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Why do firms sell gift cards although consumers prefer cash to gift cards?☆

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ABSTRACT

We provide a novel rationale as to why firms sell gift cards, although consumers prefer cash to gift cards. Issuing gift cards enables firms to charge higher prices for products. Since gift cards have the effect of price discrimination by discounting the product prices only to card-holding consumers, the card-holding consumers become less price sensitive, and thus firms can raise prices due to the elasticity effect. Although gift cards lock consumers into the card-issuing firm, the lock-in effect is not essential for our result. We show that in the absence of lock-in effects (when competing firms honor their rival's gift cards), the equilibrium price, surprisingly, rises even higher due to a double elasticity effect. Our results predict that rapid growth in the gift card market is likely to continue, and that it could attract additional regulatory scrutiny based on their anti-competitive effects.

1. Introduction

Gift cards (also referred to as *gift vouchers*, *gift tokens*, or *gift certificates*) are used far more widely than standard microtheory models predict. The number of consumers worldwide who appear to ignore the lesson found in undergraduate economics textbooks—that cash gifts (of an amount equal to the gift card's face value) would generally buy more utility for recipients (from a larger, less restricted choice set) than gift certificates restricted to a particular store do—is substantial.[1] The annual volume of gift card transactions in the U.S. has nearly doubled in the last decade, reaching an estimated 160 billion dollars in 2018. Gift card transaction volume is projected to account for an increasing share of retail sales in many other countries. For example, consumers in South Korea, New Zealand, and Nigeria currently purchase substantially larger volumes of gift cards relative to GDP than in the U.S. Gift cards apparently accomplish some consumer objectives better than cash does (e.g., avoiding social stigma associated with handling cash, risk of theft, and other hassles associated with banknotes). Why, then, do firms bear the costs of issuing them? This paper identifies a previously unrecognized strategic motive for firms to sell gift cards (different from the well-known motives of capturing sales revenue earlier), which is to achieve greater pricing power.

Gift cards are often restricted so that consumers can only redeem them in a particular store. In other cases, groups of retailers form an agreement to honor each other's gift cards. Network-branded gift cards (distinct from debit cards because they are not reloadable with additional credit) issued by Visa, Mastercard, Discover and American Express are prime examples. In New Zealand, "Prezzy cards" (given as "presents" and frequently used as promotional give-aways by national chain retailers) are similarly non-reloadable and redeemable wherever (with a few exceptions) major credit and debit cards are accepted. In Korea, competing retailers "Shinsegae Department Store" and "Emart" mutually accept each others' gift cards, as do the footwear chains, Esquire and Kumkang.[2] In both cases, the consumer's decision to

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[1] Consumer preference for cash over in-kind transfers, including coupons, may be reversed when price inflation is high. This argument does not apply to gift cards, however, because gift cards are not in-kind transfers, although they could influence income inequality similar to Kakar and Daniels (2018) cash-in-advance constraint.

[2] In 2017, Applebees restaurant chain ran a promotion in the State of Texas honoring gift cards from any other firm for up to 50% of the value of the customer's restaurant bill. *Consumer Reports* sometimes publishes names of stores that accept rivals' gift cards, especially in cases where the card issuer has gone bankrupt (e.g., American Express and Discover honoring gift cards issued by Sharper Image).

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exchange cash (physical or electronic) for a more restricted, less fungible gift card with an expiration date, which can only be used to make purchases from particular sellers, is puzzling.

We distinguish between consumers who purchase gift cards and consumers who purchase *goods*, referred to equivalently in this paper as *products*. Products are defined as any good or service that is not itself cash or a gift card. Consumers who want products would, in general, have no motive to buy a gift card and later redeem them for products.[3] Consumers who want to give gifts to others but find it socially awkward to give cash (or business purchasers whose organizations forbid them from handling cash, e.g., universities that require experimental labs to "pay" participants with grocery store vouchers or other gift cards) do, however, have a clear motive to buy them. Purchasing gift cards for others means that someone else redeems the card for products. The market for gift cards, therefore, could be thought of as emerging naturally from consumers' desire to give gifts and sellers' motive to secure certain sales revenues.

In this paper, we provide a novel rationale as to why firms want to issue gift cards. Insofar as consumers regard products sold by competitors as perfect substitutes, store-restricted gift cards have the effect of locking in card-holding consumers regardless of future changes in price. For example, if the card-issuing store's stated price is $4 more than the rival's price, then an expenditure-minimizing consumer with at least $4 credit on their card will purchase from the higher-priced card-issuing store, because the net cash outlay using the gift card is less than paying the rival store's stated prices without using a gift card. Therefore, issuing gift cards gives the firm more pricing power. The novel motive that we identify concerns the re-framing of product prices from the stated price that cash consumers face to the discounted effective price that card-holding consumers face. The effective price that card-holding consumers face is simply the amount of cash required to complete the purchase when redeeming a gift card. By issuing gift cards, firms can price-discriminate between consumers who hold the cards and those who do not.[4] The low effective price applied only to card-holding consumers causes demand to become more price-inelastic, thereby enabling the card-issuing firm to raise stated prices.[5]

Surprisingly, our analysis shows that the lock-in effect is not necessary for the collusive effect of gift cards to hold. The "collusive effect" refers to the fact that issuing gift cards causes the product price and profits to rise. When sellers accept each other's cards, the lock-in effect disappears and equilibrium prices rise even more (i.e., the collusive effect of gift cards grows stronger). The intuition is as follows. Suppose two firms honor gift cards issued by either firm. Card-holding consumers issued by either store can purchase the product from either firm, enjoying the full redemption value of their gift card without restricting which store they buy from. In this case, there is no lock-in effect. Although there is no lock-in effect, these gift cards continue to exert elasticity effects on card-holding consumers (issued by either firm). In such a scenario, both firms now face a larger segment of valid card-holding consumers that face significantly lower effective prices when they make purchases with gift cards, and both firms' market demand curves become more inelastic (i.e., less price-sensitive). As a result, in equilibrium, the product price increases more when both sellers honor each others' gift cards due to this double elasticity effect. This argument relies on the assumption that there is a tacit or formal agreement that no additional payments between card-issuing firms will be made after honoring each other's gift cards, sometimes referred to as a *no-settlement rule* or a *bill-and-keep rule*. If the firms use settlement rules to reimburse gift card transactions to non-card-issuing firms, then they have an incentive to lower product prices to reduce settlement payments to the other firm. The no-settlement rule therefore reinforces the collusion effect.

It is well known that any selling practices that generate lock-in effects enable firms to raise prices.[6] Loyalty programs and repeat-purchase coupons have similar effects as gift cards do, in the sense that both have cash value that lowers the effective price and therefore generates a lock-in effect. On the other hand, they differ in the sense that the collusive effect of gift cards does not require repeat purchases. The collusive effect of repeat-purchase coupons disappears if both firms honor their rival's coupons,[7] unlike gift cards. Our analysis shows that the collusive effect of gift cards becomes stronger if both firms honor their rival's gift cards with a no-settlement rule. To the best of our knowledge, economic analysis of the collusive pricing power that gift cards provide appears absent from the literature on collusion.[8]

The empirical observation that there are billions of dollars of unredeemed gift cards (Paul, 2016; Bird, 2018)—and recent legislation appearing (unevenly) across many jurisdictions worldwide to regulate issuance of gift cards (e.g., the U.S.'s Credit Card Accountability Responsibility and Disclosure Act of 2009, which is a federal requirement that expiration dates should give consumers at least five years from date of issue to redeem them, and Canadian provinces' bans on expiration dates for issuers of gift cards)—would seem consistent with, or at least complement, the collusion motive that we analyze.

