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Facilitating Fit Revelation in the Competitive Market

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This study examines firms' strategic decisions in the competitive market regarding whether to engage in marketing activities to assist consumers in finding the fit between their personal tastes and products' horizontal attributes. We find that competitive firms' strategies to facilitate fit revelation critically depend on the product qualities they offer. In particular, a firm offering a high-quality product is more likely to facilitate fit revelation in the competitive market than it would as a market monopolist, whereas a firm offering a low-quality product is less likely to do so. In addition, the firm offering the high-quality product implements fit-revealing activities in a greater intensity than its rival that offers the low-quality product, if the quality difference between the two products is small and both products' qualities are sufficiently high.

Key words: consumer fit uncertainty; fit revelation; competitive strategies; game theory
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1. Introduction

In many product categories, such as food, drugs, cosmetics, books, and magazines, a consumer's purchase decision largely depends on how well a product's horizontal attributes fit her personal taste. Nonetheless, it is often difficult for a consumer to predict her fit with a product without consumption experience. In this study, we explore competitive firms' incentive and strategies to engage in marketing activities to assist consumers in finding the product fit before making purchases. Consider a mother shopping for an infant formula for her newborn, Emily. The mother can learn about a formula's price and nutrient content from the product label, but in the meantime, she worries that Emily will resist feeding if she does not like the flavor. Adding to the mother's difficulty, every baby is different, and her other children or her friends' babies liking a formula's flavor does not guarantee that Emily will also like it. Furthermore, each formula has its distinct flavor, and Emily liking brand A hardly helps the mother predict whether she would like brand B.

The infant formula market exhibits three distinct features that make fit revelation an important firm decision. First, consumers have a good knowledge about product quality; second, consumers' perceived fits with products greatly influence their purchase decisions; and third, the market contains a large segment of fit-uncertain consumers. In particular, an infant formula product's nutrient content is a vertical quality attribute, because all babies benefit from a higher nutrition level; a formula's flavor is a horizontal attribute, because some babies like the flavor, whereas others do not. The infant formula market is subject to the regulations of the U.S. Food and Drug Administration (FDA hereafter), and all producers are required to provide nutrient content information in product labels. Nonetheless, a baby's overall benefit from a formula largely depends on how much she likes its flavor, which is difficult to predict before a feeding.[1] Moreover, babies commonly stop taking formulas beyond 12 months, and every year millions of newborns enter the market. As a result, the infant formula market typically contains a large pool of consumers who are uncertain about their fits with product options. Operating in a market characterized by the three features, a firm may want to invest in fit-revealing marketing activities such as free trials and free samples, which can assist consumers in

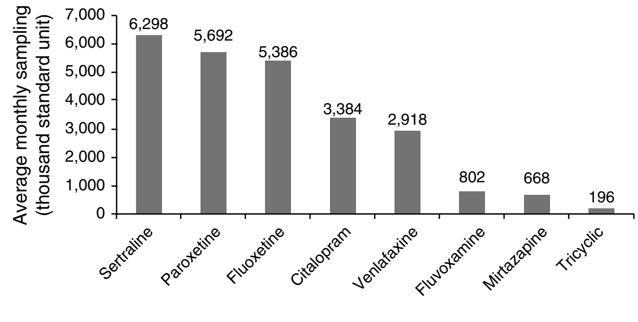
[1] Third-party reviews may provide valuable information about a product. Nonetheless, third-party reviews are often more useful in providing information about the quality of a product than about the personal fit of a product. This happens because consumers have homogeneous valuations about quality but idiosyncratic valuations about fit. For example, if a third-party reviewer says that a baby formula can easily dissolve in water, it is likely that other consumers will also find the formula easily dissolvable. On the other hand, if the reviewer says that her baby likes the formula's flavor, it is likely that many other consumers will find their babies do not like the flavor. In this example, the ease of dissolving in water is a vertical (quality) attribute of the formula and the flavor is a horizontal attribute of the formula.

finding the product fit before purchases. For example, infant formula producers often provide free samples through doctor offices and hospitals.[2]

Another market that exhibits the three features is the prescription drug market, where physicians decide which drug to prescribe for a patient. First, physicians have a good knowledge about drug quality, as pharmaceutical companies are regulated by the FDA to make drug quality (efficacy and safety) information publicly available. Second, the physician community has long recognized that a particular drug's overall benefit to an individual patient critically depends on whether the drug's distinct mechanism of function would work for the patient's unique biophysics system and that different patients can respond very differently to the same medication (Joseph and Mantrala 2009). Limited by the current development in medical science, physicians can hardly predict the best match between idiosyncratic patient characteristics and particular drugs without trials. Finally, because recovered patients exit the market and new patients enter every year, the market constantly contains a large segment of fit-uncertain new patients. To help physicians find the best "match" between patients and drugs, pharmaceutical companies commonly distribute free drug samples (Crawford and Shum 2005, Joseph and Mantrala 2009).

In this paper, we examine two research questions pertinent to firms' fit-revealing strategies in a competitive market. First, how do competitive firms' strategies of implementing fit-revealing activities differ from their strategies of providing other types of information, such as product quality information or information that helps consumers find their quality preferences? This question is important because different consumer markets are characterized by distinct consumer needs for information. Whereas providing quality preference and/or quality information is important for high-tech products such as digital cameras, for which consumers are confused about how much they should desire a higher level of a particular quality attribute (Kuksov and Lin 2010), assisting consumers in finding product fit is important in categories such as infant formula and prescription drugs, where consumer preferences are idiosyncratic. Also note that disclosing different types of information affects consumer demand and market competition in different ways. In particular, fit uncertainty is specific to the match between an individual consumer and a particular product, implying that one firm's fit revelation cannot resolve consumers' fit uncertainty regarding another product. In contrast, consumer uncertainty in quality preference is specific to the individual but not to the product, and as a result, any firm's provision of preference-revealing information will fully resolve consumer uncertainty. In addition, although facilitating fit revelation induces heterogeneity in consumer preferences for a product, the provision of product quality information makes all consumers' preferences for the product shift in one direction. Investigating competitive firms' fit-revealing strategies thus constitutes a unique theoretical contribution to the growing literature on firm information disclosure strategies (e.g., Wernerfelt 1994, Lewis and Sappington 1994, Anderson and Renault 2006, Bhardwaj et al. 2008, Chen and Xie 2008, Guo and Zhao 2009, Kuksov and Lin 2010, Mayzlin and Shin 2011).

