) charging a high price $c \geq \bar{c}$ to induce the manufacturer to revoke its commitment and charge consumers a high retail price $p > p_c$.

Under strategy (1), the supplier's profit is maximized to $\Pi_1 = \min\left(\frac{1}{8}, \frac{\underline{c}(1-\underline{c})}{2}\right)$ at $c = \min\left(\frac{1}{2}, \underline{c}\right)$; under strategy (2), the supplier's profit is maximized to $\Pi_2 = (1 - p_c)\bar{c}$ at $c = \bar{c}$; under strategy (3), the supplier's profit is maximized to $\Pi_3 = \min\left(\frac{1}{8}, \frac{\bar{c}(1-\bar{c})}{2}\right)$ at $c = \max\left(\frac{1}{2}, \bar{c}\right)$. A straightforward comparison of the three strategies yields the supplier's optimal pricing strategy, which is summarized in the following lemma. To break ties, we assume that, when the manufacturer is indifferent, it always chooses the lowest possible retail price, which maximizes demand as well as the supplier's profit.

Lemma 2 *Given p_c, when $F \leq \frac{1}{64}$, the supplier's optimal pricing decision is as follows:*

$$c = \begin{cases} \frac{1}{2} & \text{if } p_c > \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}, \\ \bar{c} & \text{if } \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} < p_c \leq \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}, \\ \frac{1}{2} & \text{if } p_c < \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}. \end{cases} \tag{2}$$

When $F \geq \frac{1}{64}$, the supplier's optimal pricing decision is as follows:

$$c = \begin{cases} \frac{1}{2} & \text{if } p_c > \frac{3}{4} + \sqrt{F}, \\ \underline{c} & \text{if } \frac{5+2\sqrt{F}}{6} \leq p_c \leq \frac{3}{4} + \sqrt{F}, \\ \bar{c} & \text{if } \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} \leq p_c \leq \frac{5+2\sqrt{F}}{6}, \\ \frac{1}{2} & \text{if } p_c < \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}. \end{cases} \tag{3}$$

Figure 3 illustrates the supplier's optimal pricing decision. The intuition underlying the supplier's pricing strategy is as follows. When the manufacturer's preannounced retail price is extremely low (i.e., $p_c < \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$), the manufacturer has a strong incentive to revoke its commitment and charge consumers a higher retail price unless the supplier charges a very low input price $c < \underline{c}$. However, such a low input price would squeeze the supplier's margin substantially and hurt its profit; as a result, the supplier ignores the preannounced price and charges the manufacturer a standard double marginalization price $c = \frac{1}{2}$, inducing it to revoke its price commitment and charge consumers a high retail price $p = \frac{3}{4} > p_c$.

When the preannounced retail price is moderate, the price commitment is reasonable and the supplier has no incentive to induce the manufacturer to revoke it. The retail price p and consumer demand are insensitive to c as long as $\underline{c} \leq c \leq \bar{c}$. Recognizing this, the supplier simply charges the price ceiling within the interval, i.e., it charges $c = \bar{c}$, inducing the manufacturer to charge $p = p_c$.

When the manufacturer's preannounced retail price is relatively high (i.e., $\frac{5+2\sqrt{F}}{6} \leq p_c \leq \frac{3}{4} + \sqrt{F}$), it depresses consumer demand (i.e., $1 - p_c$ becomes low) and hurts the supplier if the commitment is fulfilled. Therefore, the supplier becomes willing to distort its input price downward, charging a price $c = \underline{c} < \frac{1}{2}$ to induce the manufacturer to revoke its price commitment and charge consumers a low retail price $p < p_c$ instead.

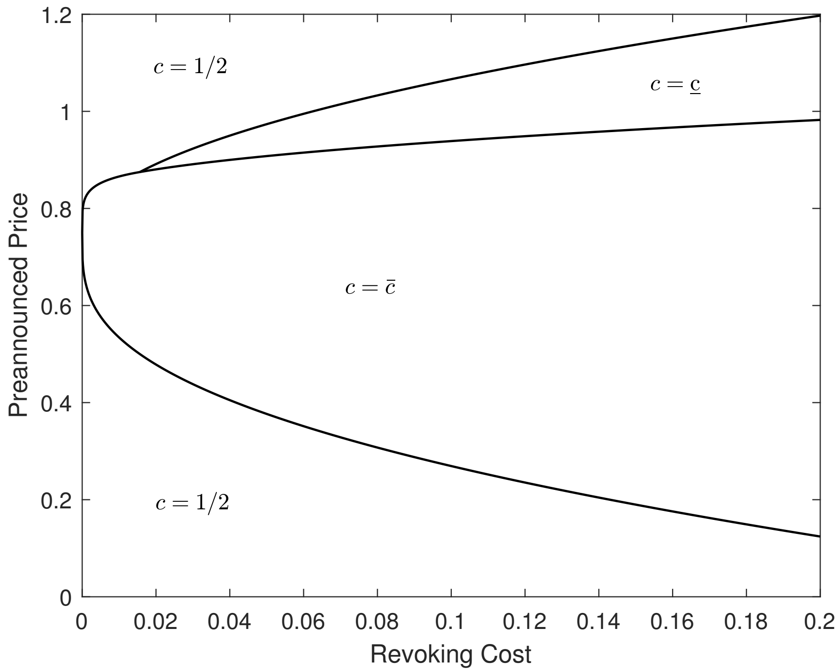


Figure 3: The supplier's optimal pricing strategy

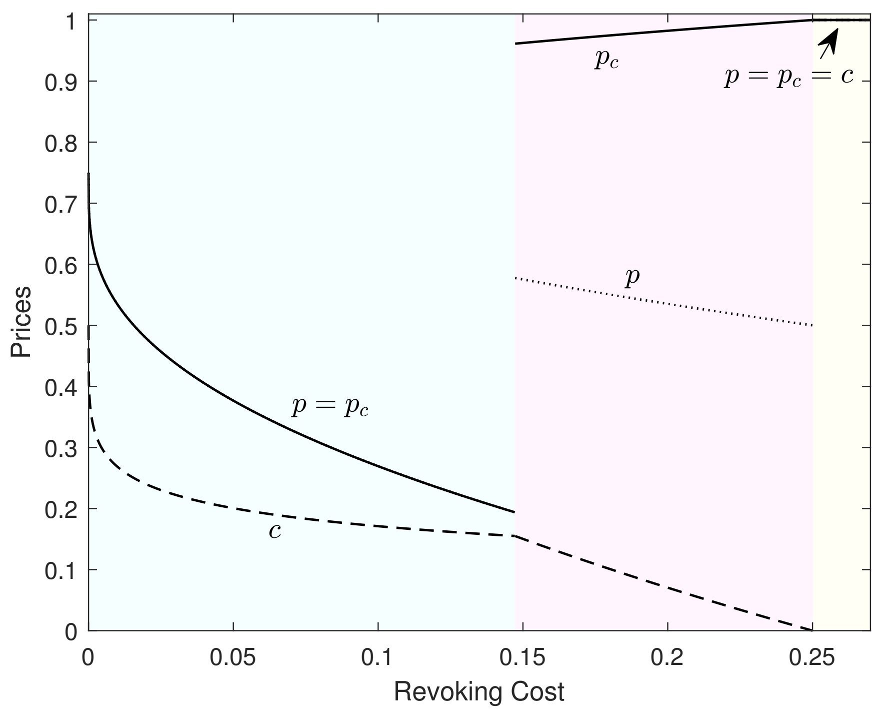
Lastly, consider the case in which the manufacturer's preannounced retail price is extremely high (i.e., $p_c > \max\left\{\frac{3}{4} + \sqrt{F}, \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}\right\}$). If the price commitment is delivered, it depresses consumer demand significantly and hurts both the supplier and manufacturer. In this case, the manufacturer is willing to revoke its price commitment even without receiving a low input price from its supplier. As such, the supplier need not distort its input price; it charges a standard double marginalization input price $c = \frac{1}{2}$ and can still have the manufacturer revoke its commitment and charge a low price $p = \frac{3}{4} < p_c$.

Manufacturer's Preannouncement Decision

Now, consider the manufacturer's price preannouncement decision p_c. The manufacturer chooses between four strategies: (1) preannouncing an excessively high or low retail price, inducing the supplier to charge a standard input price $c = \frac{1}{2}$ and revoking its price commitment later, (2) preannouncing a relatively high retail price, inducing the supplier to charge a low input price $c = \underline{c}$, and revoking its price commitment later, (3) preannouncing a moderate retail price, inducing the supplier to charge an input price $c = \bar{c}$, and delivering on the commitment later, and (4) preannouncing a retail price $p_c = 1$, thus forgoing consumer demand and making zero profits, an option that is only viable when $F \geq \frac{1}{4}$. We solve for the equilibrium and summarize the results in the following lemma.

Lemma 3 *The manufacturer's optimal price preannouncement decision is as follows:*

$$p_c = \begin{cases} \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} & \text{if } F \leq \frac{59+24\sqrt{6}}{800} \approx 0.147, \\ \frac{5+2\sqrt{F}}{6} & \text{if } \frac{59+24\sqrt{6}}{800} < F \leq \frac{1}{4}, \\ 1 & \text{otherwise.} \end{cases} \tag{4}$$



Note: $p_c = p$ holds when $F \leq 0.147$, and $p_c = p = c$ holds when $F > 0.25$.

Figure 4: The equilibrium prices under price preannouncements

The solid line in Figure 4 illustrates how the manufacturer's optimal price preannouncement, p_c, changes with the revoking cost F. As shown, when $0 < F \leq \frac{59+24\sqrt{6}}{800} \approx 0.147$, the manufacturer preannounces a low p_c that is below the standard double marginalization price (i.e., $p_c = \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} < \frac{3}{4}$). The intuition for preannouncing a low p_c is as follows. When faced with a low p_c, the supplier effectively chooses between two strategies: (1) charging the manufacturer a low price $c = \bar{c} < \frac{1}{2}$ and having the manufacturer deliver on its commitment, thereby generating the high consumer demand $1 - p_c > \frac{1}{4}$; or (2) charging a standard double marginalization price $c = \frac{1}{2} > \bar{c}$, under which the manufacturer revokes its commitment and charges consumers a high $p = \frac{3}{4} > p_c$, thus depressing consumer demand. At the preannounced price $p_c = \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$, the supplier is indifferent between the two strategies and charges a low $c = \bar{c} < \frac{1}{2}$, which is the Pareto-dominant equilibrium. Such a low input price $c < \frac{1}{2}$ benefits the manufacturer.