The article is organized as follows. In Section 2, we provide a two-period model in which firms compete to sell gift cards in the first period and then compete to sell products by choosing prices in the second period. In Section 3, we examine the second-period behavior of firms based on the assumption that closed-loop gift cards (i.e., not honoured by rivals) have already been purchased. In Section 4, we expand the model from Section 3 to the case of open-loop gift cards (where both firms honor each other's gift cards) so that no lock-in effect is present. In Section 5, we analyze the first period to complete our argument that firms issue gift cards to raise prices. In Section 6, we briefly discuss the effect of alternative assumptions on the qualitative nature of our result. Concluding remarks and caveats follow in Section 7.

2. Model

We consider two competing firms, firm A and firm B, that sell differentiated goods. All consumers are assumed to purchase at most one unit from firm A or firm B.

[3] We do not consider self-control or "mental accounting" motives in this paper, where a consumer who is self-aware about impulsivity or planning problems wants to pre-commit to making their planned purchases from a particular store later.

[4] It is well known that coupons serve as a price discrimination tool to provide a lower price to a particular segment of consumers (e.g., Narasimham, 1984). It is unsurprising that gift cards play a similar role.

[5] Business strategies that have the effect of raising equilibrium prices are often referred to as collusion-facilitating practices. The term "collusion-facilitating practices" began to appear in the antitrust literature in the 1970s following a price-fixing lawsuit against General Electric (GE) and Westinghouse for turbine generators. Selling practices other than gift cards often referred to as such include: price leadership, most-favored-customer clauses, and meet-or-release clauses (e.g., Cooper, 1986; Holt and Scheffman, 1987; Logan and Lutter, 1989; Rotemberg and Saloner, 1990; and Edlin, 1997).

[6] Frequent flyer programs, repeat-purchase coupons, incompatible technologies, transaction costs, and learning costs are well-known examples. See, also, the literature on switching costs, for example, Klemperer (1987a, 1987b, 1987c), Farrell (1986), Farrell and Shapiro (1988) and Caminal and Matute (1990).

[7] See Kim (1997) and Kim and Koh (2002) for the effect of honoring the rival's repeat purchase coupons.

[8] Although coupons have similar effects to price discounting, they are distributed freely rather than sold by firms as gift cards are. Gelman and Salop (1983) considered an entrant's decision to sell coupons as a counterstrategy against incumbents' discounting strategies to deter entry. It is illegal in many places, however, for firms to sell coupons.

The demand functions for their respective goods are given by $q_i = a - bp_i + d(p_j - p_i)$ for $i = A, B, j \neq i$, where $a, b, d > 0$.[9] The parameter d is a measure of substitutability. If $d = 0$, then demand for each of the two goods is independent of the other's price; as $d \to \infty$, the two goods become perfect substitutes. The demand functions can be rewritten as $q_i = a - \alpha p_i + dp_j$, where $\alpha = b + d$. We assume that there are no fixed costs of production and that both firms share a common marginal cost, denoted c.

We analyze the following two-period model. In the first period, each of two firms chooses the volume of its gift cards to be sold. After gift cards purchased in the first period are distributed among consumers, the firms compete in the product market in the second period by choosing prices for their respective goods.

Consumers who buy gift cards must be distinguished from consumers who buy goods. Those who buy a gift card are assumed to gift it to another consumer rather than using it to purchase goods for themselves. For simplicity, we assume that the sets of consumers in the two periods are non-overlapping, which means that consumers do not take into account the effects of their first-period decisions about gift card purchases on their second-period purchases of goods. Thus, gift-card giving is assumed to give rise to a kind of consumer myopia characterized by lack of far-sighted consideration about how purchasing gift cards might affect firms' second-period pricing decisions.

We analyze this model by backward induction (i.e., first analyzing the second period), comparing two cases: one in which neither firm accepts the rival's gift cards (the case of lock-in) and the other in which both firms accept the rival's gift cards (the case of no lock-in).

3. Second period with lock-in (when firms do not honor their Rival's gift cards)

Suppose that the two firms issued gift cards with the face value v in the first period. Accordingly, some consumers are endowed with a gift card, and others have no gift card. The mass of consumers is normalized to one. Let $\lambda_i \in (0, 1)$ represent the proportion of consumers who hold the gift card issued by firm i, for $i \in A, B$. Assuming that consumers hold at most one gift card, the proportion of consumers who hold no gift card is $1 - \lambda_A - \lambda_B$.

As a benchmark case, we first consider the case that $\lambda_A = \lambda_B = 0$, i.e., neither firm issues gift cards. In the absence of gift cards, the profit of firm i is

$$\pi_i = (p_i - c)q_i = (p_i - c)(a - \alpha p_i + dp_j), \tag{1}$$

where $q_i = a - \alpha p_i + dp_j \in [0, 1]$, because the mass of consumers is normalized to one. The firm's first-order condition is

$$\phi(p_i, p_j) \equiv (p_i - c)\frac{\partial q_i}{\partial p_i} + q_i = a + \alpha c - 2\alpha p_i + dp_j = 0, \tag{2}$$

whose solution in p_i gives the best-response function of firm i:

$$p_i^{BR}(p_j) = \frac{a + \alpha c + dp_j}{2\alpha}. \tag{3}$$

It is obvious that the best-response curves are upward-sloping in the rival's price (i.e., prices are strategic complements). We denote the Nash equilibrium prices in this benchmark case as p_A^N and p_B^N. It follows from (3) that the symmetric Nash equilibrium price, denoted by p^N, is

$$p^N \equiv p_A^N = p_B^N = \frac{a + \alpha c}{2\alpha - d}. \tag{4}$$

Moving on from the benchmark case above, we re-do the analysis for the case in which both firms issue gift cards: $\lambda_i > 0$ for $i = A, B$. The *effective price* that a consumer faces when purchasing from firm k ($k = i, j$) is defined as $\widetilde{p}_k = \max\{p_k - v, 0\}$.[10] Note that revenue from selling gift cards in period 1 is exogenously given from each firm's period-2 point of view and therefore not included in its calculation of period-2 profit (below). Whenever $\widetilde{p}_i - c < 0$, firm i incurs a period-2 loss from trading with card-holding consumers (i.e., following through on its agreement to allow consumers to redeem gift certificates for costly products), ignoring gift-card revenue previously earned in period 1. The firm's period-1 objective function that integrates period-1 and period-2 profits will be considered in a later section.

Period-2 profit is calculated for each firm as follows:

$$\pi_i(p_i, p_j) = (1 - \lambda_A - \lambda_B)(p_i - c)(a - \alpha p_i + dp_j) + \lambda_i(\widetilde{p}_i - c)(a - \alpha\widetilde{p}_i + dp_j) + \lambda_j(p_i - c)(a - \alpha p_i + d\widetilde{p}_j). \tag{5}$$

The first term on the right-hand side in the expression above is firm i's profit from sales to the mass of consumers with no gift cards issued by either firm. The second term is firm i's profit from consumers who hold gift cards issued by firm i. The third term is its profit from consumers who hold gift cards issued by the rival firm. Equation (5) shows that firm i discriminates effective prices between card-holding consumers and others.

Some consumers who hold a gift card issued by firm j choose to purchase instead from firm i because the two firms' products are differentiated. Card-holding consumers who have a sufficiently strong preference for the product of the rival firm will buy its product, paying its stated price with cash, even though they wind up wasting the gift card they hold. The third term captures this feature.

Each firm's period-2 first-order condition requires:

$$\frac{\partial \pi_i(p_i, p_j)}{\partial p_i} \equiv \Phi(p_i, p_j) = (1 - \lambda_A - \lambda_B)\phi(p_i, p_j) + \lambda_i \phi(\widetilde{p}_i, p_j)\frac{\partial \widetilde{p}_i}{\partial p_i} + \lambda_j \phi(p_i, \widetilde{p}_j) = 0. \tag{6}$$

Let $p_i^{G-BR}(p_j)$ denote the best response of firm i in the case where it has previously issued gift cards. Then, $p_i^{G-BR}(p_j)$ is determined by equation (6). We want to compare the firm's best-response functions in the contrasting cases of having issued gift cards ($p_i^{G-BR}(p_j)$) and not having issued them ($p_i^{BR}(p_j)$), by comparing the first-order conditions in these two respective cases, (2) and (6).