Figure 1 **Sampling Intensity in the Antidepressant Market**



Our second research question pertains to the role of quality in firms' fit-revealing strategies. In particular, observations from both the infant formula market and the prescription drug market suggest that firms that offer high-quality products implement fit-revelation activities in a greater intensity than firms that offer low-quality products. In the infant formula market, the two leading brands, Enfamil and Similac, are believed to have higher qualities than other brands because their nutrient contents are closer to breast milk (Moore 2009), and anecdotal evidence shows that these two brands distribute many more free samples than other brands.[3] We also have similar observations in the prescription drug market. We obtained average monthly sampling data of antidepressant drugs during January 1996 through July 2001 from IMS Health and present the data in Figure 1. As shown in Figure 1, the four antidepressants with the highest sampling intensity—sertraline, paroxetine, fluoxetine,

[2] Other examples of fit-revealing activities include newspapers, magazines, and online services that provide free subscriptions; gyms, beauty salons, health clubs, and services that provide free trials; and marketing research companies that provide potential clients sample reports.

[3] We surveyed 41 parents with children aged 1–2 years, among whom 38 received free samples of infant formulas. Of the respondents who received free samples from various brands, 37 received Enfamil, 32 Similac, 6 Nestlé Good Start, 2 Parents' Choice, and 3 other brands.

and citalopram—all belong to the same subcategory, selective serotonin reuptake inhibitor (SSRI), which is believed to have superior quality to other subcategories of antidepressants (National Institute for Health and Clinical Excellence (NICE) 2004).[4] These observations are counterintuitive because one would expect that when qualities are known, low-quality firms would be more likely to reveal fit because this is the only way they can differentiate from the high-quality firms and establish a competitive advantage.[5] So why would such counterintuitive observations arise? Existing studies on firm fit-revealing strategies provide no ready answer to this question because they focus on the monopolistic setting (e.g., Chen and Xie 2008, Sun 2011).

Motivated by the theoretical importance of firm fit-revealing strategies and puzzled by the counterintuitive observations regarding firm fit-revealing activities, we develop a game-theoretical model to investigate the strategic incentives and consequences of firm fit-revealing activities. We consider two competing firms, each selling a product to a consumer market with heterogeneous consumer fit preferences. Before making purchases, consumers know both products' qualities but are uncertain about their fits with either product unless the producer implements fit-revealing activities. Our analysis generates a set of interesting results. First, we show that a firm may provide more or less information in the competitive market than in the monopolistic market, depending on the product quality level. In particular, when the product quality is high, the firm is more likely to implement fit-revealing activities in the competitive market than in the monopolistic market. On the other hand, when the product quality is low, the firm is less likely to facilitate fit revelation in the competitive market than in the monopolistic market. Our result contrasts with the findings in Guo and Zhao (2009) that market competition makes a firm provide less quality information and in Kuksov and Lin (2010) that competition motivates a firm to provide more quality preference revealing information. Our finding thus highlights the distinct impact of firms' information disclosure behaviors on consumer demand and market competition when they provide different types of information.

Second, we show that when the quality difference between the two products is small and both qualities exceed a certain threshold, the firm that offers the high-quality product implements fit-revealing activities with a greater intensity than the firm that offers the low-quality product. This result may explain the observations in the infant formula and the anti depressant markets. In these two markets, the quality difference between competitive products is generally small because both markets are subject to FDA regulation. All infant formulas marketed in the United States must meet federal nutrient requirements,[6] and all antidepressants have to demonstrate sufficient quality (efficacy and tolerability) to obtain FDA approval before entering the market. Finally, we investigate other factors that may affect firms' fit-revealing decisions and find that the parameter region where the high-quality firm implements fit-revealing activities with a greater intensity than the low-quality firm becomes larger when the fits of the two products become more negatively associated or when the marginal production cost of the high-quality firm increases.

Our study contributes to the growing literature on firms' fit-revealing strategies. Chen and Xie (2008) investigate how consumer reviews influence a monopolistic firm's incentive to provide fit-revealing information. Sun (2011) studies a monopolistic firm's incentive to provide horizontal and/or vertical information of its product. Bar-Issac et al. (2010) examine a monopolistic firm's strategic decision to make consumers' information gathering easier or harder. Adding to this literature, our study investigates the influence of market competition on firms' incentive to facilitate fit revelation. Shulman et al. (2009) examine the role of return policy after purchases in mitigating consumer fit uncertainty and show that firms may benefit from consumer uncertainty. Different from this

[4] Drug quality measures are well developed and widely accepted among researchers, companies, and regulators. The efficacy of an antidepressant is commonly measured by the average Hamilton Rating Scale for Depression (HRSD) improvement. An HRSD score is obtained from a multiple-choice questionnaire that clinicians use to rate the severity of a patient's major depression. The safety of an antidepressant is often measured using incidence of adverse events. A meta-analysis of clinical studies for antidepressants published by NICE (2004) shows that SSRIs have no significant difference in treatment effectiveness from other subclasses of antidepressants but are significantly more tolerable. Based on this study, the NICE (2004) guideline recommends SSRIs as the first-line choice for antidepressants. We then conclude that SSRI drugs have higher overall qualities than other antidepressants.

[5] One might argue that a firm offering a high-quality infant formula or drug may be conducting "money burning" to signal its product's high quality or using sampling to reveal the high quality, but quality information is publicly available by FDA regulation in these two markets. Also, research shows little difference in quality perceptions for drugs among physicians employing and not employing samples (Ubel et al. 2003). Another argument might be that firms may use sampling to create awareness at the introduction stage, but the sampling intensity often remains high for mature products that have established wide awareness and quality reputations. For example, fluoxetine was first introduced into the U.S. market in 1987, and 10 years after its market introduction, it still had a higher sampling intensity than many other antidepressants.

[6] Information regarding FDA requirements for infant formula can be found at http://www.fda.gov/Food/FoodSafety/Product-SpecificInformation/InfantFormula/ (last accessed October 16, 2012).

work, we examine firms' strategies to help resolve consumer fit uncertainty before purchases such as providing free samples or free trials. Another related paper is Wernerfelt (1994), which examines the efficiencies of different matching mechanisms in a scenario where a monopolistic seller has two products and each buyer has a good match with only one product but does not know which. Different from this study, we consider consumers' choices between two products offered by two rival firms and examine how firms use fit-revealing strategies as a competitive marketing tool.