When $\frac{59+24\sqrt{6}}{800} < F \leq \frac{1}{4}$, the manufacturer preannounces a high $p_c = \frac{5+2\sqrt{F}}{6} > \frac{3}{4}$. Observing this, the supplier is willing to offer a low price $c = \underline{c} < \frac{1}{2}$ so that the manufacturer changes its mind and charges a price $p = \frac{1+c}{2} < \frac{3}{4} < p_c$. Note that this is the equilibrium outcome of a subgame in which the manufacturer makes a price preannouncement. As will be shown later, in the whole game in which the manufacturer can choose to preannounce, it does not do so. Finally, when $F > \frac{1}{4}$, the manufacturer cannot afford to revoke its preannounced price. Like the full commitment case, the manufacturer preannounces a price $p_c = 1$ under this scenario.

In sum, our analysis reveals that the manufacturer can strategically use price preannouncements as a tool to sway the supplier's pricing decision and secure low procurement costs.

4.3 The Effect of Price Preannouncements

Thus far, we have obtained the equilibrium outcomes with and without price preannouncements, all of which are shown in Table 1.

Manufacturer's Profit

As discussed before, it is not uncommon for manufacturers to preannounce prices before their products are even developed. So, can manufacturers profit from preannouncements? We compare the manufacturer's profits with and without price preannouncements and summarize our results in the following proposition.

Proposition 1 *The manufacturer is better off making a price preannouncement when $F \leq \frac{1}{9}$ and is worse off otherwise. Moreover, when $F \leq \frac{1}{9}$, the manufacturer always delivers on its price commitment (i.e., $p = p_c$ in equilibrium).*

Table 1: Equilibrium Outcome

	No Preannouncements	With Preannouncements		
		$F \leq \frac{59+24\sqrt{6}}{800}$	$\frac{59+24\sqrt{6}}{800} < F \leq \frac{1}{4}$	$F > \frac{1}{4}$
p_c	N.A.	$\frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$	$\frac{5+2\sqrt{F}}{6}$	1
c	$\frac{1}{2}$	$\frac{1+2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{2}$	$\frac{2-4\sqrt{F}}{3}$	1
p	$\frac{3}{4}$	$\frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$	$\frac{5-4\sqrt{F}}{6}$	1
Π	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1+2\sqrt{F}-8F}{9}$	0
π	$\frac{1}{16}$	$\frac{1+4\sqrt{\sqrt{F}+F}-8(F+\sqrt{F}\sqrt{\sqrt{F}+F})}{16}$	$\frac{1+8\sqrt{F}-20F}{36}$	0
CS	$\frac{1}{32}$	$\frac{1+8F+4\sqrt{\sqrt{F}+F}+8\sqrt{F}(1+\sqrt{\sqrt{F}+F})}{32}$	$\frac{(1+4\sqrt{F})^2}{72}$	0
SW	$\frac{7}{32}$	$\frac{16-(3-2\sqrt{F}-\sqrt{\sqrt{F}+F})^2}{32}$	$\frac{11+40\sqrt{F}-16F}{72}$	0

Figure 5 illustrates how the manufacturer's equilibrium profit changes with F.

Proposition 1 and Figure 5 uncover the main finding of this paper: The manufacturer is better off making price preannouncements as long as the commitment is flexible (i.e., when F is not too high). The explanation is as follows. As discussed above, when F is not too high, the manufacturer preannounces a low retail price $p_c < \frac{3}{4}$ at the outset. Given this low preannounced price, the supplier is willing to cut its margin c to induce the manufacturer to deliver on its commitment and charge consumers a low price. As such, even though the manufacturer charges consumers a low price, it benefits from the supplier's equally thinned margin and increased demand. When $F \leq \frac{1}{9}$, the benefit of the latter effects dominates the cost of the former effect, and the manufacturer is better off with its price preannouncements.

Interestingly, even an extremely weak commitment (i.e., a very small F) can substantially improve the manufacturer's profit. For instance, under our model settings, when $F = 0.0001$, the manufacturer's profit with price preannouncements is $\pi \approx 0.087$, a 39.3 percent profit improvement over the no-price-preannouncement benchmark. While manufacturers, in practice, typically do not suffer a huge cost when failing to deliver on their commitment (the fixed cost of changing price tags or making new price announcements, for instance, is relatively low), our analysis suggests that they can still take advantage of their price preannouncements and profit from them.

Why does the manufacturer benefit significantly from a low F? While a low F reduces the credibility of the price commitment, it also makes it harder for the supplier to induce the manufacturer

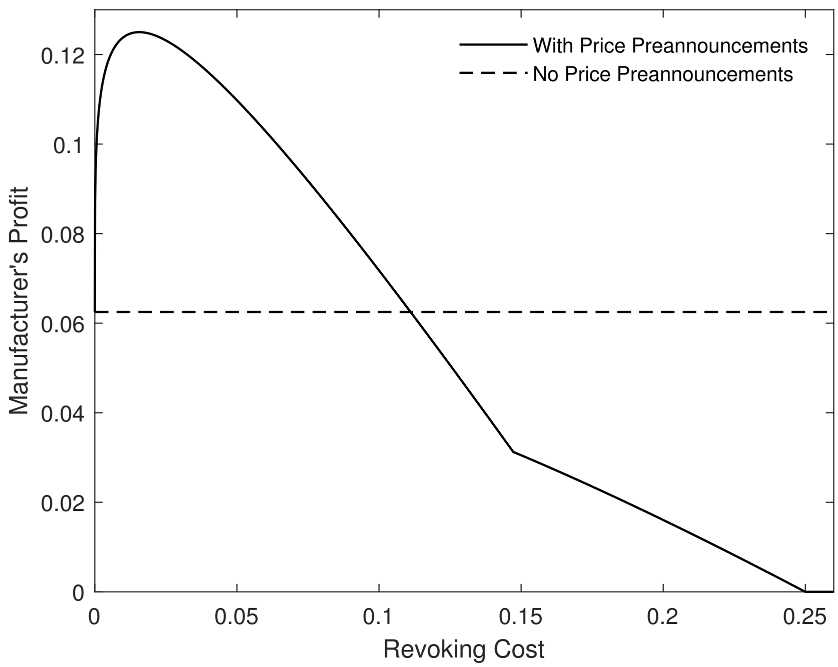


Figure 5: The manufacturer's equilibrium profit

to deliver on it. More specifically, when F is low, the manufacturer has a strong incentive to revoke its commitment unless the input price is low enough. As such, the supplier must also cut its input price significantly to induce the manufacturer to deliver on its commitment, thus benefiting the manufacturer.

Although our model dictates that a manufacturer who makes preannouncement (i.e., when $F \leq \frac{1}{9}$) always fulfills its commitment (i.e., in equilibrium, it always sets $p = p_c$), in practice, manufacturers can revoke their commitment for other reasons, e.g., when there are demand uncertainties. Please refer to Section 5.3 for details.

Supplier's Profit, Consumer Surplus, and Social Welfare

The previous section showed that manufacturers can benefit from preannouncing their prices when the cost to revoke is not too high. But how does a manufacturer's preannouncement affect its supplier, consumers, and society as a whole? We summarize the results in the following proposition.

Proposition 2 *Whenever the price preannouncement is profitable for the manufacturer (i.e., when $F \leq \frac{1}{9}$), it benefits consumer surplus and social welfare but has no effect on the supplier's profit.*

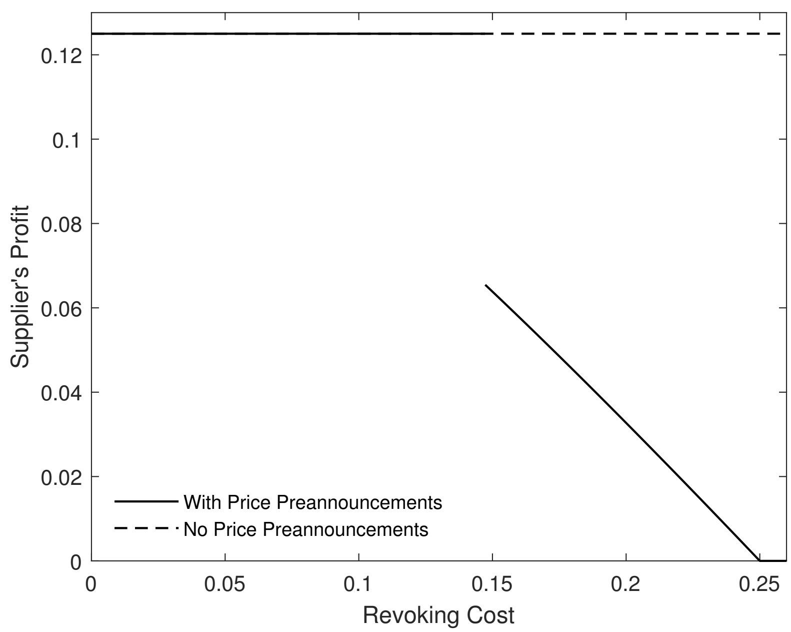


Figure 6: The supplier's equilibrium profit

Figures 6, 7 and 8 illustrate the result of Proposition 2. As discussed earlier, when $F \leq \frac{1}{9}$, the manufacturer preannounces a low retail price $p_c \leq \frac{3}{4}$, which is set strategically so that the supplier is indifferent between (1) charging a low price and having the manufacturer deliver on its commitment and (2) charging a standard double marginalization price and having the manufacturer revoke its commitment. The indifference condition implies that the supplier's equilibrium profit is always equal to its profit under the no-price-preannouncement benchmark. Because the manufacturer always delivers on its commitment and charges consumers a low price, both consumer surplus and social welfare are higher with price preannouncements.