To derive firm i's best response function ($p_i^{G-BR}(p_j)$), we consider two regions of p_i ($p_i \geq v$ and $p_i < v$) separately.

3.1. Region A ($p_i \geq v$)

Since $\phi(p_i^{BR}(p_j), p_j) = 0$, it follows from the second-order condition of (1) that $\phi(\widetilde{p}_i, p_j) > 0$ and $\phi(p_i, \widetilde{p}_j) < 0$ at $p_i = p_i^{BR}(p_j)$, because $\phi(p_i - v, p_j) > \phi(p_i, p_j) > \phi(p_i, p_j - v)$, for all p_i.

The intuition behind (6) goes as follows. If firm i raises its price marginally from the no-gift-card equilibrium price, then there will be no change in profits from consumers without gift cards (the first term in (6)), because it is an equilibrium price. Profits accruing from consumers who are locked in by gift cards that guarantee a price discount will increase due to the inelastic demand effect (the second term in (6)). And profits accruing from consumers who hold the rival's gift cards will decrease because of a smaller price effect due to lower sales (the third term in (6)). Thus, the total effect of gift cards on the best-response price depends on the relative sizes of λ_i and λ_j.

If λ_i is sufficiently greater than λ_j, then the best-response price of firm i will be greater when it issues gift cards. On the other hand, if λ_i is sufficiently smaller than λ_j, then the best-response price will be lower because the firm must reduce its price more aggressively to steal

[9] The assumption of linear demand functions implies that demand is more elastic when prices are high and quantities are low. A Hotelling model corresponds to the case that $a = \frac{1}{2}$ and $b = 0$, implying that $q_A + q_B = 1$ (i.e., total demand is inelastic with respect to the prices.).

[10] If $p_k < v$, then the remainder $v - p_k$ will never be used, based on the assumed single-stage structure of this two-period non-repeating game.

consumers who hold the rival firm's gift cards (i.e., those consumers over whom the rival firm enjoys a price advantage).

The analysis that follows formalizes the intuition described in the preceding paragraph. When $p_i \geq v$, we have

$$\Phi(p_i, p_j) = \lambda_i \phi(p_i - v, p_j) + \lambda_j \phi(p_i, p_j - v)$$
$$= \phi(p_i, p_j) + (2\alpha\lambda_i - d\lambda_j)v. \quad (7)$$

If the market shares for the gift cards are equal ($\lambda_i = \lambda_j = \lambda$), then we have $\Phi(p_i, p_j) = \phi(p_i, p_j) + (2\alpha - d)\lambda v$ where $2\alpha - d = 2(b + d) - d > 0$. This implies that if $\lambda_A = \lambda_B$, then a best-response price $p_i^{G-BR}(p_j)$ that satisfies $\Phi(p_i^{G-BR}(p_i), p_j) = 0$ is greater than $p_i^{BR}(p_j)$, i.e., the best-response curve of firm i shifts upwards when it issues gift cards, for all $p_j \geq \hat{p}_j$ such that $p_i^{BR}(\hat{p}_j) = v$.

The intuition for this is as follows. Firm i's issuance of gift cards increases demand for its product by αv at any given price, and firm j's issuance of gift cards decreases demand for firm i's product by dv. Thus, the direct price effect on the profit is positive even if $\lambda_A = \lambda_B$, because $\alpha > d$, i.e., each firm's consumer demand function responds more sensitively to its own price than to the rival firms' price.[11]

There is another effect to note related to the consumers who hold gift cards of firm i, which is the indirect price effect through reductions in quantity demanded. Because the effective price for gift-card holders is lower than the stated price, this indirect effect of reduced quantity demanded and its associated decrease in profits are smaller. Gift card issuance shrinks this negative indirect price effect and therefore enables the firm to raise its price. We refer to the sum of the direct and indirect price effects as the *elasticity effect.* Gift cards lower the effective price paid by card-holding consumers, which reduces price-elasticity of demand and leads to higher prices. If we regard the discount v as a cost (from the firm's period-2 perspective), then a decrease in the effective price can be interpreted as an increase in cost. Either way, issuing gift cards has the overall effect of raising the price it can charge.

3.2. Region B ($p_i < v$)

If $p_i, p_j < v$, then the value of the gift card more than covers the stated price of the product, which means that zero revenue is earned in period 2 when the gift card is redeemed, and (5) simplifies to:

$$\pi_i = (1 - \lambda_A - \lambda_B)(p_i - c)(a - \alpha p_i + dp_j) - \lambda_i c(a + dp_j)$$
$$+ \lambda_j (p_i - c)(a - \alpha p_i), \quad (8)$$

since $\tilde{p}_i = \tilde{p}_j = 0$. The second term, $-\lambda_i c(a + dp_j)$, measures firm i's loss from having to provide costly merchandise to card-holding consumers.

Then, in this case, (6) simplifies to:

$$\Phi(p_i, p_j) = (1 - \lambda_A - \lambda_B)\phi(p_i, p_j) + \lambda_j \phi(p_i, 0) = 0, \quad (9)$$

since $\frac{\partial \tilde{p}_i}{\partial p_i} = 0$. Intuitively, this result holds because $\lambda_i c(a + dp_j)$ is constant with respect to p_i (i.e., i-card holding consumer demand for i's product is insensitive to small changes in i's stated product price) whenever i's stated product price is strictly less than the value of the gift card it issued, which means that the card-holding consumer's effective price is zero.

3.3. Effect on the equilibrium price

Fig. 1a illustrates the first-order conditions that define the firm's respective best-response pricing rules with and without gift cards. In Fig. 1a, $\phi(p_i, p_j)$ is drawn in a solid black line showing the marginal effect of price on profit when no gift cards are issued (and the first-order condition satisfied at $\phi(p_i, p_j) = 0$). When firm i issues gift cards, the effect of any price increase on its profits has three components: the effect on consumers without gift cards, $(1 - \lambda_A - \lambda_B)\phi(p_i, p_j)$; the effect on consumers that hold firm i's gift cards, $\lambda_i \phi(p_i - v, p_j)$; and the effect on consumers that hold the rival's gift cards, $\lambda_j \phi(p_i, p_j - v)$. The first component, $(1 - \lambda_A - \lambda_B)\phi(p_i, p_j)$, is drawn as a dotted line, which has a smaller-magnitude slope than $\phi(p_i, p_j)$ and the same p_i-intercept. The second component, $\lambda_i \phi(p_i - v, p_j)$, shifts $\lambda_i \phi(p_i, p_j)$ upwards (or to the right). The third component, $\lambda_j \phi(p_i, p_j - v)$, shifts $\lambda_j \phi(p_i, p_j)$ downwards (or to the left). The marginal profit schedule with respect to own price when gift cards are issued, $\Phi(p_i, p_j)$, is formed by the sum of these three components and drawn as the discontinuous red line in Fig. 1a.

If $\lambda_A = \lambda_B$, then the overall effect of issuing gift cards on profits is positive, as shown in the discussion above following equation (7) and illustrated by the schedule $\Phi(p_i, p_j)$. The analysis above (showing that gift cards cause the $\Phi(p_i, p_j)$ schedule to shift upwards) is valid only when $p_i \geq v$.