Our study is related to the broader literature on firm information provision strategies that help resolve consumer uncertainty about product attributes (e.g., Robert and Stahl 1993, Bester and Patrakis 1993, Anderson and Renault 1999, Koessler and Renault 2012). Moorthy and Srinivasan (1995) demonstrate that firms can use money-back guarantees to signal product quality that is unknown. Heiman and Muller (1996) examine the role of demonstration in reducing consumer quality uncertainties. Guo and Zhao (2009) examine firms' strategies to voluntarily provide product quality information in a competitive market. Bhardwaj et al. (2008) show that with a bandwidth constraint such that a firm cannot tell the customer about all products' features, the firm can signal the preference of all these features or a high quality of its product by allowing buyer-initiated search. Lewis and Sappington (1994) discuss a monopolistic firm's incentive to provide information to help consumers learn about their quality preferences. Extending this work, Kuksov and Lin (2010) examine competitive firms' incentive to provide quality information and/or quality preference information when they offer products of differentiated qualities. If firms cannot directly communicate the information to consumers, they can use different instruments to affect consumer information search. For example, Shulman et al. (2009) consider product returns, Kuksov and Villas-Boas (2010) consider product line strategy, Kuksov and Xie (2010) consider postpurchase efforts to affect consumer information acquisition, and Mayzlin and Shin (2011) consider uninformative advertising. Different from these works, our study focuses on examining firms' information provision strategies when consumers are uncertain about how a particular product fits their personal tastes. As discussed earlier, different consumer markets are characterized by distinct consumer needs for information, and firms' provision of fit-revealing information has different implications for market competition compared with the provision of other types of information.[7]

Our study is also related to research in competitive strategies that suggests a firm should differentiate its product from competitors when facing heterogeneous consumer preferences (e.g., Hauser and Shugan 1983, Hauser 1988). Moorthy (1988) examines two identical firms competing on product quality and price and show that the equilibrium strategy is for firms to take different quality positions to differentiate their products. Pepall and Richards (2002) show that the firm may prefer to enter a market where its brand enjoys a low willingness to pay to ensure a more differentiated status from the dominant brand in that market. Iyer et al. (2005) consider a scenario in which consumers know their preferences for products and the role of advertising is to convey information that the product exists. When targeted advertising is feasible, a firm benefits from eliminating wasted advertising to loyal consumers of its competitors and increasing advertising to its own loyal customers. In this case, lessened price competition comes from firms' ability to differentiate consumers with different preferences. Adding to this literature, we examine a firm's incentive to differentiate from its competitor by facilitating fitrevelation when quality is predetermined.

The rest of the paper proceeds as follows. Section 2 presents the main model. Section 3 solves the main model. Section 4 discusses several extensions of the main model. Section 5 concludes the paper with discussions for future research directions.

2. Model

We consider a competitive market where two firms sell two vertically and horizontally differentiated products to serve consumers of unit mass. The two firms are denoted by 1 and 2, respectively, and their products are denoted accordingly. The two products have qualities q_1 and q_2, respectively, and are priced at p_1 and p_2, respectively. We assume $q_1 \geq q_2$, and let $\delta = q_1 - q_2$ denote the quality difference between the two products.

Each consumer has a single-unit demand. A consumer's perceived value from a product i $(i = 1, 2)$ comes from the product's vertical quality, q_i, and her perceived fit with the product's horizontal attributes, x_i. When product i is priced at p_i, the consumer's net utility is $U_i = \theta(q_i + x_i) - p_i$. Parameter θ captures the consumer's preference for product value. To ensure model tractability, we assume that consumers have homogeneous preferences for product value and normalize θ to unity. As we will show in the model extension, relaxing this assumption does not change our

[7] Another stream of literature examines how firms can create consumer uncertainty and benefit from it (e.g., Shugan and Xie 2000, Xie and Shugan 2001, Fay and Xie 2008, Fay and Xie 2010, Jerath et al. 2010, Sainam et al. 2010). Our paper departs from these studies by focusing on firm's optimal strategies to facilitate fit revelation when facing consumer fit uncertainty exogenously existed.

key results. Consumers know the qualities of both products before purchases, but they do not know their fits with either product ex ante.

The two products are horizontally differentiated in the sense that there are two attributes and each firm offers only one attribute. The attribute that a firm offers is common knowledge. Consumers are endowed with heterogeneous fits with each of the two attributes/products. We assume that a consumer's perceived fits with the two attributes/products are independent. Therefore, a consumer may find that both attributes fit, only one attribute fits, or neither. For example, different brands of baby formula are often manufactured using different bases or addictives, and different drugs work through different biographical mechanisms. For product i ($i = 1, 2$), half of the consumers will experience a good fit, $x_i = G$, and the other half of consumers will experience a bad fit, $x_i = B$, with $G > B$. When firm i does not facilitate fit revelation, consumers are uncertain about whether they will find a good or a bad fit with the product and make decisions based on the expected fit ex ante, $x_i = E = (G + B)/2$. On the other hand, when firm i ($i = 1, 2$) facilitates fit revelation, consumers find out whether they have a good fit with the product, $x_i = G$, or a bad fit, $x_i = B$, before purchase. This approach to modeling consumer horizontal heterogeneity is similar to that in Chen and Xie (2008). For normalization, we set $G = 0$ and $B = -1$, and so $E = -1/2$. Because a consumer's perceived fits with the two products, x_1 and x_2, are independent, one firm's fit revelation does not resolve consumer fit uncertainty with the other product. We use (x_1, x_2) to refer to consumers' perceived fits with the two products. For example, (G, B) refers to consumers who have a good fit with the firm 1 product and a bad fit with the firm 2 product; (E, G) refers to consumers who have an uncertain fit with the firm 1 product and a good fit with the firm 2 product.

Each firm's product quality is exogenously determined by its technology level. The marginal production cost is normalized to zero. Each firm incurs a fixed cost $c \geq 0$ to provide fit-revealing information. We constrain this cost to be small, $c \leq 1/4$, to exclude the trivial case that no information is ever provided. We constrain product qualities to be not too small nor too large, $1/2 < q_i < 2$; the lower bound of this constraint ensures that consumers have incentive to buy a product despite of fit uncertainty, and the upper bound ensures that firms have incentive to provide information to help resolve consumer fit uncertainty.

Each firm decides whether to implement marketing activities to help resolve consumer fit uncertainty about its product and decides on the price of its product. Following literature on information provision (e.g., Guo and Zhao 2009, Kuksov and Lin 2010), we model the timing of the game as follows. In the first stage, the two firms decide whether to implement marketing activities to facilitate fit revelation. In the second stage, the two firms simultaneously decide the optimal prices for their products. Firms observe each other's choice after each stage. In the third stage, consumers observe firms' fit-revealing decisions and product prices, and then they make purchase decisions. Our model allows a firm to respond to its competitor's fit-revealing strategy through price adaptation. Compared with price adaptation, changing information provision strategies commonly requires a more complex planning process, which may include budgeting, staffing, and advertising, and can thus be viewed as having a longer strategic span.

Before solving the full model, we consider a benchmark case of a monopolistic firm offering a product of quality q. If the monopolistic firm does not implement fit revealing activities, it can optimally charge a price of $q - 1/2$ and get all demand; the firm's maximized profit is $q - 1/2$. Alternatively, if the firm facilitates fit revelation, it can charge a price of q and obtain a demand of $1/2$ from consumers who find a good fit, or it can charge a price of $q - 1$ and sell to all consumers; the firm's maximized profit is thus $\max\{q/2 - c, q - 1 - c\}$. Comparing the monopolist firm's optimal payoffs when it facilitates fit revelation and when it does not, we obtain the following lemma.