4.4 Endogenous Commitment Power

In our analysis above, we assume that F, the manufacturer's cost to revoke its price commitment, is exogenously given. However, it is also plausible for the manufacturer to take measures to make its commitment more credible or flexible. For instance, to increase its commitment's flexibility,

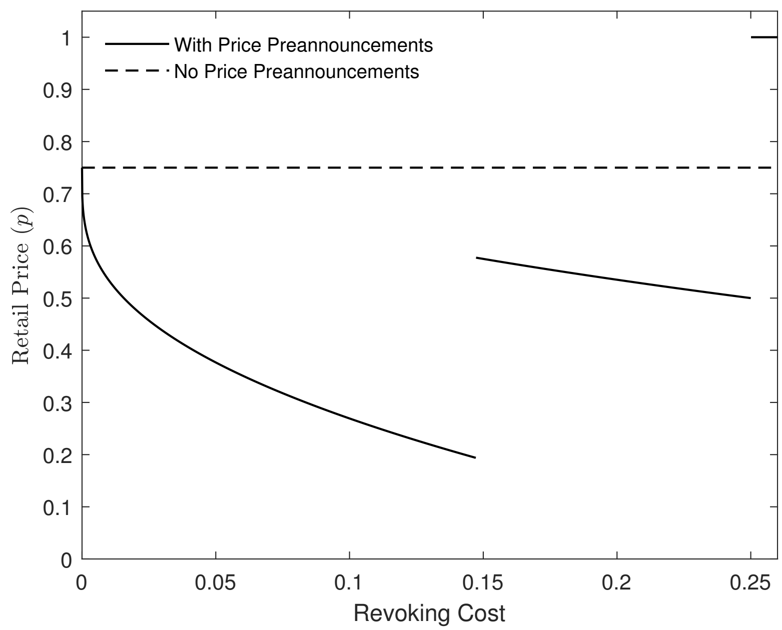
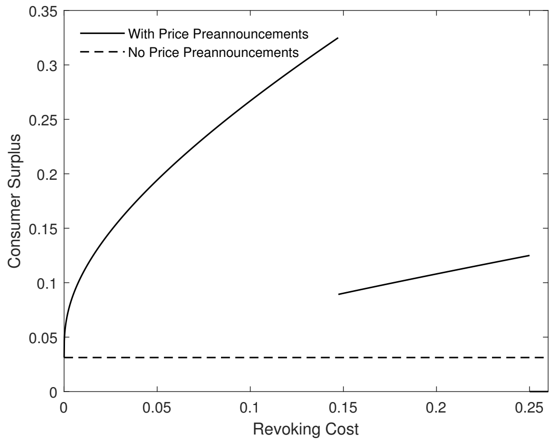


Figure 7: Equilibrium Retail Price (p)

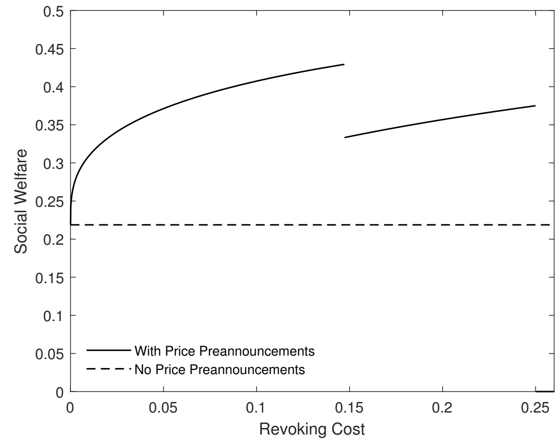
a manufacturer may use approximate terms such as ”around” or ”about” when preannouncing its product’s future price. A manufacturer can also choose a strategic channel to preannounce its prices, such as through press releases, social media, company websites, advertising, email newsletters, public events, or a combination of the above. The understanding is that, when a price preannouncement is made through formal (e.g., an official press release or TV advertising) or multiple channels, the revoking cost is likely to be higher, making the commitment more credible. Reversely, when the price preannouncement is made through informal channels (e.g., social media) or a single channel, the revoking cost is likely to be lower, making the commitment more flexible.

In this section we consider a case in which the manufacturer can both make a price preannouncement and choose the revoking cost F. We solve the model and summarize the results in the following proposition.

Proposition 3 *Suppose the manufacturer can decide its revoking cost F. In equilibrium, the manufacturer sets $F = \frac{1}{64}$ and $p_c = \frac{1}{2}$. Under this cost, the manufacturer’s profit is $\pi = \frac{1}{8}$, the supplier’s profit is $\Pi = \frac{1}{8}$, consumer surplus is $CS = \frac{1}{8}$, and social welfare is $SW = \frac{3}{8}$.*



(a) Consumer Surplus



(b) Social Welfare

Figure 8: Equilibrium Consumer Surplus and Social Welfare

According to Proposition 3, when the manufacturer chooses its revoking cost, the equilibrium retail price is $p = p_c = \frac{1}{2}$. Note that this retail price equals that of a centralized channel and maximizes the total channel profit. Therefore, the price preannouncement completely eliminates the inefficiencies of the double marginalization problem, benefiting the manufacturer and consumers without hurting the supplier. Again, this result showcases the surprising benefits of price preannouncements.

Our finding also suggests that a profitable price commitment should be flexible. Consistent with our prediction, in 2017, Chinese aircraft manufacturer COMAC unofficially announced that its new aircraft C919 would be priced at ”around \$50 million” (Goh and Hepher, 2017). Similarly, in 2020, Rivian Automotive’s CEO R.J. Scaringe told Reuters that its R1T electric pickup would sell for ”about \$69,000” (McGlaun, 2020). Compared to using precise terms in preannouncements, employing approximate terms such as “around,” “about,” or “approximately” leaves room for flexibility and interpretation. Then, if the commitment needs to be adjusted or revoked later on, it may be perceived as less definite or binding and thus less problematic, allowing the firm to alleviate significant consequences or pushback.

5 Extensions

5.1 No Cost for Price Cuts

In our basic model, we assume that the manufacturer incurs a revoking cost F whenever it charges a price p that differs from its price preannouncement, i.e., when $p \neq p_c$. In practice, however, consumers may actually appreciate price cuts and be extra sensitive to price increases, the backlash of which can damage the manufacturer's reputation. To capture this effect, we consider an alternative model in which the manufacturer incurs a revoking cost only when it charges a higher price $p > p_c$ than what was originally preannounced. It does not incur any cost when charging a lower price, and the rest of the model is unchanged.

When the manufacturer does not preannounce its product price, the game is unaffected and the equilibrium replicates the standard double marginalization outcome. When the manufacturer makes a preannouncement, we solve the model using backward induction.

Consider the manufacturer's pricing decision in the last stage. Similar to the basic model, we find:

$$p = \begin{cases} \frac{1+c}{2} & \text{if } c \leq \underline{c} = 2p_c - 1, \\ p_c & \text{if } \underline{c} < c \leq \bar{c} = 2p_c + 2\sqrt{F} - 1, \\ \frac{1+c}{2} & \text{otherwise.} \end{cases} \tag{5}$$

In line with Equation (1), the manufacturer revokes its commitment and charges consumers a high (low) price when the input price is excessively high (low) and fulfills its commitment otherwise. Unlike the basic model, however, the manufacturer is now more likely to charge consumers a price $p < p_c$ because it does not incur any costs to do so.

Given the manufacturer's best response function, we solve for the supplier's pricing decision:

$$c = \begin{cases} \frac{1}{2} & \text{if } p_c > \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}, \\ \bar{c} & \text{if } \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} \leq p_c \leq \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}, \\ \frac{1}{2} & \text{if } p_c < \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}. \end{cases} \tag{6}$$

Equation (6) shows that the supplier's pricing decision hinges on the manufacturer's preannounced price. When this price is very high, the manufacturer becomes willing to revoke its price commitment and charge consumers a lower price. In this case, the supplier does not need to distort its input price and, instead, charges the standard double marginalization price $c = \frac{1}{2}$. When the preannounced price is low enough, it becomes too costly for the supplier to induce the manufacturer to deliver on its commitment. As such, the supplier charges the standard double marginalization price. When the preannounced price is somewhere in between, demand becomes insensitive to the input price so long as $\underline{c} \leq c \leq \bar{c}$. The supplier charges the highest possible price $c = \bar{c}$ and induces the manufacturer to deliver on its commitment.

Lastly, we consider the manufacturer's price preannouncement decision p_c. Straightforward algebra reveals that the manufacturer's optimal price preannouncement is

$$p_c = \begin{cases} \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} & \text{if } F \leq \frac{1}{9}, \\ 1 & \text{otherwise.} \end{cases} \tag{7}$$

The intuition is as follows. Similar to the basic model, when F is low, the manufacturer preannounces a low price $p_c < \frac{3}{4}$. Given this low p_c, the supplier becomes willing to collaborate with the manufacturer, charge it a low input price c and encourage it to deliver on its commitment to charge consumers a low price. This process generates high consumer demand and, as such, the manufacturer benefits from the lowered input price and increased profits.

When F is high, the manufacturer's price preannouncement generates results that are slightly different from those of the basic model. Recall that, in the basic model, price preannouncements become unprofitable when F is high because it severely restricts the manufacturer's pricing flexibility, which the supplier is free to exploit. But, now, the manufacturer does not incur a revoking cost when charging a price $p < p_c$, and, therefore, simply preannounces a prohibitively high price $p_c = 1$ (or any price $p_c \geq 1$), giving the manufacturer full flexibility to adjust its price at a later stage. In this case, the price preannouncement virtually has no effect in equilibrium.

Comparing equilibrium outcomes with and without price preannouncements, we derive the following proposition.

Proposition 4 *Suppose the manufacturer only incurs a revoking cost when charging a price $p > p_c$. In equilibrium, the manufacturer strictly benefits from making price preannouncements when $0 < F < \frac{1}{9}$. Within this regime, the manufacturer's price preannouncement improves consumer surplus and social welfare without hurting the supplier.*

Proposition 4 replicates our main result, which is that, when the revoking cost F is not too high, price preannouncements alleviate the double marginalization problem and benefit the manufacturer and consumers alike. Moreover, it is easy to verify that, when the manufacturer can choose its F, it still chooses $F = \frac{1}{64}$, leading to a retail price $p = p_c = \frac{1}{2}$, equal to that of a centralized channel. Overall, our results show that the effects of price preannouncements holds even if the manufacturer only incurs a revoking cost when adjusting its preannounced price upward.