If $p_i < v$, then the second component disappears, and the schedule shifts downwards, as can be seen from equation (9). Note that $\Phi(p_i, p_j)$ is discontinuous at $p_i = v$. The schedule Φ shows that $p_i^{G-BR}(p_j) > p_i^{BR}(p_j)$ as long as λ_j is not too much larger than λ_i.[12] This result implies that if $v \leq p_A^N = p_B^N$ and $\lambda_i \geq \lambda_j$, then the best-response curve shifts upward:

$$p_i^{G-BR}(p_j) = \frac{a + dp_j + \alpha c}{2\alpha} + \frac{2\alpha\lambda_i - d\lambda_j}{2\alpha} v, \quad (10)$$

for $p_j \geq \hat{p}_j$ such that $p_i^{BR}(\hat{p}_j) = v$. (See Fig. 2.) In particular, if $\lambda_A = \lambda_B = \lambda$, then issuance of gift cards increases the best-response pricing rule by $\frac{2\alpha - d}{2\alpha}\lambda v$.

The collusive effect of gift cards comes from firms discounting the effective price for locked-in consumers. Therefore, the stated price will increase more as discounting (v) becomes larger (i.e., so long as $v \leq p_i^N$). It is also clear that the collusive effect becomes stronger (reflected by firm i choosing a higher price), the larger is the share of locked-in consumers (λ_i). An increase in the proportion of locked-in consumers has the effect of shifting $\lambda_i \phi(\tilde{p}_i, p_j)$ farther to the right.

Denote equilibrium prices in the case where gift cards are issued as p_A^G and p_B^G. We can compute these equilibrium prices by solving (10):

$$p_i^G = \frac{a + \alpha c}{2\alpha - d} + \lambda_i v. \quad (11)$$

If $\lambda_A = \lambda_B = \lambda$, then the symmetric prices are $p_A^G = p_B^G = \frac{a+\alpha c}{2\alpha - d} + \lambda v > p^N = \frac{a+\alpha c}{2\alpha - d}$, which implies that gift cards are collusive in the sense of enabling firms to achieve higher equilibrium prices.

Proposition 1. *Assume that $\lambda_A = \lambda_B = \lambda$. If $v < p^N$, then there exists $\overline{\lambda} \in (0, \frac{1}{2})$ such that, for any $\lambda < \overline{\lambda}$, $p^G > p^N$ in equilibrium.*

Proposition 1 says that if λ_A and λ_B are small enough, then equilibrium prices will be higher when gift cards are issued than when they are not (all else equal). The proposition therefore implies that gift cards can be used for collusion. The intuition is as follows. If $v \leq p_i^N$, then gift cards have the effect of discounting the effective price that card-holding consumers face, which makes their demand less elastic. Therefore, the firm can raise its price on consumers who face cheaper effective prices thanks to holding gift cards.

There are other implications of Proposition 1 worth noting. First, in the case of closed-loop gift cards not honored by rivals (as considered in this section), card-holding consumers are locked-in, in the sense that

[11] If we assumed a Hotelling model instead, i.e., a model with inelastic demand, then $\alpha = d$, so that the two effects would cancel out whenever $\lambda_A = \lambda_B$.

[12] Depending on the size of λ_j and v, there are other cases with different inequalities to consider. We focus on this particular case because we are only interested in whether issuing gift cards has the effect of raising the equilibrium price, i.e., the possibility that $p_i^{G-BR}(p_j) > p_i^{BR}(p_j)$. If v or λ_j are sufficiently large, then it is possible that $p_i^{G-BR}(p_j) < p_i^{BR}(p_j)$. See Fig. 1b.

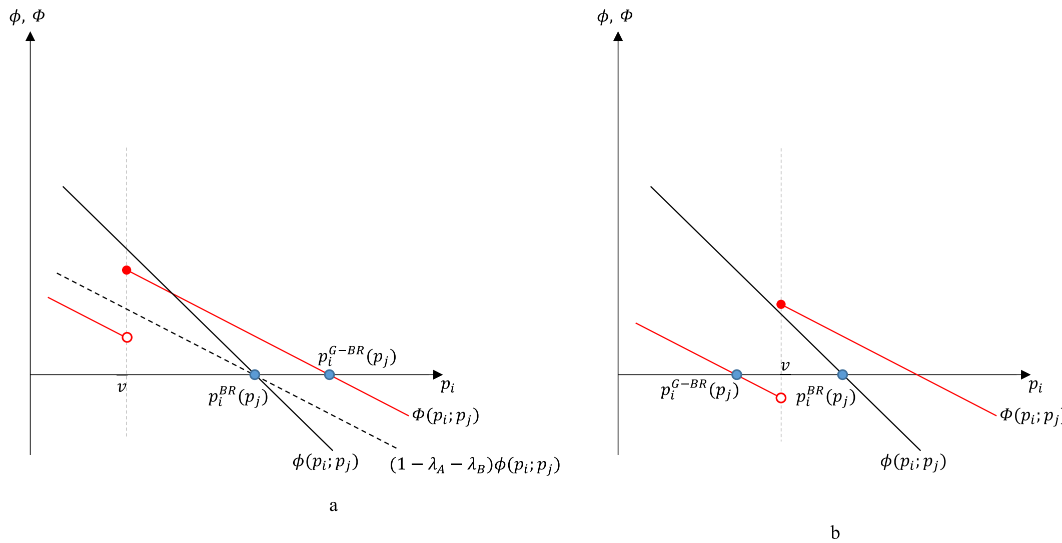

Fig. 1. a. Best response $(v < p_i^{BR}(p_j) < p_i^{G-BR}(p_j))$ b. Best response $(p_i^{G-BR}(p_j) < v < p_i^{BR}(p_j))$.

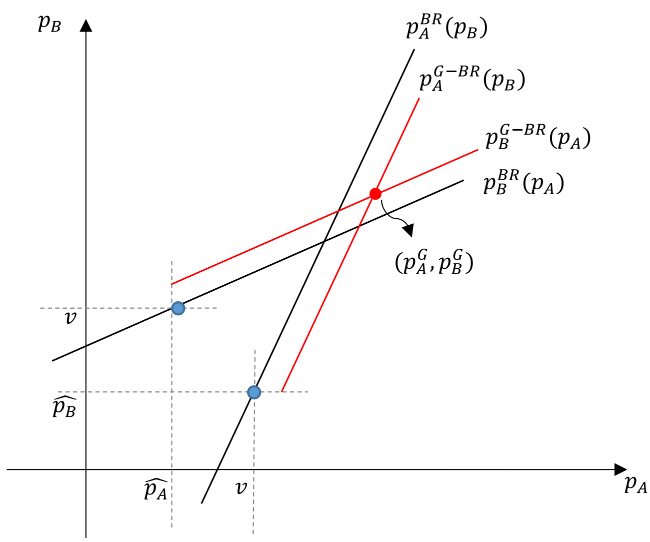

Fig. 2. Best response when firms issue gift cards that are not honored by the rival.

larger price cuts by the rival are required to induce them to switch away from the firm for which they hold a gift card. Card-holding consumers compare the rival's stated price with the card-issuing firm's effective price (where they can complete the transaction by redeeming the gift card worth v and making an additional cash payment of only $p_i - v$). This lock-in effect reflects a price advantage. Firm i's effective price for a consumer who holds a card issued by firm i is $p_i - v$, which competes against firm j's undiscounted price, p_j.

The insight that a firm can raise its price because consumers are willing to buy the product at a higher price due to the lock-in effect generated by the "discounted" effective price that gift cards provide is the same mechanism analyzed in the literature on switching costs (locking in consumers and thereby reducing competition). This lock-in effect can also be viewed as an increase in quantity demanded at any given price.