Lemma 1. *A monopolistic firm obtains a greater profit by facilitating fit revelation if product quality is low,* $q < 1 - 2c$; *otherwise, the firm obtains a greater profit by not doing so.*

A monopolistic firm balances the margin–demand trade-off in making the fit-revelation decision. As discussed earlier, the firm is willing to reveal fit to benefit from the enhanced margin only if its quality is sufficiently low.

3. Analysis

We solve the game through backward induction to obtain the subgame-perfect equilibrium. In §3.1, we solve competing firms' equilibrium pricing strategies and market payoffs under all possible fit-revelation scenarios. In §3.2, we examine firms' equilibrium fit-revealing strategies.

3.1. Equilibrium Firm Payoffs Under Various Fit-Revelation Scenarios

There are four possible information provision scenarios in the competitive market: (1) neither firm 1 (offering the high-quality product) nor firm 2 (offering the low-quality product) implements fit-revealing activities (NN); (2) only the low-quality firm implements fit-revealing activities (*ND*), (3) only the high-quality firm implements fit-revealing activities (*DN*), and (4) both firms implement fit-revealing activities (*DD*). We summarize the two firms' equilibrium pricing strategies and payoffs in each of the four scenarios in the following lemma.

Lemma 2 (Equilibrium Market Outcomes Under Various Fit-Revealing Scenarios). *When neither firm facilitates fit revelation* (*NN*), *unique pure-strategy equilibrium in pricing exists. When one firm facilitates fit revelation* (*ND or DN*) *or both firms facilitate fit revelation* (*DD*), *firms employ mixed pricing strategies in equilibrium. The two firms' optimal pricing strategies and their equilibrium market payoffs under the four information provision scenarios are presented in Tables* 1 *and* 2, *respectively.*

When neither firm facilitates fit revelation (*NN*), consumers are uncertain about their fits with either product and have expected utilities of $U_1^{NN} = q_1 - p_1 - 1/2$ and $U_2^{NN} = q_2 - p_2 - 1/2$. Each firm has incentive to undercut its competitor's price until the high-quality firm charges a price slightly lower than the quality difference between the two products (δ) and gets all demand; in equilibrium, the high-quality firm obtains a profit of $\pi_1^{NN} = \delta$ and the low-quality firm obtains zero profit, $\pi_2^{NN} = 0$. That is, the high-quality firm exploits its quality advantage through price competition and obtains a greater profit when it has a larger quality advantage (a larger δ). When only the low-quality firm implements fit-revealing activities (*ND*), half of the consumers find a good fit with the product and the other half find a bad fit. The market is split into two segments: (E, G) consumers have utilities of $U_1^{ND} = q_1 - p_1 - 1/2$ and $U_2^{ND} = q_2 - p_2$ from the two products, respectively; and (E, B) consumers have utilities of $U_1^{ND} = q_1 - p_1 - 1/2$ and $U_2^{ND} = q_2 - p_2 - 1$. With the segmented market, each firm has incentive to undercut its competitor's price to obtain demand of a whole segment until it is no longer profitable to do so, in which case the mixed pricing strategy arises as the only possible equilibrium outcome.[8] Similarly, when only the high-quality firm reveals fit (*DN*) or when both firms do so (*DD*), the market is split into multiple segments, with consumer preferences varying across different segments, also leading to mixed-strategy equilibrium in pricing.

Table 1 Equilibrium Prices Under Various Fit-Revealing Scenarios

	Firm 2	
Firm 1	Facilitate fit revelation	Not facilitate fit revelation
Facilitate fit revelation	$p_1^{DD*} \in [\delta + q_2/2, \delta + q_2]$ $p_2^{DD*} \in [q_2/2, q_2]$	$p_1^{DN*} \in [\delta + q_2/2 + 1/4, \delta + q_2]$ $p_2^{DN*} \in [q_2/2 - 1/4, q_2 - 1/2]$
Not facilitate fit revelation	$p_1^{ND*} \in [q_2/2 + \delta/2 - 1/4, q_2 + \delta - 1/2]$ $p_2^{ND*} \in [q_2/2 - \delta/2 + 1/4, q_2]$	$p_1^{NN*} = \delta$ $p_2^{NN*} = 0$

Table 2 Equilibrium Profits Under Various Fit-Revealing Scenarios

	Firm 2	
Firm 1	Facilitate fit revelation	Not facilitate fit revelation
Facilitate fit revelation	$\pi_1^{DD*} = q_2/4 + \delta/2 - c$ $\pi_2^{DD*} = q_2/4 - c$	$\pi_1^{DN*} = q_2/4 + \delta/2 + 1/8 - c$ $\pi_2^{DN*} = q_2/2 - 1/4$
Not facilitate fit revelation	$\pi_1^{ND*} = q_2/2 + \delta/2 - 1/4$ $\pi_2^{ND*} = q_2/4 - \delta/4 + 1/8 - c$	$\pi_1^{NN*} = \delta$ $\pi_2^{NN*} = 0$

3.2. Equilibrium Fit-Revealing Strategies

We discuss firms' equilibrium fit-revealing strategies in two steps. First, in §3.2.1 we examine a special case in which competing firms offer products of the same quality, $q_1 = q_2 = q$. We then examine the general case and discuss how quality difference between products affects firm fit-revealing strategies in §3.2.2.

3.2.1. Fit-Revealing Strategies When Firms Offer Products of the Same Quality. When the two firms offer products of the same quality in the competitive market, $q_1 = q_2 = q$, their equilibrium payoffs under different fit-revealing scenarios are as stated in Lemma 1, with $\delta = 0$. We solve for the pure-strategy equilibrium of the fit-revealing game as shown in Table 2 when $\delta = 0$ and obtain the following proposition.

Proposition 1. *When the two competing firms offer products of the same quality and make fit-revealing decisions simultaneously*, (1) *if $q \le 1 - 4c$, the unique pure-strategy equilibrium is* (*DD*), *and both firms implement fit-revealing activities; or* (2) *if $q > 1 - 4c$, there are two pure-strategy equilibria* (*DN*) *and* (*ND*), *and in equilibrium only one firm implements fit-revealing activities.*

Proof. See the appendix.

Proposition 1 shows that when two competing firms offer the same product quality, in equilibrium at least one firm implements fit-revealing activities. This is because a firm always has incentive to facilitate fit revelation when it expects its competitor not to do so. When neither firm implements fit-revealing activities (*NN*), the fierce price competition drives

[8] Note that in our parameter range of $1/2 < q_i < 2$, no pure-strategy equilibrium in pricing exists. The same applies to the cases of (*ND*) and (*DD*).

both firms' profits down to zero, $\pi_1^{NN} = \pi_2^{NN} = 0$. When one firm, say, firm 1, implements fit-revealing activities (DN), the realized consumer fit heterogeneity about product 1 leads to two market segments with differentiated preferences—segment (G, E) consumers favor product 1 and segment (B, E) consumers favor product 2. Such differentiated consumer preferences alleviate price competition, manifested in that both firms can now charge a positive price.