5.2 A Model with Reference Effects

In the basic model, we assume that the revoking cost is a fixed cost for the manufacturer, e.g., paid through reputation damage and legal consequences. In this section, we consider an alternative model in which the revoking cost arises from consumers' reference effects.

More specifically, when the manufacturer preannounces its retail price p_c, consumers take this as their reference price. If the eventual price differs from the reference price p_c, consumers suffer a psychological loss proportional to the magnitude of the price deviation. Mathematically, we assume that the consumer demand is $D(p, p_c) = 1 - p - \lambda|p - p_c|$, where $\lambda > 0$ captures the extent of loss aversion. Here, $\lambda|p - p_c|$ can be thought of as consumers' disutility when purchasing at a price $p \neq p_c$. Our results continue to hold when consumers only incur a loss when $p > p_c$. We delegate the detailed analysis to the appendix and summarize the results in the following proposition:

Proposition 5 *Consider a model with reference effects. For any* $0 < \lambda < 8$*, in equilibrium, price precommitments alleviate double marginalization and improve the supplier's and manufacturer's profits, consumer surplus and social welfare.*

Proposition 5 suggests that, with consideration to reference effects, price precommitments continue to profit the manufacturer, so long as λ is not too high (see Figure 9). For instance, when $\lambda = 0.5$, price precommitments lead to an 18.5% profit improvement for both the supplier and manufacturer. But why is this so?

The intuition is somewhat similar to that of the basic model. In equilibrium, the manufacturer precommits to a low retail price $p_c < \frac{3}{4}$. Faced with this low price, the supplier charges either (1) a low input price to induce the manufacturer to deliver on its commitment and boost demand or

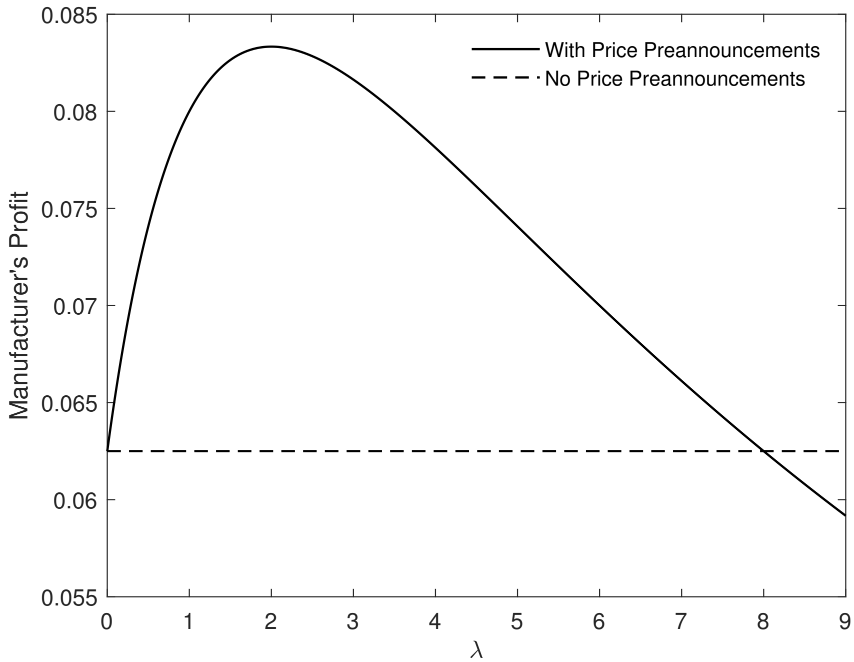


Figure 9: The effect of price preannouncements on the manufacturer

(2) a high input price to induce the manufacturer to revoke its commitment and charge consumers a high retail price. Note that, in the latter case, demand is squeezed by both the high price (i.e., $1 - p$ decreases) and the reference effects (i.e., $\lambda|p - p_c|$ increases), which substantially hurts the supplier's profits. As a result, the supplier prefers the first strategy, charging the manufacturer a low input price $c < \frac{1}{2}$. When λ is not too high, both the manufacturer and supplier charge lower prices, thereby alleviating the issue of double marginalization, which leaves both firms better off and also benefits consumers with lowered prices. When $\lambda > 8$, equilibrium prices become too high, which hurts the firms' profits. As a result, the manufacturer is worse off preannouncing its product price.

As discussed earlier, the manufacturer may have some control over λ, the extent of consumer loss aversion, e.g., using approximate terms such as "around," "about," or "approximately" when preannouncing future product prices to reduce loss aversion or making the price preannouncement through formal and/or multiple channels to increase loss aversion. In this case, what is the manufacturer's optimal decision λ? The following proposition summarizes the result:

Proposition 6 *Suppose the manufacturer can decide consumers' loss aversion λ. In equilibrium, the man-*

ufacturer chooses $\lambda = 2$. At this λ, the manufacturer's profit is $\pi = \frac{1}{12}$, the supplier's profit is $\Pi = \frac{1}{6}$, and the total channel profit is $\Pi_c = \frac{1}{4}$, which is equivalent to that of a centralized channel.

Proposition 6 replicates the findings of our basic model, which state that, when the manufacturer can choose the extent of loss aversion, price preannouncements significantly improve its profits as well as the total channel profit. This result shows the non-trivial role that price preannouncements play in channel coordination.

5.3 Demand Uncertainty

In the basic model, the product's market demand is deterministic (i.e., $D(p) = 1 - p$). This assumption simplifies reality, in which market demand is often stochastic. In this section, we demonstrate the robustness of our model by considering the role of price preannouncements in the presence of demand uncertainty.

To capture the effects of demand uncertainty, we assume that demand for the product is $D(p) = A - p$, where A is a random variable that follows the following two-point distribution: $A = 1 - \sigma$ and $A = 1 + \sigma$ with equal probability, where $\sigma \geq 0$ captures the extent of demand uncertainty.[4] Our basic model is, thus, a special case in which $\sigma = 0$.

The sequence of events is as follows. The manufacturer, if choosing to make a price preannouncement, preannounces its retail price, p_c. Because preannouncements are often made years before the actual product launch, the manufacturer does not know its market demand at this stage. Upon observing p_c, the supplier decides on its input price c. Lastly, demand uncertainty is resolved, and the manufacturer decides its retail price, p. As before, the manufacturer must expend a revoking cost F if its eventual retail price differs from the preannounced price.

Consider the game in which the manufacturer preannounces. Again, we analyze the game using backward induction: Given input price c, preannounced price p_c and the realized demand A, the manufacturer decides whether or not to deliver on its commitment and, subsequently, the eventual price charged to consumers. If the manufacturer delivers on its commitment, its profit is $\pi_1 = (A - p_c)(p_c - c)$. If the manufacturer revokes its commitment, it optimally charges a retail price $p = \frac{A+c}{2}$, and its profit is $\pi_2 = \frac{(A-c)^2}{4} - F$. Comparing profits under these two scenarios, it

[4] We thank an anonymous referee for suggesting this model setup.

follows that the manufacturer's optimal pricing decision is

$$p = \begin{cases} \frac{A+c}{2} & \text{if } c \le 2p_c - 2\sqrt{F} - A, \\ p_c & \text{if } 2p_c - 2\sqrt{F} - A < c \le 2p_c + 2\sqrt{F} - A, \\ \frac{A+c}{2} & \text{if } 2p_c + 2\sqrt{F} - A < c. \end{cases} \tag{8}$$

Plugging the distribution of A into Equation (8), we rewrite the manufacturer's pricing decision as $p = (p_H, p_L)$, where p_H (p_L) is the manufacturer's eventual price when demand is high (low):

If demand variation is low, i.e., $\sigma^2 \le 4F$, we have

$$(p_H, p_L) = \begin{cases} \left(\frac{1+c+\sigma}{2}, \frac{1+c-\sigma}{2}\right) & \text{if } c \le 2p_c - 2\sqrt{F} - 1 - \sigma, \\ \left(p_c, \frac{1+c-\sigma}{2}\right) & \text{if } 2p_c - 2\sqrt{F} - 1 - \sigma < c \le 2p_c - 2\sqrt{F} - 1 + \sigma, \\ (p_c, p_c) & \text{if } 2p_c - 2\sqrt{F} - 1 + \sigma < c \le 2p_c + 2\sqrt{F} - 1 - \sigma, \\ \left(\frac{1+c+\sigma}{2}, p_c\right) & \text{if } 2p_c + 2\sqrt{F} - 1 - \sigma < c \le 2p_c + 2\sqrt{F} - 1 + \sigma, \\ \left(\frac{1+c+\sigma}{2}, \frac{1+c-\sigma}{2}\right) & \text{if } 2p_c + 2\sqrt{F} - 1 + \sigma < c. \end{cases} \tag{9}$$

Alternatively, if demand variation is high, i.e., $\sigma^2 > 4F$, we have

$$(p_H, p_L) = \begin{cases} \left(\frac{1+c+\sigma}{2}, \frac{1+c-\sigma}{2}\right) & \text{if } c \le 2p_c - 2\sqrt{F} - 1 - \sigma, \\ \left(p_c, \frac{1+c-\sigma}{2}\right) & \text{if } 2p_c - 2\sqrt{F} - 1 - \sigma < c \le 2p_c + 2\sqrt{F} - 1 - \sigma, \\ \left(\frac{1+c+\sigma}{2}, \frac{1+c-\sigma}{2}\right) & \text{if } 2p_c + 2\sqrt{F} - 1 - \sigma < c \le 2p_c - 2\sqrt{F} - 1 + \sigma, \\ \left(\frac{1+c+\sigma}{2}, p_c\right) & \text{if } 2p_c - 2\sqrt{F} - 1 + \sigma < c \le 2p_c + 2\sqrt{F} - 1 + \sigma, \\ \left(\frac{1+c+\sigma}{2}, \frac{1+c-\sigma}{2}\right) & \text{if } 2p_c + 2\sqrt{F} - 1 + \sigma < c. \end{cases} \tag{10}$$

Interestingly, when $\sigma^2 > 4F$, $p_H = p_L = p_c$ never arises as an equilibrium outcome, i.e., the manufacturer always revokes its commitment with positive probabilities. This is because high demand variation never allows the same input price to fit both demand states. Under a moderately low input price ($2p_c - 2\sqrt{F} - 1 - \sigma < c \le 2p_c + 2\sqrt{F} - 1 - \sigma$), the manufacturer is willing to deliver on its commitment when demand is high but prefers to revoke and charge a low price $p < p_c$ when demand is low. Under a moderately high input price ($2p_c - 2\sqrt{F} - 1 + \sigma < c \le 2p_c + 2\sqrt{F} - 1 + \sigma$), the manufacturer is willing to deliver on its commitment when demand is low but prefers to revoke and charge a high price $p > p_c$ when demand is high.