A second implication of Proposition 1 follows from the observation that firm i is not the only one that issues gift cards. If the rival firm also issues gift cards and some consumers are locked in to the rival firm, then it causes a price disadvantage for firm i. Because of this lock-in effect caused by the rival firm's gift cards, firm i is forced to more aggressively cut its price to attract consumers locked in to the rival firm. This rival lock-in effect can be similarly viewed as a decrease in demand at any given price, due to price disadvantage. If firm i could discriminate stated prices, then it would offer discounts only to consumers locked in to its rival j and charge a higher price to consumers locked in to itself (firm i). Because it cannot price discriminate, the uniform stated price it charges must aggregate all of these effects. First, the lock-in effect that enables a firm to raise its price is slightly larger than the countervailing rival's lock-in effect which forces the firm to lower its price in order to poach the rival's locked-in consumers, even if $\lambda_A = \lambda_B$. Second, there is the additional indirect price effect just mentioned that attenuates profit due to a lower effective price. Considering all these things together, the overall elasticity effect raises the equilibrium price.

Note that Proposition 1 suggests that if $\lambda \approx \frac{1}{2}$, it is also possible that $p^G < p^N$. Intuitively, this is because larger values of λ_j make the rival's lock-in effect so large that it creates a strong incentive to lower price to attract those consumers locked into the rival firm. We can call this the *poaching effect* (borrowing this term from Fudenberg and Tirole, 2000). If $p_i < v \leq p^N$, then the second term in (6) disappears (as it did in (8)), so that there is no direct price effect, and only the rival's lock-in effect that induces the poaching effect remains.

A natural question to raise is whether the collusive prices in this model are merely a consequence of the lock-in effect, which is already well known in the literature. In other words, is the elasticity effect identified in this section merely due to locked-in consumers? The next section considers open-loop gift cards (mutually redeemable at rival firms) that generate no lock-in effects but nevertheless support collusive pricing.

4. Second period without lock-in (when both firms honor their Rival's gift cards)

If firms issue gift cards that are mutually accepted by rival firms, then the lock-in effects discussed in the previous section disappear. They disappear because, when a firm raises its price marginally, it now loses some of its previously locked-in consumers who hold gift cards. The face value of a gift card (which measures the discount from stated to the effective price which card-holding consumers face) no longer gives a price advantage to the card-issuing firm. In this case, the profit of firm i is calculated as:

$$\pi_i(p_i,p_j) = (1-\lambda_A-\lambda_B)(p_i-c)(a-\alpha p_i+dp_j) + (\lambda_A+\lambda_B)(\widetilde{p}_i-c)(a-\alpha\widetilde{p}_i+d\widetilde{p}_j) + \lambda_j\theta(p_i-\widetilde{p}_i)(a-\alpha\widetilde{p}_i+d\widetilde{p}_j) - \lambda_i\theta(p_j-\widetilde{p}_j)(a-\alpha\widetilde{p}_j+d\widetilde{p}_i), \tag{12}$$

where the third term is the settlement payment that firm i receives from firm j for honoring the gift cards issued by firm j, and the last term is the settlement payment that firm i gives to firm j. Here, $\theta \in [0,1]$ is the settlement ratio. If $\theta = 1$, it corresponds to a full-settlement rule. If $\theta = 0$, it corresponds to a so-called no-settlement rule.[13] If $p_i, p_j > v$, then (12) reduces to:

$$\pi_i(p_i,p_j) = (1-\lambda_A-\lambda_B)(p_i-c)q_i + (\lambda_A+\lambda_B)(\widetilde{p}_i-c)\widetilde{q}_i + \lambda_j\theta(p_i-\widetilde{p}_i)\widetilde{q}_i - \lambda_i\theta(p_j-\widetilde{p}_j)\widetilde{q}_j, \tag{13}$$

where $q_i = a-\alpha p_i + dp_j$ and $\widetilde{q}_i = q_i + bv$. If $p_i < v$, then (12) reduces to:

$$\pi_i(p_i,p_j) = (1-\lambda_A-\lambda_B)(p_i-c)q_i - (\lambda_A+\lambda_B)c(a+d\widetilde{p}_j) + \lambda_j\theta p_i(a+d\widetilde{p}_j) - \lambda_i\theta(p_j-\widetilde{p}_j)(a-\alpha\widetilde{p}_j).$$

Comparing (13) with (5), both the price advantage for the firm's own consumers and the price disadvantage for the rival firm's consumers disappear, since consumers who hold gift cards issued by the rival firm j can also use the card to buy from firm i. Firm i gives and takes settlement payments with firm j in return for honoring the other's gift cards. The first-order condition is modified as explained below.

4.1. Region A ($p_i \geq v$)

When $p_i \geq v$:

$$\frac{\partial\pi_i(p_i,p_j)}{\partial p_i} = (1-\lambda_A-\lambda_B)\phi(p_i,p_j) + (\lambda_A+\lambda_B)\phi(\widetilde{p}_i,\widetilde{p}_j) - (\alpha\lambda_j+d\lambda_i)\theta v = a+\alpha c-2\alpha p_i+dp_j+(\lambda_A+\lambda_B)(2\alpha-d)v-(\alpha\lambda_j+d\lambda_i)\theta v = 0, \tag{14}$$

if $p_j \geq v$. Then the best-response function of firm i, denoted p_i^{H-BR}, is:

$$p_i^{H-BR}(p_j) = \frac{a+\alpha c+dp_j}{2\alpha} + \frac{V_i}{2\alpha}, \tag{15}$$

where $V_i = (\lambda_A + \lambda_B)(2\alpha - d)v - (\alpha\lambda_j + d\lambda_i)\theta v > 0$.

4.2. Region B ($p_i < v$)

If $p_i < v$:

$$\frac{\partial\pi_i}{\partial p_i} = (1-\lambda_A-\lambda_B)\phi(p_i,p_j) + \lambda_j\theta(a+d\widetilde{p}_j) = 0. \tag{16}$$

For $p_i < v$, p_i^{H-BR} is computed as:

$$p_i^{H-BR}(p_j) = \frac{a+\alpha c+dp_j}{2\alpha} + \frac{\Lambda}{2\alpha}v, \tag{17}$$

where $\Lambda = \frac{\lambda_j}{1-\lambda_A-\lambda_B}\theta(a+d\widetilde{p}_j) > 0$. Surprisingly, when the two rivals honor each other's gift cards, the best-response function shifts upwards (comparing the best-response price with and without gift cards), regardless of whether $p_i \geq v$ or $p_i < v$. This result holds primarily because the price disadvantage and, consequently, the poaching effect disappears.[14]

4.3. Effect on the equilibrium price

Let p_i^H denote the equilibrium price of firm i when both firms honor their rival's gift cards. The general solution for equilibrium prices is difficult to express explicitly, but we can provide equilibrium prices for the special case that $\theta = 0$:

$$p_i^H = p_j^H = \frac{a+\alpha c}{2\alpha-d} + (\lambda_A+\lambda_B)v. \tag{18}$$

If $\lambda_A = \lambda_B = \lambda$, we have:

$$p_i^H = p^N + 2\lambda v. \tag{19}$$

For general θ, the symmetric equilibrium price follows from equation (15):

$$p^H(\theta) = \frac{a+\alpha c+V}{2\alpha-d}, \tag{20}$$

where $V = [2(2\alpha - d) - (\alpha + d)\theta]\lambda v$.

Proposition 2. *(i) If $v \leq p^N$, then p^H is strictly decreasing in θ. (ii) In particular, $p^H(0) > p^G > p^N$ if firms make no settlements ($\theta = 0$). (iii) If they make full settlements ($\theta = 1$), then $p^H(1) > p^N$ and $p^H(1) \gtrless p^G$ if $\alpha \gtrless 2d$.*[15]

Note from (20) that $p^H = p^N + 2\lambda v$, which is greatest when $\theta = 0$, whereas p^H is lowest when $\theta = 1$. Proposition 2 implies that gift cards can facilitate collusion even if firms mutually honor each other's gift cards and, furthermore, that the no-settlement rule reinforces collusion.[16] Thus, an interesting policy implication from Proposition 2 is that it could be socially desirable to regulate the no-settlement rule in order to limit the collusive effect of gift cards.