Note that in the above example, firm 2 does not facilitate fit revelation and yet benefits from the lessened price competition ($\pi_2^{DN} = q/2 - 1/4 > \pi_2^{NN} = 0$). Nonetheless, firm 2 may still have incentive to implement fit-revealing activities because doing so will allow it to charge an even higher price and extract a greater surplus from consumers who find a good fit with its own product. In particular, from DN to DD, the upper endpoint of firm 2's price range increases from $q_2 - 1/2$ to q_2. This insight highlights the distinction between consumer uncertainty in product fit and in quality preference (Kuksov and Lin 2010). In the latter case, once a consumer learns about her quality preference upon one firm's information provision, she knows her utilities from both products. Therefore, no firm has incentive to provide preference-revealing information if expecting its competitor to do so. In addition, from DN to DD, firm 2's increased price may cause it to lose demand from consumers who find a bad fit with its product. Balancing this margin–demand trade-off, firm 2 is willing to facilitate fit revelation only if its product quality is sufficiently low, $q \le 1 - 4c$. This is because with a lower quality, firm 2 expects a lower margin and a smaller loss in profit from losing demand, and thus it favors more a margin-oriented strategy facilitated through fit revelation. Therefore, when $q \le 1 - 4c$, in equilibrium both firms implement fit-revealing activities (DD). Otherwise, when quality is high, $q > 1 - 4c$, firm 2 profitably refrains from facilitating fit revelation; thus in equilibrium only one firm reveals fit. Because firms 1 and 2 are symmetric, in this quality range there are two pure-strategy equilibria, DN and ND.

Interestingly, note that when firm 1 already implements fit revealing activities, firm 2's fit-revelation actually intensifies price competition. This is because now firms have stronger incentive to cut price to compete for demand from consumers in segment (G, G) who find a good fit with both products. This insight is manifested in that from DN to DD, firm 2's fit-revelation makes the midpoint of firm 1's price range decrease from $3q/4 + 1/8$ to $3q/4$ and makes firm 1's profit decrease from $q/4 + 1/8 - c$ to $q/4 - c$.

The above discussion shows that fit revelation may alleviate or intensify price competition. To examine how competition affects firms' fit-revealing incentive, we compare Proposition 1 and Lemma 1, and we obtain the following proposition.

Proposition 2 (Fit Revelation in Monopolistic vs. in Competitive Markets). *If $q \le 1 - 4c$, a firm facilitates fit revelation both as a market monopolist and in the competitive market; if $1 - 4c < q \le 1 - 2c$, a firm facilitates fit revelation as a market monopolist but may not do so in the competitive market; and if $q > 1 - 2c$, a firm does not facilitates fit revelation as a market monopolist but may provide such information in the competitive market.*

Proposition 2 shows that market competition may motivate a firm to facilitate fit revelation or discourage it from doing so, depending on the product quality level. This is because market competition has two impacts on a firm's fit-revealing incentive that work in opposite directions, and the product quality level determines the relative strength of the two effects. On the one hand, competition curtails a firm's capability to extract consumer surplus, motivating it to reveal fit to induce differentiated consumer preferences. On the other hand, in the competitive market a firm's fit revelation allows its competitor to "free ride" and benefit from the induced differentiation in consumer preferences, and therefore it discourages its competitor from revealing fit to avoid intensifying competition. When quality is very low, $q \le 1 - 4c$, a firm has strong incentive to enhance margin and always exerts effort to facilitate fit revelation, no matter whether a competitor exists and whether the competitor reveals fit. When quality is low but not too low, $1 - 4c < q \le 1 - 2c$, a firm implements fit-revealing activities as a market monopolist but will free ride its competitor's fit revelation in the competitive market. When quality is high, $q > 1 - 4c$, the firm as a market monopolist expects a high margin and refrains from engaging in fit-revealing activities to maximize its demand from the undifferentiated market; in the competitive market, however, price competition limits the firm's capability to extract consumer surplus, motivating it to implement fit-revealing activities to alleviate competition if expecting its competitor not to do so.

Our result differs from Kuksov and Lin (2010), who show that competition motivates a firm to provide more quality-preference-revealing information. Unlike consumer fit uncertainty, consumer uncertainty about quality preference is not specific to any product; when one firm provides information to resolve consumer preference uncertainty, the other firm's provision of the same information has no impact on consumer preference and therefore does not change market competition intensity. Our result also contrasts with the finding in Guo and Zhao (2009) that a firm provides less quality information in a competitive market than in a monopoly market. This is because the provision of quality information makes all consumers' product preferences shift in one direction, whereas the provision of fit revealing information leads to differentiated consumer preferences and thus brings the unique benefit of lessening competition. Our result thus highlights the distinct impact of firms' marketing activities on consumer demand and market competition when they facilitate fit revelation as opposed to providing other types of information.

3.2.2. Fit-Revealing Strategies When Firms Offer Products of Different Qualities. Now we examine the case when firm 1 offers a higher-quality product than that offered by firm 2, $q_1 > q_2$ (that is, $\delta > 0$), and examine how quality difference δ affects firms' equilibrium fit-revealing strategies. From Table 2, we obtain that when expecting the other firm to refrain from implementing fit-revealing activities, the high-quality firm has incentive to facilitate fit revelation ($\pi_1^{DN*} > \pi_1^{NN*}$) only if $\delta < \delta_{c1} = q_2/2 + 1/4 - 2c$, and the low-quality firm has incentive to reveal fit ($\pi_2^{ND*} > \pi_2^{NN*}$) only if $\delta < \delta_{c2} = q_2 + 1/2 - 4c$. Note that the low-quality firm has stronger incentive to reveal fit than the high-quality firm ($\pi_2^{ND*} - \pi_2^{NN*} > \pi_1^{DN*} - \pi_1^{NN*}$, or $\delta_{c1} < \delta_{c2}$) if expecting the other firm not to implement fit-revealing activities. This is because the differentiated consumer preferences in *DN* or *ND* actually dilute the high-quality firm's quality advantage in competition. Holding the low-quality level constant, an increased quality difference between the two products reduces the fit-revealing incentive of both firms (i.e., $\pi_2^{ND*} - \pi_2^{NN*}$ and $\pi_1^{DN*} - \pi_1^{NN*}$ decrease with δ). When the quality difference between competing products is sufficiently large ($\delta > \delta_{c2}$), *NN* may arise as the equilibrium, in which neither firm provides fit-revealing information.