The following corollary follows immediately from the above discussion.

Corollary 1 *When demand is highly volatile, $\sigma^2 > 4F$, regardless of the input price, the manufacturer always revokes its price commitment with positive probabilities.*

Next, we investigate the supplier's decision on c. When $\sigma^2 \leq 4F$, the supplier chooses from the following alternatives:

(1) The supplier charges a very low input price, inducing the manufacturer to revoke its commitment and charge a price $p < p_c$ under both demand states. In this case, the supplier's profit-maximization problem is

$$\max_c \Pi_1 = \frac{1}{2}\left(\frac{1+\sigma-c}{2}\right)c + \frac{1}{2}\left(\frac{1-\sigma-c}{2}\right)c,$$

$$\text{s.t.,} \quad c \leq 2p_c - 2\sqrt{F} - 1 - \sigma.$$

The supplier's profit is maximized at $c = \min(\frac{1}{2}, 2p_c - 2\sqrt{F} - 1 - \sigma)$.

(2) The supplier charges a relatively low input price, inducing the manufacturer to deliver on its commitment only when demand is high and revoke and charge $p < p_c$ when demand is low. In this case, the supplier's profit-maximization problem is

$$\max_c \Pi_2 = \frac{(1+\sigma-p_c)c}{2} + \frac{1}{2}\left(\frac{1-\sigma-c}{2}\right)c,$$

$$\text{s.t.,} \quad 2p_c - 2\sqrt{F} - 1 - \sigma < c \leq 2p_c - 2\sqrt{F} - 1 + \sigma.$$

The supplier's profit is maximized at

$$c = \max\left(2p_c - 2\sqrt{F} - 1 - \sigma, \min\left(\frac{3-2p_c+\sigma}{2}, 2p_c - 2\sqrt{F} - 1 + \sigma\right)\right).$$

(3) The supplier charges a moderate input price, which induces the manufacturer to deliver on its commitment under both demand states. In this case, the supplier's profit is $\Pi_3 = \frac{(1+\sigma-p_c)c}{2} + \frac{(1-\sigma-p_c)c}{2}$, which is maximized at $c = 2p_c + 2\sqrt{F} - 1 - \sigma$, the price upper bound.

(4) The supplier charges a relatively high input price, inducing the manufacturer to deliver on its commitment only when demand is low and revoke and charge $p > p_c$ when demand is high. In this case, the supplier's profit-maximization problem is

$$\max_c \ \Pi_4 = \frac{1}{2}\left(\frac{1+\sigma-c}{2}\right)c + \frac{(1-\sigma-p_c)c}{2},$$

$$\text{s.t.,}\quad 2p_c + 2\sqrt{F} - 1 - \sigma \le c \le 2p_c + 2\sqrt{F} - 1 + \sigma.$$

The supplier's profit is maximized at

$$c = \max\left(2p_c + 2\sqrt{F} - 1 - \sigma, \min\left(\frac{3-2p_c-\sigma}{2}, 2p_c + 2\sqrt{F} - 1 + \sigma\right)\right).$$

(5) The supplier charges a very high input price, inducing the manufacturer to revoke its commitment and charge $p > p_c$ under both demand states. In this case, the supplier's profit-maximization problem is

$$\max_c \ \Pi_5 = \frac{1}{2}\left(\frac{1+\sigma-c}{2}\right)c + \frac{1}{2}\left(\frac{1-\sigma-c}{2}\right)c,$$

$$\text{s.t.,}\quad c \ge 2p_c + 2\sqrt{F} - 1 + \sigma.$$

The supplier's profit is maximized at $c = \max(\frac{1}{2}, 2p_c + 2\sqrt{F} - 1 + \sigma)$.

The supplier compares the above alternatives and chooses an input price c that maximizes its profit. Due to the complexity of the profit functions, we are unable to write in closed-form the boundary conditions of optimal solutions to the supplier's global optimization problem.

Next, consider the case in which $\sigma^2 > 4F$. Similar to the previous case, the supplier chooses among the following alternatives:

(1) The supplier charges a very low input price, inducing the manufacturer to revoke its commitment and charge $p < p_c$ under both demand states. In this case, the supplier's profit-maximization problem is

$$\max_c \ \Pi_1 = \frac{1}{2}\left(\frac{1+\sigma-c}{2}\right)c + \frac{1}{2}\left(\frac{1-\sigma-c}{2}\right)c,$$

$$\text{s.t.,}\quad c \leq 2p_c - 2\sqrt{F} - 1 - \sigma.$$

The supplier's profit is maximized at $c = \min(\frac{1}{2}, 2p_c - 2\sqrt{F} - 1 - \sigma)$.

(2) The supplier charges a relatively low input price, inducing the manufacturer to deliver on its commitment when demand is high and revoke and charge $p < p_c$ when demand is low. In this case, the supplier's profit-maximization problem is

$$\max_c \ \Pi_2 = \frac{(1+\sigma-p_c)c}{2} + \frac{1}{2}\left(\frac{1-\sigma-c}{2}\right)c,$$

$$\text{s.t.,}\quad 2p_c - 2\sqrt{F} - 1 - \sigma < c \leq 2p_c + 2\sqrt{F} - 1 - \sigma.$$

The supplier's profit is maximized at

$$c = \max\left(2p_c - 2\sqrt{F} - 1 - \sigma, \min\left(\frac{3-2p_c+\sigma}{2}, 2p_c + 2\sqrt{F} - 1 - \sigma\right)\right).$$

(3) The supplier charges a moderate input price, inducing the manufacturer to revoke its commitment and charge $p < p_c$ ($p > p_c$) when demand is low (high). In this case, the supplier's profit-maximization problem is

$$\max_c \ \Pi_3 = \frac{1}{2}\left(\frac{1+\sigma-c}{2}\right)c + \frac{1}{2}\left(\frac{1-\sigma-c}{2}\right)c,$$

$$\text{s.t.,}\quad 2p_c + 2\sqrt{F} - 1 - \sigma < c \leq 2p_c - 2\sqrt{F} - 1 + \sigma.$$

The supplier's profit is maximized at

$$c = \max\left(2p_c + 2\sqrt{F} - 1 - \sigma, \min\left(\frac{1}{2}, 2p_c - 2\sqrt{F} - 1 + \sigma\right)\right).$$

(4) The supplier charges a relatively high input price, inducing the manufacturer to deliver on its commitment when demand is low and revoke and charge $p > p_c$ when demand is high. In this case, the supplier's profit-maximization problem is

$$\max_c \ \Pi_4 = \frac{1}{2}\left(\frac{1+\sigma-c}{2}\right)c + \frac{(1-\sigma-p_c)c}{2},$$

$$\text{s.t.,} \quad 2p_c - 2\sqrt{F} - 1 + \sigma \le c \le 2p_c + 2\sqrt{F} - 1 + \sigma.$$

The supplier's profit is maximized at

$$c = \max\left(2p_c - 2\sqrt{F} - 1 + \sigma, \min\left(\frac{3 - 2p_c - \sigma}{2}, 2p_c + 2\sqrt{F} - 1 + \sigma\right)\right).$$

(5) The supplier charges a very high input price, inducing the manufacturer to revoke its commitment and charge $p > p_c$ under both demand states. In this case, the supplier's profit-maximization problem is

$$\max_c \ \Pi_5 = \frac{1}{2}\left(\frac{1+\sigma-c}{2}\right)c + \frac{1}{2}\left(\frac{1-\sigma-c}{2}\right)c,$$

$$\text{s.t.,} \quad c \ge 2p_c + 2\sqrt{F} - 1 + \sigma.$$

The supplier's profit is maximized at $c = \max(\frac{1}{2}, 2p_c + 2\sqrt{F} - 1 + \sigma)$.

Again, due to the complexity of the profit function, we are unable to write in closed-form the boundary conditions of the optimal solutions to the supplier's global optimization problem.

Lastly, in anticipation of the supplier's pricing decision, the manufacturer makes its price preannouncement decision to maximize its expected profit. Because we do not have closed-form solutions to the supplier's problem, we employ numerical analyses to investigate how demand uncertainty affects the power of price preannouncements. Figure 10 illustrates how the manufacturer's profits change with σ ($F = 0.05$).

In the above numerical example, under the no-price-commitment benchmark, the manufacturer's profit always increases with σ, the magnitude of demand uncertainty. This is because, when σ increases, the manufacturer earns lower (higher) profits when the demand state is low (high). Overall, the latter gain dominates the former loss, and the manufacturer is better off with volatilized demand. We refer to this effect as the *demand uncertainty effect*.