A similar intuition applies to this result. Prices rise because gift cards make consumer demand less elastic by discounting the effective price paid after redeeming gift cards they hold. There is no lock-in effect and no poaching effect due to price advantage or disadvantage insofar as the effective prices of the firms are the same by mutually honoring gift cards. Hence, only the elasticity effect remains, and furthermore the elasticity effect is effective in both markets for consumers with gift cards issued by either firm A or firm B. As a result, prices rise even more when firms mutually honor their rival's gift cards than when they do not honor the rival's gift cards. Thus, our finding that gift cards raise prices is not merely a consequence of lock-in effects.

If $\theta > 0$, then serving consumers who hold the other firm's cards provides an extra benefit of settlement payments, which gives each firm an incentive to cut prices. On the other hand, if i-card-holding consumers are served by the other firm j, then settlement payments are an extra cost to firm i. In this case, too, the firm has an incentive to lower its price in order not to lose its own consumers. Therefore, as θ becomes larger, the collusive effect of gift cards becomes weaker. And if $\theta = 1$, then it is not guaranteed that the double elasticity effect exceeds the settlement effect (i.e., nothing guarantees that $p^H > p^G$). As the two goods become closer substitutes (larger d), price competition for more settlement revenues intensifies and the settlement effect becomes more likely to dominate the double elasticity effect.

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[13] In settlements of connection charges for telecommunication services, the case of $\theta = 0$ is called a bill-and-keep arrangement. The bill-and-keep arrangement is often used when the market shares of the two telecommunications carriers are similar. Sinsegae Department Store and Emart, which mutually honor each other's gift cards, use the no-settlement rule. Although the two firms are affiliated to the same holding corporation (Samsung), they are independent corporations.

[14] For $p_i < v$, there is no poaching effect. Settlement revenue from firm j increases in p_i because demand is inelastic with respect to p_i. Therefore, the best-response curve shifts upwards when moving from no gift cards to gift cards whenever $p_i < v$.

[15] In a Hotelling model, $p^H(0) > p^G > p^N$ *if firms make no settlements* ($\theta = 0$)*, and* $p^G > p^H(1) = p^N$ *if they make full settlements* ($\theta = 1$)*. Thus, if* $\theta = 1$*, there is no collusive effect from gift cards that are mutually honored.*

[16] We can easily check from equation (13) that $\pi^H(\theta)$ is decreasing in θ, just as $p^H(\theta)$ is decreasing in θ.

5. First period

Issuing gift cards incurs some costs to an issuing firm in period 1. It is costly to produce, promote and sell gift cards. Insofar as issuing gift cards serves a strategic purpose that increases profits over the two-period game, however, the firm (which is assumed to take into account its total profit over both periods) may choose to issue gift cards whenever the dynamic benefit of doing so exceeds its static cost. In this section, we analyze the two-period game that now includes firms' first-period decisions about issuing gift cards rather than taking them as predetermined (or exogenously given) as in the single-stage period-2 game analyzed in the previous two sections.

As described in Section 2, in the first period, firm $i \in A, B$ chooses the volume that it will sell of gift cards with face value v. That is, each firm chooses $\lambda_i \in [0,1]$ where $\lambda_A + \lambda_B \leq 1$. We assume that the price of a gift card is equal to its face value v. In the second period, firms compete by choosing product prices p_A and p_B. As in Section 3, firms do not honor their rival's gift cards.

The analysis in this section rests on the assumption that the set of consumers who purchase gift cards is not identical to the set of consumers who buy goods with gift cards—which means that the market for gift cards is distinct from the market for products. This assumption is motivated by the observation that gift cards are frequently bought and then gifted to others (e.g., friends, family members, colleagues, bosses, etc.), so that the individual who purchases a gift card is typically a different individual from the one who redeems it at the issuing firm's stores for a product.

Let e represent the exogenously given common cost that firms incur when they sell one unit of gift cards. The total (two-period) profit of firm i (from its period-1 perspective) is calculated as:

$$\Pi_i = \psi_i + \pi_i(\lambda_A, \lambda_B), \tag{21}$$

where $\psi_i = (v - e)\lambda_i$ and $\lambda_A + \lambda_B \in [0,1]$. Each firm can at least duplicate the equilibrium outcome when no gift cards are issued by choosing $\lambda_i = 0$. We are therefore only interested in interior solutions where $\lambda_i > 0$.

Now, consider how the two firms compete when choosing gift card volumes in period 1 while taking into account later price competition in period 2. Differentiating total profit with respect to λ_i, we have:

$$\frac{d\Pi_i}{d\lambda_i} = v - e + \frac{d\pi_i}{d\lambda_i}. \tag{22}$$

Applying the envelope theorem to develop the last term on the right-hand side, we have:

$$\frac{d\pi_i}{d\lambda_i} = \frac{\partial \pi_i}{\partial \lambda_i} + \frac{\partial \pi_i}{\partial p_j}\frac{\partial p_j^G}{\partial \lambda_i}. \tag{23}$$

Since $\frac{\partial \pi_i}{\partial \lambda_i} = \widetilde{\pi}_i^G - \pi_i^G$ from (5) and $\frac{\partial p_j^G}{\partial \lambda_i} = 0$ from equation (11), equation (23) reduces to:

$$\frac{d\pi_i}{d\lambda_i} = \frac{\partial \pi_i}{\partial \lambda_i} = \widetilde{\pi}_i^G - \pi_i^G \tag{24}$$

where:

$$\widetilde{\pi}_i^G = (\widetilde{p}_i^G - c)(a - \alpha\widetilde{p}_i^G + dp_j^G),$$

$$\pi_i^G = (p_i^G - c)(a - \alpha p_i^G + dp_j^G).$$

Note the difference between $\frac{\partial \pi_i}{\partial \lambda_i}$ and $\frac{d\pi_i}{d\lambda_i}$. The former is just the direct effect of a change in λ_i on i's profit without taking into account the second-period effects of a change in λ_i on profit through a change in equilibrium prices. The latter takes the direct effect and second-period effects of equilibrium price adjustment into account.

Based on (24), however, it turns out that $\frac{d\pi_i}{d\lambda_i} = \frac{\partial \pi_i}{\partial \lambda_i}$. Equation (24) shows a tradeoff between selling to consumers without gift cards and those with gift cards. When λ_i increases, the profit from consumers with gift cards increases (i.e., the first term), and the profit from the consumers without gift cards decreases (i.e., the second term), because the proportion of cardless (or cash) consumers is reduced.

The first-order condition of firm i's first-period profit maximization problem (setting (22) equal to zero) can be expressed as follows:

$$\frac{d\Pi_i}{d\lambda_i} = \left(v - e + \widetilde{\pi}_i^G\right) - \pi_i^G = 0. \tag{25}$$

It is then straightforward to develop the following inequalities to see that if the cost of gift cards is sufficiently small, then the firm will want to issue the largest possible volume of gift cards:

$$\begin{aligned}\frac{d\Pi_i}{d\lambda_i} &\equiv \left(v - e + \widetilde{\pi}_i^G\right) - \pi_i^G \\ &\geq (p^G - c)(a - bp^G + \alpha v) - (p^G - c)(a - bp^G) - e \\ &= (p^G - c)\alpha v - e \\ &> 0,\end{aligned} \tag{26}$$

if $e \approx 0$. The first inequality is due to $q_i^G \equiv a - bp^G + \alpha v \in [0,1]$, since the entire mass of consumers is one. The last inequality implies that both firms will want to increase λ_i as much as possible so that the symmetric equilibrium proportions of card-holders are $\lambda_A^* = \lambda_B^* = \frac{1}{2}$. If e is large enough, however, there can also be an interior solution for (25), which is required to satisfy:

$$v + \widetilde{\pi}_i^G - \pi_i^G = e. \tag{27}$$

The left-hand side (LHS) of (27) is the net marginal benefit of issuing an additional gift card and the right hand side (RHS) is its marginal cost. The symmetric λ^* must be determined to balance the marginal benefit and the marginal cost. If marginal benefit exceeds marginal cost, then firm i will issue gift cards as much as possible to increase its market share in the gift card market.