In addition, note that the fit-revelation activities of firms offering different quality products have different impacts on market competition. In particular, price competition is less severe when only the high-quality firm facilitates fit revelation (*ND*) than when only the low-quality firm does so (*DN*). This is because in *DN*, the high-quality firm has incentive to maintain a high price to extract the increased surplus from consumers who find a good fit with its product, which keeps it from exploiting its quality advantage through price competition; this incentive, however, is absent in *ND*. The lessened price competition in *DN* benefits both firms. This insight is manifested in that from *ND* to *DN* the midpoint of the high-quality firm's price range increases by more than half, which is the increase in the willingness to pay of consumers who find a good fit of the product, and the midpoint of the low-quality firm's price range decreases by less than half.

We first solve the equilibrium fit-revealing strategies when the two firms make fit-revealing decisions simultaneously. In solving firms' fit-revealing game, we check the pure-strategy equilibrium and also the mixed-strategy equilibrium wherever more than one pure-strategy equilibria exist. In a mixed-strategy equilibrium, we solve the probability with which firm 1 and firm 2 reveal fit, $\Pr_1$ and $\Pr_2$, respectively ($0 \le \Pr_1, \Pr_2 \le 1$), and we interpret a firm's fit-revealing probability as its intensity of implementing fit-revealing activities within a planning period. The more intense the fit-revealing activities, the higher the likelihood that the consumers become informed (Iyer et al. 2005). Our analysis shows that when $q_2 > q_{c1} = 1 - 4c$ and $\delta \le \delta_{c1}$, there exists two pure-strategy equilibria, *DN* and *ND*, and a mixed-strategy equilibrium $\{\Pr_1 = (2q_2 - 2\delta + 1 - 8c)/(4q_2 - 1 - 2\delta), \Pr_2 = (2q_2 - 4\delta + 1 - 8c)/(4q_2 - 1 - 4\delta)\}$, in which $\Pr_1 > \Pr_2$. We obtain the following proposition.

Proposition 3. *When two firms make fit-revealing decisions simultaneously, in the mixed-strategy equilibrium, the high-quality firm implements fit-revealing activities in a greater intensity than the low-quality firm if both products' qualities are sufficiently high and the quality difference between the two products is not too large* ($\Pr_1 > \Pr_2$ *if* $q_2 > q_{c1} = 1 - 4c$ *and* $\delta \le \delta_{c1} = q_2/2 + 1/4 - 2c$).

Proof. See the appendix.

Proposition 3 reveals an interesting region in which the high-quality firm is more likely to implement fit-revealing activities than the low-quality firm, which highlights the discrepancy between firms' information-revealing incentives and their equilibrium behaviors. In this parameter region, each of the two firms has incentive to facilitate fit revelation if expecting the other firm not to do so. Because the price competition is less severe when only the high-quality firm reveals fit, the low-quality firm has incentive to free ride on the high-quality firm's fit revelation, leading to its lower fit-revealing probability. As a result, in equilibrium, the fraction of consumers who are only informed about the high-quality product, $\Pr_1(1 - \Pr_2)$, is greater than the fraction of consumers who are informed about the low-quality product, $(1 - \Pr_1)\Pr_2$. Out result thus may explain the observations in the infant formula and antidepressant markets that firms with high-quality products tend to distribute more free samples to facilitate fit revelation than firms with low-quality products. In these two markets, the quality difference between competitive products is generally small because both markets are subject to FDA regulation. All infant formulas marketed in the United States must meet federal nutrient requirements, and all antidepressants have to demonstrate sufficient quality (efficacy and tolerability) to obtain FDA approval to enter the market.[9]

[9] An alternative explanation for the drug sampling practice in the antidepressant market is that larger firms tend to spend more on sampling activities. In our model the firm with the higher-quality product will have higher sales, which is consistent with this conjecture.

We further examine the case when firms make fit-revealing decisions sequentially. In this case, the decision follower decides whether to implement fit-revealing activities based on the decision leader's move, and the decision leader makes the optimal move by rationally anticipating the decision follower's response. Therefore, the decision leader occupies a more advantageous competitive position and can strategically induce the follower to act in a way that works to the leader's own benefit. Note that the equilibrium market payoffs depend only on whether the high-quality and low-quality firms implement fit-revealing activities but not on which firm moves first. Therefore, the fit-revealing game is the same as depicted in Table 2. We obtain the following proposition.

Proposition 4. *When the two competing firms offer products of different qualities and make fit-revealing decisions sequentially, DN is the unique pure-strategy equilibrium if $q_{c1} < q_2 \le 3/2 - 4c$ and $3/2 - q_2 - 4c < \delta < \delta_{c1}$; that is, only the high-quality firm facilitates fit revelation, regardless of the decision sequence.*

Proof. See the appendix.

Proposition 4 shows that a pure-strategy equilibrium may arise in which only the high-quality firm facilitates fit revelation, as the decision leader or follower. This result may provide another explanation to the puzzling observations in the infant formula and prescription drug markets that high-quality firms provide more samples than low-quality firms. As discussed earlier, in this region, price competition is less severe in *DN* than in *ND*, which benefits both firms. In particular, the high-quality firm obtains a greater profit in *DN* than in *ND* if its quality is not very high, $q_1 < 3/2 + \delta - 4c$ (this condition is further written as $q_2 < 3/2 - 4c$ in Proposition 4). The low-quality firm benefits from the alleviated price competition and obtains a greater profit in *DN* than in *ND* if its quality disadvantage (δ) is sufficiently large, i.e., $\delta > 3/2 - q_2 - 4c$. When both firms favor *DN* over *ND*, *DN* becomes the dominant strategy. In this case, if the high-quality firm moves first, it will facilitate fit revelation and rationally anticipate the low-quality firm not to do so; on the other hand, if the low-quality firm moves first, it will refrain from facilitating fit revelation and rationally anticipate the high-quality firm to implement fit-revealing activities. This result contrasts the finding in Kuksov and Lin (2010) that the high-quality firm as the decision leader never wants to disclose information to resolve consumer quality preference uncertainty and rationally expects the low-quality firm as the decision follower to provide such information.

The above discussion also shows that when competing firms offer asymmetric product qualities ($\delta > 0$), making fit-revealing decisions sequentially may allow both firms to obtain a greater profit than when they make simultaneous decisions. This is because if the two firms offer the same quality, they pursue the same optimal competitive position, and the decision leader is better off by making the first move to occupy such a position. In contrast, if the two firms offer different qualities, they pursue different competition positions, which may both be achieved.

4. Model Extensions

In this section, we consider several modifications and extensions to the main model to derive further insights regarding firms' competitive fit-revealing strategies.