Consider now the manufacturer's profit under price commitments. When $\sigma \le \sigma_1 \approx 0.0267$, demand uncertainty is low, and the results are similar to those of the basic model: in equilibrium, the manufacturer preannounces a low retail price, and the supplier offers the manufacturer a low input price to induce it to deliver on its commitment under both demand states. Again, the

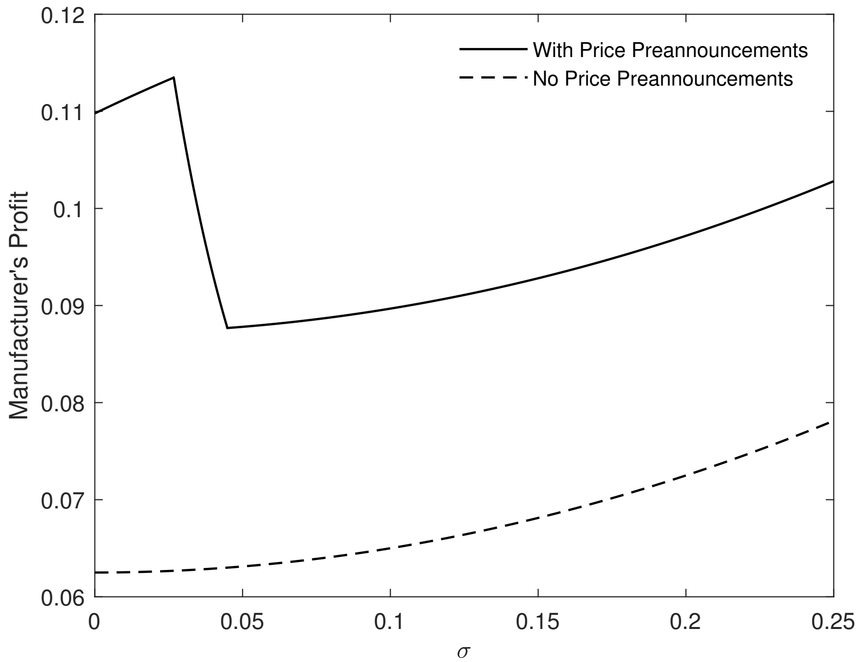


Figure 10: The benefit of price preannouncements under uncertain demand ($F = 0.05$)

manufacturer's profit increases with σ owing to the demand uncertainty effect.

The case becomes more complex when $\sigma_1 < \sigma \leq \sigma_2 \approx 0.0449$. Within this regime, demand uncertainty becomes higher, giving the supplier a strong incentive to charge a high input price. In anticipation of this, the manufacturer also distorts its preannounced price p_c upward to cater to the supplier's pricing incentive. Even though the manufacturer always delivers on its commitment, the preannounced price becomes inefficiently high at a low demand state, which hurts the manufacturer's profit. This distortion dominates the benefit of the demand uncertainty effect, and the manufacturer's profit decreases with σ.

Lastly, when demand uncertainty is too high ($\sigma > \sigma_2$), the two demand states become so different that the manufacturer is unable to deliver on its commitment under either state. In equilibrium, the manufacturer preannounces a retail price that fits only the low demand state and revokes its commitment under a high demand state. Under this regime, the manufacturer's profit increases with c, again owing to the demand uncertainty effect.

We also find that, consistent with our basic model, price preannouncements soften double marginalization and improve total channel profits and consumer surplus. The effect of price preannouncements on the supplier's profit is more subtle, with the supplier sometimes being better off with the manufacturer's price preannouncements.

Overall, demand uncertainty significantly affects the equilibrium outcome, and the manufacturer does not always deliver on its commitment when demand uncertainty is high. Nonetheless, we find that our key intuitions hold under demand uncertainty, and price preannouncements can still alleviate the issue of double marginalization and benefit the manufacturer.

6 Concluding Remarks

Manufacturers often preannounce the prices of their products even before they are produced or developed. In this paper, we consider a manufacturer that sources inputs from an upstream supplier and converts them into final products that are sold to consumers. We depart from classic distribution channel literature by assuming that the manufacturer can preannounce a retail price before contracting the supplier. The price preannouncement is flexible in the sense that the manufacturer can later revoke the price at a cost.

Intuition suggests that the manufacturer's preannouncement restricts its pricing flexibility, which can only hurt its profit. While this is true when the price preannouncement is binding or when the cost of revoking the price commitment is prohibitive, it does not necessarily hold when the cost of revoking is low. In this case, we find that price preannouncements benefit manufacturers and consumers without harming suppliers, thereby leading to Pareto-improvement. This is because, when the cost of revoking is low, the manufacturer preannounces a low retail price for its product, which generates high consumer demand if fulfilled. Upon observing the price preannouncement, the supplier is willing to charge a low input price to encourage the manufacturer to fulfill its commitment and generate high consumer demand. The manufacturer, in turn, benefits from the low procurement cost as well as high consumer demand. In addition, because retail prices are lower, consumer surplus and social welfare are also raised.

We also consider a scenario in which the manufacturer can decide on the cost of revoking its commitment. We find that, in this scenario, under a linear demand, the manufacturer enjoys a 100 percent profit improvement compared to the no-price-preannouncement benchmark, and the total channel profit is equal to that of a centralized channel. Together, these results underscore the surprising effect that price preannouncements exert on channel coordination.

Our work can be extended in a number of directions. First, our model considers a monopolistic channel with only one upstream supplier and one downstream manufacturer. It would be interesting to consider the effect of price preannouncements in the presence of upstream or downstream competition. Second, our model focuses on price preannouncements while, in practice, firms also preannounce other decisions such as a product's launch date or configuration. Future research may investigate firms' preannouncement decisions on these variables. Lastly, while our work analytically elucidates the effects of price preannouncement, its external validity is lacking. Future research could empirically test our model predictions (e.g., firms may prefer a low revoking cost when preannouncing), which will provide a further understanding of price preannouncements.

A Technical Details

Proof of Lemma 1. In the paper, we obtained that $\pi_1 = (1-p_c)(p_c - c)$ and $\pi_2 = \frac{(1-c)^2}{4} - F$. It follows that $\pi_1 \geq \pi_2$ if and only if $2p_c - 1 - 2\sqrt{F} \leq c \leq 2p_c - 1 + 2\sqrt{F}$. Q.E.D.

Proof of Lemma 2. Consider the following cases.

Case (1): $p_c \geq \frac{3}{4} + \sqrt{F}$. In this case, we have $\Pi_1 = \frac{1}{8}$, $\Pi_2 = (1-p_c)\bar{c}$, and $\Pi_3 = \frac{\bar{c}(1-\bar{c})}{2}$. Comparing the above profits, we find that $\Pi_1 \geq \Pi_3$ always holds, whereas $\Pi_2 > \Pi_1$ holds if and only if $p_c \leq \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}$. Thus, when $p_c \geq \max\left(\frac{3+4\sqrt{F}}{4}, \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}\right)$, the supplier prefers strategy (1) and charges $c = \frac{1}{2}$. When $\frac{3+4\sqrt{F}}{4} \leq p_c \leq \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}$, the supplier prefers strategy (2) and charges $c = \bar{c}$.

Case (2): $\frac{3}{4} \leq p_c \leq \frac{3}{4} + \sqrt{F}$. In this case, we have $\Pi_1 = \frac{\underline{c}(1-\underline{c})}{2}$, $\Pi_2 = (1-p_c)\bar{c}$, and $\Pi_3 = \frac{\bar{c}(1-\bar{c})}{2}$. In addition, we find that $\Pi_1 \geq \Pi_3$ always holds within this regime. Moreover, $\Pi_1 \geq \Pi_2$ holds if and only if $p_c \geq \frac{5+2\sqrt{F}}{6}$. Thus, when $\frac{5+2\sqrt{F}}{6} \leq p_c \leq \frac{3+4\sqrt{F}}{4}$, the supplier prefers strategy (1) and charges $c = \underline{c}$. When $\frac{3}{4} \leq p_c \leq \frac{5+2\sqrt{F}}{6}$, the supplier prefers strategy (2) and charges $c = \bar{c}$.

Case (3): $\frac{3}{4} - \sqrt{F} \leq p_c \leq \frac{3}{4}$. In this case, we have $\Pi_1 = \frac{\underline{c}(1-\underline{c})}{2}$, $\Pi_2 = (1-p_c)\bar{c}$, and $\Pi_3 = \frac{\bar{c}(1-\bar{c})}{2}$. In addition, we find that $\Pi_2 > \Pi_3 \geq \Pi_1$ always holds within this regime. As such, the supplier always prefers strategy (2) and charges $c = \bar{c}$.

Case (4): $p_c \leq \frac{3}{4} - \sqrt{F}$. In this case, we have $\Pi_1 = \frac{\underline{c}(1-\underline{c})}{2}$, $\Pi_2 = (1-p_c)\bar{c}$, and $\Pi_3 = \frac{1}{8}$. Comparing the above profits, we find that $\Pi_3 \geq \Pi_1$ always holds, whereas $\Pi_2 > \Pi_3$ holds if and only if $p_c \geq \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$. Thus, when $\frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} \leq p_c \leq \frac{3-4\sqrt{F}}{4}$, the supplier prefers strategy (2) and charges $c = \bar{c}$. When $p_c \leq \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$, the supplier prefers strategy (3) and charges $c = \frac{1}{2}$.

Summarizing the above cases, we prove Lemma 2. Q.E.D.

Proof of Lemma 3. As discussed in the main paper, the manufacturer chooses between the following strategies and earn its respective profits:

(1) Preannouncing an excessively high or low retail price ($p_c > \max\left\{\frac{3}{4} + \sqrt{F}, \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}\right\}$ or $p_c < \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$): In this case, the supplier charges a standard double marginalization input price $c = \frac{1}{2}$, and the manufacturer revokes its price commitment and charges a price $p = \frac{3}{4}$. The manufacturer's profit is $\pi_1 = \frac{1}{16} - F$.

(2) Preannouncing a relatively high retail price ($\frac{5+2\sqrt{F}}{6} \leq p_c \leq \frac{3}{4} + \sqrt{F}$): In this case, the supplier is willing to charge the manufacturer a low input price $c = \underline{c}$ so that the manufacturer changes its mind, revokes its price commitment, and charges consumers a price $p = \frac{1+\underline{c}}{2} < p_c$. The manufacturer's profit-maximization problem is

$$\max_{p_c} \pi_2 = \left(1 - \frac{1+\underline{c}}{2}\right)\left(\frac{1+\underline{c}}{2} - \underline{c}\right),$$

$$\text{s.t. } \frac{5+2\sqrt{F}}{6} \leq p_c \leq \frac{3}{4} + \sqrt{F}.$$

Solving the problem, we obtain that the manufacturer's profit is maximized to $\pi_2 = \frac{1+8\sqrt{F}-20F}{36}$ at $p_c = \frac{5+2\sqrt{F}}{6}$ when $F \geq \frac{1}{64}$ (note that $\frac{5+2\sqrt{F}}{6} \leq \frac{3}{4} + \sqrt{F}$ holds only when $F \geq \frac{1}{64}$).