Substituting λ^*, we obtain the equilibrium symmetric total profit, $\Pi^* \equiv \Pi(\lambda^*, \lambda^*)$. Fig. 3a presents numerical calculations showing that $\Pi^* > \pi^N \equiv \pi(p^N, p^N)$ for parameter values of $a = 0.5$, $b = c = 0.1$, $\alpha = 0.3$ and different values of v and e. It also illustrates some comparative statics with respect to changes in v and e, respectively. In the figure, $\Pi_1^G(v), \Pi_2^G(v)$ and $\Pi_3^G(v)$ are profits for $e = 0, 0.01$ and 0.02 respectively. Fig. 3b shows how the collusive effect of gift cards changes with respect to θ (the settlement ratio) given $v = 0.2$ when both firms honor their rival's gift cards. This provides a rationale for firms to issue gift cards despite their additional costs.

6. Discussions

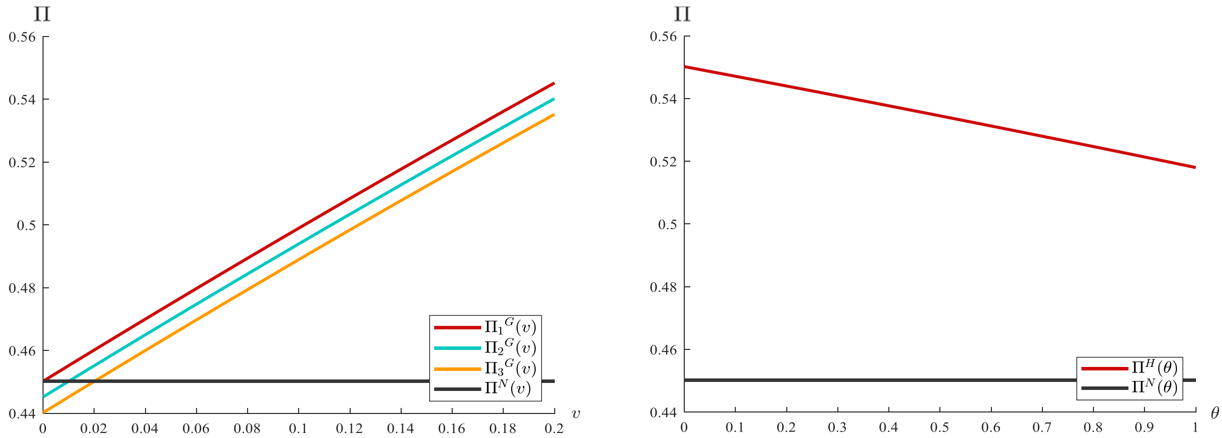
In this section, we briefly discuss how various modifications of the model affect the main result that gift cards increase sellers' pricing power.

6.1. Overlapping consumers

So far, we have assumed that consumers hold at most one gift card. We now consider the possibility that some consumers hold gift cards from both firms. Let λ_{AB} be the proportion of consumers that hold both sellers' gift cards. The proportion of consumers that hold gift cards from only firm i is given by $\lambda_i - \lambda_{AB}$.

If firms do not honor their rival's gift cards, then the function measuring profits of firm i is slightly modified as follows:

$$\begin{aligned}\pi_i(p_i, p_j) &= (1 - \lambda_A - \lambda_B + \lambda_{AB})(p_i - c)(a - \alpha p_i + dp_j) \\ &\quad + (\lambda_i - \lambda_{AB})(\widetilde{p}_i - c)(a - \alpha\widetilde{p}_i + dp_j) \\ &\quad + (\lambda_j - \lambda_{AB})(p_i - c)(a - \alpha p_i + d\widetilde{p}_j).\end{aligned}$$



a b

Fig. 3. a. Total Profits with a change in v and e Π_1^G for $e = 0$, Π_2^G for $e = 0.01$, Π_3^G for $e = 0.02$. b. Settlement Ratio vs. Total Profit.

Note that gift cards cannot give any price advantage to consumers who hold both gift cards, since they can buy a product at a discounted effective price from either firm. These consumers will therefore decide which firm to buy from simply by comparing the stated (i.e., undiscounted) prices, just as consumers with no gift cards do. Therefore, the effect of gift cards on equilibrium price—and thus, the collusive effect of gift cards—is reduced, which can be demonstrated by calculating the symmetric equilibrium price, $\hat{p}^G = p^N + (\lambda - \lambda_{AB})v$.

If firms mutually honor each other's gift cards, then equation (13) is modified as:

$$\begin{aligned}\pi_i(p_i, p_j) = {} & (1 - \lambda_A - \lambda_B + \lambda_{AB})(p_i - c)(a - \alpha p_i + dp_j) \\ & +(\lambda_A + \lambda_B - \lambda_{AB})(\widetilde{p}_i - c)(a - \alpha\widetilde{p}_i + d\widetilde{p}_j) \\ & +\lambda_j\theta(p_i - \widetilde{p}_i)(a - \alpha\widetilde{p}_i + d\widetilde{p}_j) - \lambda_i\theta(p_j - \widetilde{p}_j)(a - \alpha\widetilde{p}_j + d\widetilde{p}_i).\end{aligned}$$

The proportion of card holders is now strictly less than $\lambda_A + \lambda_B$, because some consumers hold both firms' cards. If the proportion of card holders who are double counted is eliminated, then the proportion of card-holders who generate elasticity effects is reduced by λ_{AB}, and the collusive effect of gift cards is similarly reduced. If $\theta = 0$, the resulting symmetric equilibrium price is $\hat{p}^H = p^N + \frac{V_{AB}}{2\alpha - d}$, where $V_{AB} = (\lambda_A + \lambda_B - \lambda_{AB})(2\alpha - d)v - (\alpha + d)\theta\lambda v$. This calculation shows that the increase in equilibrium price from the issuance of gift cards is reduced by $\lambda_{AB}v$ once overlapping consumers are introduced.

6.2. Quantity competition

In this section, we consider quantity instead of price competition between the two firms. Assume that two firms produce homogeneous goods in the product market. The consumer's subjective valuation of the good (i.e., reservation price) is denoted by r, which is assumed to be uniformly distributed on $[0, 1]$.

If no gift cards are issued, then a consumer with subjective valuation r buys one unit from either firm whenever $r \geq p$. Therefore, the total demand function is $D(p) = 1 - p$. Let q_i represent firm i's output (in an abuse of notation, re-using the same symbol from previous sections for simplicity). As is well known, the Cournot-Nash equilibrium output quantity of each firm is:

$$q^{CN} = \frac{1 - c}{3},$$

and the resulting market price is:

$$p^{CN} = 1 - 2q^{CN} = \frac{1 + 2c}{3}.$$

Suppose now that both firms issue gift cards with face value v to proportions of consumers denoted $\lambda_A, \lambda_B \in (0, 1)$, respectively (assuming that no consumer holds both gift cards). Firm i now faces two groups of consumers: a group that does not hold gift cards issued by firm i, and another group that does. Consumers without gift cards buy a product from either firm if $r \geq v$ as before, and consumers holding gift cards issued by firm i buy one from firm i if $r \geq p - v$. Note that consumers who hold gift cards issued by the rival firm will never buy from firm i, since the two products are homogeneous.

Let the demand for the consumers without gift cards be denoted as $\widetilde{Q}$. Then, we have:

$$\widetilde{Q} = (1 - \lambda_A - \lambda_B)(1 - p), \tag{28}$$

where $\widetilde{Q} = x_A + x_B$ and x_i is the quantity that firm i sells to consumers without gift cards.