4.1. Correlated Product Fits

In the main model, we assume that the two products have independent fits. In reality, the fits of competing products may be differentiated but correlated; in addition, consumers may have some knowledge about the correlation ex ante. We extend the model to incorporate this possibility. We assume that a consumer's perceived fits with the two competing products are negatively correlated.[10] In particular, a consumer will find the fits of products 1 and 2 to be opposite by probability r ($0 \le r \le 1$) and to be independent by probability $1 - r$. We then have

$$\begin{aligned}\Pr(x_2 = B \mid x_1 = G) = \Pr(x_2 = G \mid x_1 = B) &\\ = r + (1-r)/2 = (1+r)/2,&\\ \Pr(x_2 = G \mid x_1 = G) = \Pr(x_2 = B \mid x_1 = B) = (1-r)/2.&\end{aligned}$$

The parameter r indicates the fit correlation between the two products. When r is larger, consumers rationally expect that their perceived fits with the two products are opposite with a greater probability. We solve firms' equilibrium pricing strategies and market payoffs under various information revelation scenarios in the appendix. We present the fit-revealing game in Table 3 and solve the game in the appendix.

Our analysis suggests that our main results regarding firms' equilibrium fit-revealing strategies in the main model still hold. We further obtain the following proposition.

Proposition 5. *When the fits of the two products are more negatively associated, the mixed-strategy equilibrium is more likely to arise in which the high-quality firm implements fit-revealing activities in a greater intensity than the low-quality firm.*

Proof. See the appendix.

[10] Positive fit correlation between products suggests product similarity and is thus omitted.

Table 3 Fit-Revealing Game with Correlated Product Fits

Firm 1	Firm 2: Facilitate fit revelation	Firm 2: Not facilitate fit revelation
Facilitate fit revelation	$\pi_1^{DD*} = q_2(1+r)/4 + \delta/2 - c$ $\pi_2^{DD*} = q_2(1+r)/4 - c$	• If $r \le (2q_2-1)/3$ $\pi_1^{DN*} = q_2/4 + \delta/2 + (1+3r)/8 - c$ $\pi_2^{DN*} = q_2/2 - (1-r)/4$ • If $(2q_2-1)/3 < r \le 2q_2 - 1$ $\pi_1^{DN*} = q_2/2 + \delta/2 - c$ $\pi_2^{DN*} = q_2/2 - (1-r)/4$ • If $r > 2q_2 - 1$ $\pi_1^{DN*} = q_2/2 + \delta/2 - c$ $\pi_2^{DN*} = q_2/2 - (1-r)/4$
Not facilitate fit revelation	• If $r \le (2q_1-1)/3$ $\pi_1^{ND*} = q_2/2 + \delta/2 - (1-r)/4$ $\pi_2^{ND*} = q_2/4 - \delta/4 + (1+3r)/8 - c$ • If $(2q_1-1)/3 < r \le 2q_1 - 1$ $\pi_1^{ND*} = q_2/2 + \delta/2 - (1-r)/4$ $\pi_2^{ND*} = q_2/2 - c$ • If $r > 2q_1 - 1$ $\pi_1^{ND*} = q_2/2 + \delta/2 - (1-r)/4$ $\pi_2^{ND*} = q_2/2 - c$	$\pi_1^{NN*} = \delta$ $\pi_2^{NN*} = 0$

When the fits of the two products are more negatively associated (r is larger), consumers know that if they find a good fit with a firm's product, they are less likely to find a good fit with the other firm's product. That is, a stronger negative fit association between competing products alleviates price competition between the two products. As a result, a firm benefits more from facilitating fit revelation and inducing product differentiation if expecting the other firm not to do so. In addition, when r is larger, one firm's fit revelation offers more accurate information about the fit of the other product, reducing the benefit of further fit revelation facilitated by the other firm. Taking the two effects together, the parameter region where both DN and ND are pure-strategy equilibria becomes larger, and in this region, in the mixed-strategy equilibrium the low-quality firm has a smaller fit-revealing probability because it has incentive to free ride on its high-quality rival's fit revelation to benefit from the lessened price competition.

4.2. Modeling Marginal Production Cost

In the main model, we assume zero marginal production costs for both firms. In this section, we relax this assumption and investigate how the marginal cost influences competing firms' fit-revealing strategies. We assume that the high-quality firm incurs a positive marginal cost, $mc > 0$, and the low-quality firm incurs zero marginal cost. We restrain $mc < \delta$ to ensure that the high-quality firm maintains a competitive advantage. We solve firms' equilibrium pricing strategies and market payoffs under various information-revelation situations in the appendix and present the fit-revealing game in Table 4.

Table 4 Fit-Revealing Game When the High-Quality Firm Incurs a Positive Marginal Cost ($mc > 0$)

Firm 1	Firm 2: Facilitate fit revelation	Firm 2: Not facilitate fit revelation
Facilitate fit revelation	$\pi_1^{DD*} = q_2/4 + \delta/2 - mc/2 - c$ $\pi_2^{DD*} = q_2/4 - c$	$\pi_1^{DN*} = q_2/4 + \delta/2 + 1/8 - mc/2 - c$ $\pi_2^{DN*} = q_2/2 - 1/4$
Not facilitate fit revelation	$\pi_1^{ND*} = q_2/2 + \delta/2 - 1/4 - mc/2$ $\pi_2^{ND*} = q_2/4 - \delta/4 + 1/8 + mc/4 - c$	$\pi_1^{NN*} = \delta - mc$ $\pi_2^{NN*} = 0$

We solve firms' equilibrium information provision strategies in simultaneous disclosure in the appendix and obtain the following proposition.

Proposition 6. *When the marginal production cost of the high-quality firm becomes larger, the mixed-strategy equilibrium is more likely to arise in which the high-quality firm implements fit-revealing activities in a higher intensity than the low-quality firm.*

Proof. See the appendix.

The increased marginal cost lowers the high-quality firm's profits across all fit-revelation scenarios and is particularly detrimental when it adopts a demand-oriented strategy. Therefore, when mc is larger, the high-quality firm is more inclined to take a margin-oriented strategy—that is, to facilitate fit revelation so that it can exploit the enhanced surplus of good fit consumers. In addition, the increased marginal cost curtails the high-quality firm's ability to undercut the low-quality firm's price, which allows the low-quality firm to benefit more from free riding. As a result, the parameter region where both ND and DN are pure-strategy equilibria becomes larger, and in this region, in the mixed-strategy equilibrium the high-quality firm has a larger fit-revealing probability than the low-quality firm.