(3) Preannouncing a moderate retail price ($\frac{3}{4} + \sqrt{F} < p_c \leq \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}$ or $\frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} \leq p_c \leq \min\left\{\frac{5+2\sqrt{F}}{6}, \frac{3}{4} + \sqrt{F}\right\}$): In this case, the demand $1 - p_c$ is good when the commitment is fulfilled. Thus, the supplier charges an input price equal to the price ceiling $c = \bar{c}$, and the manufacturer delivers on the commitment later. The manufacturer's profit-maximization problem is

$$\max_{p_c} \pi_2 = (1 - p_c)(p_c - \bar{c}),$$

$$\text{s.t. } \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} \leq p_c \leq \min\left\{\frac{5+2\sqrt{F}}{6}, \frac{3}{4} + \sqrt{F}\right\} \text{ or } \frac{3}{4} + \sqrt{F} \leq p_c \leq \frac{3-2\sqrt{F}+2\sqrt{\sqrt{F}+F}}{4}.$$

Solving the problem, we find that the manufacturer's profit is maximized to $\pi_3 = \frac{1+4\sqrt{\sqrt{F}+F}-8(F+\sqrt{F}\sqrt{\sqrt{F}+F})}{16}$ at $p_c = \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$ when $F \leq \frac{3+2\sqrt{2}}{32}$. When $F > \frac{3+2\sqrt{2}}{32}$, the manufacturer cannot make a positive profit.

(4) Preannouncing a retail price $p_c = 1$: The manufacturer forgoes consumer demand and makes zero profits, i.e., $\pi_4 = 0$.

We now compare the manufacturer's profit under different strategies and obtain its equilibrium price preannouncement decision as follows:

$$p_c = \begin{cases} \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} & \text{if } F \leq \frac{59+24\sqrt{6}}{800}, \\ \frac{5+2\sqrt{F}}{6} & \text{if } \frac{59+24\sqrt{6}}{800} < F \leq \frac{1}{4}, \\ 1 & \text{otherwise.} \end{cases}$$

We further explain the intuitions for the above results as follows.

First, when $0 < F \leq \frac{59+24\sqrt{6}}{800} \approx 0.147$, the manufacturer preannounces a low p_c that is below the standard double marginalization price (i.e., $p_c = \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4} < \frac{3}{4}$). When faced with the low p_c, the supplier effectively chooses between two strategies: (1) charging the manufacturer a low price $c = \bar{c} < \frac{1}{2}$ and having the manufacturer deliver on its commitment, thereby generating the high consumer demand $1 - p_c > \frac{1}{4}$; or (2) charging a standard double marginalization price $c = \frac{1}{2} > \bar{c}$, at which the manufacturer revokes its commitment and charges consumers a high $p = \frac{3}{4} > p_c$, thus depressing consumer demand. At the preannounced price $p_c = \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$, the supplier is exactly indifferent between the two strategies and charges a low $c = \bar{c} < \frac{1}{2}$, which is the Pareto-dominant equilibrium. Such a low input price $c < \frac{1}{2}$ benefits the manufacturer.

Note that, when $0 < F \leq \frac{59+24\sqrt{6}}{800}$, the preannounced price $p_c = \frac{3-2\sqrt{F}-2\sqrt{\sqrt{F}+F}}{4}$ decreases with F (see Figure 4). This is because, as F increases, the supplier can more easily induce the manufacturer to deliver on its commitment, given that revoking has become more costly. In other words, when F increases, the supplier can make the manufacturer deliver on its commitment without having to distort the input price downward too much.

Mathematically, the supplier's margin $c = \bar{c} = 2p_c - 1 + 2\sqrt{F} < \frac{1}{2}$ increases with F, which positively affects the supplier's profit. Despite this, the supplier must be made indifferent between inducing the manufacturer to deliver on its commitment or revoke. To achieve this indifference condition, the manufacturer must distort p_c downward to counteract the above increase in $\bar{c}$: When p_c decreases, the supplier is also pressured to cut its own margin to induce the manufacturer to deliver on its commitment, i.e., $\bar{c} = 2p_c - 1 + 2\sqrt{F}$ also decreases. This decrease in p_c squeezes the supplier's margin and hurts its profit, thereby counteracting the former effect and again making the supplier indifferent. As a result, p_c decreases with F.

Following the above logic, when F becomes larger, the manufacturer must also distort its price

$p = p_c$ significantly downward to make the supplier collaborate, which hurts the manufacturer's profit. Eventually, at $F = \frac{59+24\sqrt{6}}{800}$, the manufacturer finds it no longer profitable to pursue this route. Instead, the manufacturer preannounces a high price $p_c = \frac{5+2\sqrt{F}}{6} > \frac{3}{4}$. Faced with this high p_c, the supplier effectively chooses between charging (1) a high input price $c = \bar{c} > \frac{1}{2}$ to induce the manufacturer to deliver on its commitment or (2) a low input price $c = \underline{c} < \frac{1}{2}$ to convince the manufacturer to revoke its commitment and charge a low price $p = \frac{\underline{c}+1}{2} < p_c < \frac{3}{4}$. At the preannounced price $p_c = \frac{5+2\sqrt{F}}{6}$, the supplier is exactly indifferent between the two strategies and charges a low $c = \underline{c} < \frac{1}{2}$, which is the Pareto-dominant equilibrium. Such a low input price $c < \frac{1}{2}$ benefits the manufacturer.

When $\frac{59+24\sqrt{6}}{800} < F \leq \frac{1}{4}$, the preannounced price $p_c = \frac{5+2\sqrt{F}}{6} > \frac{3}{4}$ increases with F (see Figure 4). This is because as F increases, the supplier struggles more to induce the manufacturer (who now finds revoking to be more costly) to revoke its commitment and charges a low p instead. In other words, when F increases, the supplier must distort its price downward more to change the manufacturer's mind. Mathematically, the supplier's margin $c = \underline{c} = 2p_c - 1 - 2\sqrt{F} < \frac{1}{2}$ decreases with F, which negatively affects the supplier's profit. Despite this, the supplier must be made indifferent between inducing the manufacturer to revoke its commitment or make good on it. To achieve this indifference, the manufacturer must distort $p_c > \frac{3}{4}$ upward to counteract the above decrease in $\underline{c}$ ($\underline{c} = 2p_c - 1 - 2\sqrt{F}$ increases with p_c). This increase in p_c widens the supplier's margin and improves its profit, thereby counteracting the former effect and again making the supplier indifferent. As a result, p_c increases with F.

Finally, as F reaches $\frac{1}{4}$, the high revoking cost makes it impossible for the supplier to induce the manufacturer to change its mind, regardless of the precommitted price. This is equivalent to the full-commitment case, in which the market breaks down. Q.E.D.

Proof of Proposition 1. The proof follows immediately from comparisons of profit.

Why does the manufacturer only benefit from price preannouncements when $F < \frac{1}{9}$? The intuition is as follows. In the proof for Lemma 3, we show that when F increases, the manufacturer must distort its price preannouncement p_c downward to make the supplier indifferent between (1) inducing the manufacturer to deliver on its commitment and (2) obtaining the standard double marginalization outcome. Such a distortion squeezes the manufacturer's margin and hurts its profit. At $F = \frac{1}{9}$, the distortion becomes so large that the manufacturer no longer benefits from its price preannouncement.

It is also worth noting that the manufacturer's profit first increases and then decreases with F when $F < \frac{59+24\sqrt{6}}{800}$. The reason is as follows. The preannounced price is equal to $\frac{3}{4}$ at $F = 0$ and then decreases with F. As p_c decreases from $\frac{3}{4}$ to $\frac{1}{2}$, the retail price also becomes closer to the first-best price ($p = \frac{1}{2}$), which improves the manufacturer's profit. As p_c further decreases from $\frac{1}{2}$, the retail price also departs from the first-best price, thereby hurting the manufacturer's profit. As a result, the manufacturer's profit first increases and then decreases with F. Q.E.D.

Proof of Proposition 2. The proof follows immediately by comparing the supplier's profits, consumer surplus, and social welfare under different regimes. Q.E.D.

Proof of Proposition 3. When $F \leq \frac{59+24\sqrt{6}}{800}$, we take the first-order condition of the manufacturer's profit and find that the manufacturer's profit is maximized at $F = \frac{1}{64}$. At this point, the retail price is $p = \frac{1}{2}$ and the manufacturer's profit is $\pi = \frac{1}{8}$. When $F \geq \frac{59+24\sqrt{6}}{800}$, the manufacturer's profit decreases with F, and the manufacturer's profit peaks at $F = \frac{59+24\sqrt{6}}{800}$. At this point, the retail price is $p = \frac{14-\sqrt{6}}{20}$ and the manufacturer's profit is $\pi = \frac{1}{32} < \frac{1}{8}$. As such, when the manufacturer decides on the revoking cost, it chooses $F = \frac{1}{64}$. Other results follow immediately. Q.E.D.

Proof of Proposition 4. The proof follows from a direct comparison of equilibria. Q.E.D.

Proof of Proposition 5. We first analyze the manufacturer's pricing decision given c and p_c. Simple calculations show that the manufacturer's optimal price is

$$p = \begin{cases} \frac{c}{2} + \frac{1-p_c\lambda}{2(1-\lambda)} & \text{if } c \leq \underline{c} = p_c - \frac{1-p_c}{1-\lambda}, \\ p_c & \text{if } \underline{c} < c < \bar{c} = p_c - \frac{1-p_c}{1+\lambda}, \\ \frac{c}{2} + \frac{1+p_c\lambda}{2(1+\lambda)} & \text{otherwise.} \end{cases} \tag{11}$$

That is, when the input price is low enough, the manufacturer finds it optimal to revoke its commitment and charge consumers a price $p < p_c$; when the input price is moderate, the manufacturer does not have an incentive to deviate and so fulfills its commitment; when the input price is high enough, the manufacturer finds it optimal to revoke its commitment and charges consumers a price $p > p_c$.