Firm i calculates its profit as:

$$\pi_i = (p - c)x_i + \lambda_i(\widetilde{p} - c)(1 - \widetilde{p}), \tag{29}$$

where $\widetilde{Q} = x_A + x_B = (1 - \lambda_A - \lambda_B)(1 - p)$, or equivalently, $p = 1 - \frac{x_A + x_B}{1 - \lambda_A - \lambda_B}$.

If $p > v$, then the first-order condition for profit maximization requires:

$$\frac{\partial \pi_i}{\partial x_i} = x_i\frac{\partial p}{\partial x_i} + (p - c) + \lambda_i[(1 - p + v) - (p - v - c)]\frac{\partial p}{\partial x_i} = 0, \tag{30}$$

where $\frac{\partial p}{\partial x_i} = -\frac{1}{1 - \lambda_A - \lambda_B}$.

Let x^* represent the symmetric equilibrium quantity and p^* represent the equilibrium price when $\lambda_A = \lambda_B = \lambda$. It is not difficult to see that $q^{CN} > \frac{x^*}{1 - 2\lambda}$ (The Proof is provided in the Appendix A). Therefore, $p^* > p^{CN}$, which implies that the equilibrium price rises when firms issue gift cards. The Appendix A also shows that if firms accept each other's gift cards, then the market price rises even higher. This confirms that the model's main qualitative result—that gift cards function as a collusive device that intensifies pricing power—continues to hold under quantity competition, similar to the results obtained previously under price competition.

7. Conclusion and caveats

This paper demonstrates a new rationale explaining why firms incur costs of production, marketing and transaction processing to issue gift cards. Gift cards help firms to collude by making consumer demand less price sensitive. Card-holding consumers face a lower effective product price whenever they can redeem the face value of their gift cards as partial or total payment for the consumer product. The gap between the firm's stated price for a consumer product and card-holding consumers' effective price causes price-elasticity of demand to decrease. Thus, gift cards enable firms to raise prices for consumer products.

We acknowledge that our model abstracts from potentially important institutional detail that characterizes issuance of gift cards in the real world and is, therefore, incomplete. Our assumption that consumers purchase goods at most once forces card-holding consumers to waste any unused gift-card credit whenever they purchase a product whose stated price is strictly less than the face value of the gift card. Considering the reality that consumers can use gift cards more than once, this assumption is a limitation of our model, although the empirical observation that billions of dollars of gift card balances are never redeemed is consistent with consumers wasting gift-card credit in our model. Theoretically, the effects of the remaining gift card balances on equilibrium product pricing should be addressed by extending our model to include future periods in which the gift card can be used repeatedly. A second limitation of our model is that, to simplify the analysis, we assumed that gift card and product markets are independent. In reality, of course, demand for gift cards issued by a particular firm may be somewhat dependent on demand for that firm's product, even when purchasers of gift cards and products are different. We expect these issues to be addressed in future research.

Appendix A

Proof of Proposition 1. To show that $\Phi(p_i, p_j; \lambda) > 0$ for all $p_i < v$ for any small $\lambda > 0$, it suffices to show that there exists $\overline{\lambda} \in (0,1)$ such that $\Phi(v, p_j; \lambda) > 0$ for any $\lambda < \overline{\lambda}$, because the second-order condition implies that $\Phi'(p_i; \lambda) < 0$.

If $p_i < v$, we have:

$$\Phi(p_i, p_j; \lambda) = (1-2\lambda)\phi(p_i, p_j) + \lambda\phi(p_i, \widetilde{p}_j). \tag{31}$$

Although $\Phi(p_i, p_j; \lambda)$ is discontinuous at $p_i = v$, we may consider a continuous extension $\widetilde{\Phi}(p_i)$ of $\Phi(p_i)$ on $(-\infty, v]$. By abusing notation, we will use $\widetilde{\Phi}$ and Φ interchangeably if there is no chance of confusion. Then, we have:

$$\widetilde{\Phi}(v, p_j; \lambda) = \Phi(v, p_j; \lambda) = (1-2\lambda)\phi(v, p_j) + \lambda\phi(v, p_j - v). \tag{32}$$

Note that $\Phi(v, p_j; 0) = \phi(v, p_j) > 0$. If $\Phi(v, p_j; \frac{1}{2}) = \frac{1}{2}\phi(v, p_j - v) \geq 0$, then the Proof is done. If $\Phi(v, p_j; \frac{1}{2}) < 0$, then there exists $\widehat{\lambda}$ such that $\Phi(v, p_j; \overline{\lambda}) = 0$ by continuity of Φ with respect to λ. Define $\overline{\lambda}$ by $\Phi(v, p_j; \overline{\lambda}) = 0$. Then, we have:

$$\Phi(v, p_j; \overline{\lambda}) = (1-2\overline{\lambda})\phi(v, p_j) + \overline{\lambda}\phi(v, p_j - v) = 0. \tag{33}$$

Since $p^N > v$, we have $\phi(v, p_j) > 0$, implying that $\phi(v, p_j - v) < 0$. Therefore, it follows that $\Phi(v, p_j; \lambda) < 0$ if $\lambda > \overline{\lambda}$ and $\Phi(v; p_j\lambda) > 0$ if $\lambda < \overline{\lambda}$. ■

Proof of Proposition 2. This is immediate from comparing (4), (11) and (18). ■

Claim 1. *In the quantity competition game, $p^* > p^{CN}$ in both cases of lock-in (closed-loop gift-card institution) and no lock-in (open-loop gift-card institution).*

Proof. If firms do not accept the rival's gift cards, then equation (30) reduces to:

$$-\frac{x^*}{1-2\lambda} + 1 - \frac{2x^*}{1-2\lambda} - c - \frac{\lambda}{1-2\lambda}[1 + c - 2(p^* - v)] = 0, \tag{34}$$

where $\lambda_A = \lambda_B = \lambda$. By using $p^* = 1 - \frac{2x^*}{1-2\lambda}$, equation (34) can be rearranged as:

$$\frac{3-2\lambda}{1-2\lambda}x^* = (1-c)(1-2\lambda) - \lambda(1-c+2v) = (1-c)(1-3\lambda) - 2\lambda v. \tag{35}$$

Therefore, we have:

$$\frac{x^*}{1-2\lambda} = \frac{(1-c)(1-3\lambda) - 2\lambda v}{3-2\lambda}. \tag{36}$$

To show that $x^* < q^{CN}$, we have:

$$\begin{aligned}\nabla &\equiv q^{CN} - \frac{x^*}{1-2\lambda} \\ &= \frac{1}{3}(1-c) - \frac{(1-c)(1-3\lambda) - 2\lambda v}{3-2\lambda} \\ &= \frac{7\lambda}{3(3-2\lambda)}(1-c) + \frac{2\lambda v}{3-2\lambda} \\ &> 0.\end{aligned}$$

Therefore, $x^* < q^{CN}$, implying that $p^* > p^{CN}$.

If firms accept their rival's gift cards, then λ_i is replaced by $\lambda_A + \lambda_B$ in equations (29) and (30). Letting $\widetilde{x}^*$ represent the equilibrium quantities that consumers without gift cards will purchase from firm i in the case of no lock-in, we have:

$$\begin{aligned}\widetilde{\nabla} &\equiv q^{CN} - \frac{\widetilde{x}^*}{1-2\lambda} \\ &= \frac{1}{3}(1-c) - \frac{(1-c)(1-4\lambda) - 4\lambda v}{3-2\lambda} \\ &= \frac{10\lambda}{3(3-2\lambda)}(1-c) + \frac{4\lambda v}{3-2\lambda} \\ &> 0.\end{aligned}$$

This shows that $\widetilde{x}^* < x^* < q^{CN}$, implying that the equilibrium price rises even higher without lock-in than in the case of lock-in. ■

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.econmod.2020.03.020.

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