Consider next the supplier's pricing decision:

$$c = \begin{cases} \frac{1+\lambda p_c}{2(1+\lambda)} & \text{if } p_c \leq \frac{3}{4+\lambda}, \\ p_c - \frac{1-p_c}{1+\lambda} & \text{if } \frac{3}{4+\lambda} < p_c \leq \bar{p}_c, \\ \frac{1-\lambda p_c}{2(1-\lambda)} & \text{otherwise,} \end{cases} \tag{12}$$

where

$$\bar{p}_c = \frac{4\left(3+\sqrt{\frac{\lambda}{1+\lambda}}\right) - \lambda\left(7+3\lambda+4\lambda^2\sqrt{\frac{\lambda}{1+\lambda}}\right)}{16-(8-\lambda)\lambda(1+\lambda)}.$$

The intuition is as follows. When the committed price is too low, the supplier charges a high input price, at which the manufacturer prefers to revoke its commitment and charge consumers a high price instead. When the committed price is moderate, the supplier prefers to induce the manufacturer to deliver on its commitment. In this case, the supplier charges the highest possible input price $c = \bar{c}$, at which the manufacturer delivers on its commitment. Finally, when the committed price is too high, the supplier charges a low input price, at which the manufacturer prefers to revoke its commitment and charge consumers a low price instead.

We compare the manufacturer's profit under different strategies and find that the manufacturer's profit is always maximized at

$$p_c = \frac{3}{4+\lambda}.$$

The corresponding equilibrium outcome is

$$c = \frac{2}{4+\lambda},\ p = \frac{3}{4+\lambda},\ \Pi = \frac{2(1+\lambda)}{(4+\lambda)^2},\ \pi = \frac{1+\lambda}{(4+\lambda)^2}.$$

The corresponding consumer surplus and social welfare is

$$CS = \frac{1+\lambda}{2(4+\lambda)^2},\ SW = \frac{1}{2} - \frac{9}{2(4+\lambda)^2}.$$

The proof follows from direct comparisons. Q.E.D.

References

Anand, K., Anupindi, R. and Bassok, Y., 2008. Strategic inventories in vertical contracts. *Management Science*, 54(10), 1792–1804.

Bayus, B.L., Jain, S. and Rao, A.G., 2001. Truth or consequences: An analysis of vaporware and new product announcements. *Journal of Marketing Research*, 38(1), 3–13.

Bulow, J.I., Geanakoplos, J.D. and Klemperer, P.D., 1985. Multimarket oligopoly: Strategic substitutes and complements. *Journal of Political Economy*, 93(3), 488–511.

Business Week, 1993. Boeing Launches A Stealth Attack on Airbus, *Business Week* (January 18), 32.

Carroll, G., 2015. Robustness and linear contracts. *American Economic Review*, 105(2), 536–563.

Caruana, G. and Einav, L., 2008. A theory of endogenous commitment. *Review of Economic Studies*, 75(1), 99–116.

Choi, J.P., Kristiansen, E.G. and Nahm, J., 2005. An economic analysis of product preannouncements. *CESifo Economic Studies*, 51(2-3), 299–319.

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

Cui, T., Raju, J. S., and Zhang, Z. J. 2007. Fairness and channel coordination. *Management Science*, 53(8), 1303–1314.

Dillow, C. 2011. Space Adventures Plans Tourism Missions Around the Moon (for Just $150 Million!) *Popular Science* (April 28). `https://www.popsci.com/technology/article/2011-04/space-adventures-plans-tourism-missions-moon-just-150-million/`

Dukes, A. and Liu, Y., 2010. In-store media and distribution channel coordination. *Marketing Science*, 29(1), 94–107.

Eliashberg, J. and Robertson, T.S., 1988. New product preannouncing behavior: A market signaling study. *Journal of Marketing Research*, 25(3), 282–292.

Farrell, J. and Saloner, G., 1986. Installed base and compatibility: Innovation, product preannouncements, and predation. *American Economic Review*, 76(5), 940–955.

Fudenberg, D. and Villas-Boas, J.M., 2006. Behavior-based price discrimination and customer recognition. *Handbook on economics and information systems*, 1, 377–436.

Gerlach, H.A., 2004. Announcement, entry, and preemption when consumers have switching costs. *RAND Journal of Economics*, 35(1), 184–202.

Gerstner, E. and Hess, J.D., 1995. Pull promotions and channel coordination. *Marketing Science*, 14(1), 43–60.

Goh, B., and Hepher, T. 2017. Ready for take-off? China's answer to Boeing now just needs to sell. *Reuters* (April 25). https://www.reuters.com/article/us-china-aviation-comac-analysis/ready-for-take-off-chinas-answer-to-boeing-now-just-needs-to-sell-idUSKBN17Q2F8/

Hawkins, A. 2022. Lucid raises its EV prices as the company continues to struggle with production / Average of 10 percent increase per model. *The Verge* (May 7). https://www.theverge.com/2022/5/6/23059976/lucid-motor-ev-price-increase-q1-2022-earnings

Ho, T. H., and Zhang, J. 2008. Designing pricing contracts for boundedly rational customers: Does the framing of the fixed fee matter? *Management Science*, 54(4), 686–700.

Hope, G. 2022. China's New Autonomous ROBO-01 Car Revealed. *IOT World Today* (June 15). https://www.iotworldtoday.com/transportation-logistics/china-s-new-autonomous-robo-01-car-revealed

Hoxmeier, J.A., 2000. Software preannouncements and their impact on customers' perceptions and vendor reputation. *Journal of Management Information Systems*, 17(1), 115–139.

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

Jiang, J. and He, C., 2021. Low-price guarantees in a dual channel of distribution. *Marketing Science*, 40(4), 765–782.

Judd, K.L., 1985. Credible spatial preemption. *RAND Journal of Economics*, 16(2), 153–166.

Kovrijnykh, N., 2013. Debt contracts with partial commitment. *American Economic Review*, 103(7), 2848–2874.

KrASIA, 2024. Xiaomi faces a pricing dilemma for the SU7, its inaugural EV model. *KrASIA* (Jan 19). https://kr-asia.com/xiaomi-faces-a-pricing-dilemma-for-the-su7-its-inaugural-ev-model.

Krok, A. 2017. The Lucid Air electric luxury car will start at $52,500... sort of. *CNET* (March 15). https://www.cnet.com/roadshow/news/the-lucid-air-electric-luxury-car-will-start-at-52500-sort-of/

Kuksov, D. and Wang, K., 2014. The bright side of loss aversion in dynamic and competitive markets. *Marketing Science*, 33(5), 693–711.

Li, X., 2025. Endogenous costs, market competition, and disclosure. *Marketing Science*, 44(2), 374–389.

Li, X., Li, Y. and Chen, Y.J., 2022. Strategic inventories under supply chain competition. *Manufacturing & Service Operations Management*, 24(1), 77–90.

Li, X., Li, K.J. and Wang, X., 2020. Transparency of behavior-based pricing. *Journal of Marketing Research*, 57(1), 78–99.

Li, X. and Liu, Q. 2021. Contract unobservability and downstream competition. *Manufacturing & Service Operations Management*, 23(6), 1468–1482.

Li, K.J. and Li, X., 2023. Advance selling in marketing channels. *Journal of Marketing Research*, 60(2), 371–387.

Lohmann, S., 1992. Optimal commitment in monetary policy: credibility versus flexibility. *American Economic Review*, 82(1), 273–286.

Machkovech, S. 2014. Amazon announces Echo, a $199 voice-driven home assistant. Ars Technica (Nov 7). `https://arstechnica.com/gadgets/2014/11/amazon-announces-echo-a-199-voice-driven-home-assistant/`

McAfee, R.P. and Schwartz, M., 1994. Opportunism in multilateral vertical contracting: Nondiscrimination, exclusivity, and uniformity. *American Economic Review*, 85(1), 210–230.

McGlaun, S. 2020. Rivian surprises with lower prices for its electric pickup and SUV. *Slash Gear* (Jan 27). `https://www.slashgear.com/rivian-surprises-with-lower-prices-for-its-electric-pickup-and-suv-27607737`

Min, D., 2021. Bayesian persuasion under partial commitment. *Economic Theory,* 72(3), 743–764.

Moorthy, K.S., 1987. Managing channel profits: Comment. *Marketing Science*, 6(4), 375–379.

Muthoo, A., 1996. A bargaining model based on the commitment tactic. *Journal of Economic Theory*, 69(1), 134–152.

Ofek, E. and Turut, Ö., 2013. Vaporware, suddenware, and trueware: New product preannouncements under market uncertainty. *Marketing Science*, 32(2), 342–355.

Phogotraphy. 2015. What the Hell is a Light L16 Camera? *Phogotraphy* (October 8). `https://phogotraphy.com/2015/10/08/what-the-hell-is-light/`

Phys. 2015. Amazon launches virtual assistant speaker to public. *Phys* (June 23). `https://phys.org/news/2015-06-amazon-virtual-speaker.html`

Ramos, A. 2022. What Is a Lucid Air EV, How Much Do They Cost, & How Fast Are They? *MUO* (August 1). `https://www.makeuseof.com/how-much-is-a-lucid-air/`

Rao, R. and Turut, Ö., 2019. New product preannouncement: Phantom products and the Osborne effect. *Management Science*, 65(8), 3776–3799.

Robertson, T.S., Eliashberg, J. and Rymon, T., 1995. New product announcement signals and incumbent reactions. *Journal of Marketing*, 59(3), 1–15.

Soresu, A., Shankar, V. and Kushwaha, T., 2007. New product preannouncements and shareholder value: Don't make promises you can't keep. *Journal of Marketing Research*, 44(3), 468–489.

Tirole, J., 1988. *The theory of industrial organization*. MIT press.

Warren, N.L. and Sorescu, A., 2017. Interpreting the stock returns to new product announcements: How the past shapes investors' expectations of the future. *Journal of Marketing Research*, 54(5), 799–815.