4.3. Modeling Heterogeneous Consumer Value Preferences

In the main model, we assume that consumers have homogeneous preferences for product value, $\theta = 1$, to ensure model tractability. We now examine the case when consumers have heterogeneous value preferences and assume θ follows a uniform distribution on the interval $[0, 1]$. When neither firm implements fit-revealing activities (NN), a consumer buys the high-quality product if her value preference is high, $\theta \geq (p_1 - p_2)/(q_1 - q_2)$; buys the low-quality product if her value preference is in the intermediate range, $\max\{p_2/(q_2 - 1/2), 0\} \leq \theta < (p_1 - p_2)/(q_1 - q_2)$; and buys neither product if her value preference is low, $\theta < \max\{p_2/(q_2 - 1/2), 0\}$. In each of the other three information provision scenarios (*ND*, *DN*, or *DD*), consumers can be divided into different market segments based on their fits (good, bad, or uncertain) with the two products. Our numerical results show that when quality difference becomes larger, if expecting the other firm to refrain from facilitate fit revelation, both firms have less incentive to reveal fit, and the low-quality firm has stronger incentive to reveal fit than the high-quality firm; when the quality difference is sufficiently large, *NN* may arise as the equilibrium in which neither firm facilitates fit revelation. In addition, a pure-strategy equilibrium may arise in which only the high-quality firm reveals fit. These results are consistent with those in the main model.[11]

5. Conclusion

This study examines firms' strategic decisions regarding whether to implement fit-revealing activities to assist consumers in finding the fit between their personal tastes and products' horizontal attributes. Fit-revelation decisions are important in product categories such as food, drugs, cosmetics, books, and magazines, where consumers' perceived fit with products largely affects their purchase decisions. Our analysis identifies product quality and quality difference between competing products as two important factors that affect firms' fit revealing incentive and strategies. In particular, in the competitive market, a firm is more likely to facilitate fit revelation than it would as a market monopolist if its product quality is high; otherwise, it is less likely to. In addition, when the quality difference between the two products becomes larger, both the high-quality firm and the low-quality firm have less incentive to reveal fit, and they may both refrain from facilitating fit revelation when the quality difference is sufficiently large. Furthermore, our analysis shows that when both firms' product qualities exceed a threshold and the quality difference is small, the high-quality firm implements fit-revealing activities in a greater intensity. We also show that when firms make fit-revealing decisions sequentially, a unique equilibrium may arise in which only the high-quality firm reveals fit regardless of the decision order. Our theoretical results provide explanations for puzzling observations in firms' fit-revelation practice in the infant formula and prescription drug markets.

In this study, we focus on the case when consumers have full information about product quality. For a new product, consumers may have quality uncertainty as well as fit uncertainty. In this case, when a firm provides information to help consumers find the product's fit, it may in the meantime inform consumers about its quality. Because only the high-quality firm has incentive to provide quality information (Guo and Zhao 2009, Kuksov and Lin 2010), consumer uncertainty in quality will increase the information provision incentive of the high-quality firm but reduce such an incentive of the low-quality firm. In addition, when consumers are uncertain about how much they should desire an increased quality, a firm's information provision may simultaneously inform a consumer of her fit with the product and her quality preference. Because the low-quality firm has stronger incentive to provide preference-revealing information than the high-quality firm (Kuksov and Lin 2010), consumer uncertainty in quality preference will enhance the revelation incentive of the low-quality firm but reduce the incentive of the high-quality firm. To facilitate analysis, we model quality and fit as independent attributes and assume away consumer brand loyalty; future research can examine the impact of these factors in a more general framework. It would be interesting to examine the case when firms can control the disclosing process and provide different types of information (e.g., quality, fit, price) in different stages of the process. Another interesting issue to investigate is the information provision strategy of a firm selling two products with different qualities. We leave these interesting issues to future explorations.

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Appendix

A.1. Proof of Lemma 1

We solve the four possible information provision scenarios in the competitive market (NN, ND, DN, and DD) separately.

1. *When neither firm facilitates fit revelation* (*NN*). Consumer utilities from the two products are $U_1^{NN} = q_1 - p_1 - 1/2$ and $U_2^{NN} = q_2 - p_2 - 1/2$. The competition between the two firms reduces to a Bertrand competition. In equilibrium, firm 2 charges zero price, $p_2^{NN^*} = 0$; firm 1 charges a price slightly lower than $\delta = q_1 - q_2$ and obtains all market demand. In equilibrium, the two firms' profits are $\pi_1^{NN^*} = \delta$ and $\pi_2^{NN^*} = 0$.

2. *When only the low-quality firm facilitates fit revelation* (*ND*). Consumer utilities from the two products are $U_1^{ND} = q_1 - p_1 - 1/2$ and $U_2^{ND} = q_2 - p_2 - x_2$, respectively, $x_2 \in \{0, 1\}$.

[11] Model details are available upon request.

Consumers are evenly divided into two segments, (E, G) and (E, B). In this case, firm 1's demands from (E, G) consumers and (E, B) consumers when $p_1 \le q_1 - 1/2$ are, respectively,

$$D_1^{EG}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta - \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_1 = p_2 + \delta - \frac{1}{2}, \\ \frac{1}{2} & \text{if } p_1 < p_2 + \delta - \frac{1}{2}; \end{cases}$$

$$D_1^{EB}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta + \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_1 = p_2 + \delta + \frac{1}{2}, \\ \frac{1}{2} & \text{if } p_1 < p_2 + \delta + \frac{1}{2}. \end{cases}$$

Firm 2's demands from (E, G) consumers and (E, B) consumers when $p_2 \le q_2$ are, respectively,

$$D_2^{EG}(p_1, p_2) = \begin{cases} \frac{1}{2} & \text{if } p_1 > p_2 + \delta - \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_1 = p_2 + \delta - \frac{1}{2}, \\ 0 & \text{if } p_1 < p_2 + \delta - \frac{1}{2}; \end{cases}$$

$$D_2^{EB}(p_1, p_2) = \begin{cases} \frac{1}{2} & \text{if } p_1 > p_2 + \delta + \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_1 = p_2 + \delta + \frac{1}{2}, \\ 0 & \text{if } p_1 < p_2 + \delta + \frac{1}{2}. \end{cases}$$

To solve for the mixed-strategy equilibrium for the pricing game, note that firm 1 and firm 2 price compete for demand in segment (E, G), but firm 2 has no incentive to undercut price to compete for demand in segment (E, B). To see this, suppose that firm 1's price is fixed at p_1, and firm 2 charges $p_2 < q_1 - 1/2$ to obtain demand from segment (E, G); firm 2's profit is thus $p_2/2$. In this case, to obtain demand from segment (E, B), firm 2 has to charge a price no higher than $p_2 - 1$, which leads to a profit no higher than $p_2 - 1$. This profit, however, is lower than $p_2/2$, since $p_2 \le q_2 < 2$. Therefore, firm 1 is ensured a demand of 1/2 from segment (E, B). Firm 1 and 2's demand function thus reduces to

$$\begin{cases} D_1 = \frac{1}{2}, D_2 = \frac{1}{2} & \text{if } p_1 > p_2 + \delta - \frac{1}{2}, \\ D_1 = \frac{3}{4}, D_2 = \frac{1}{4} & \text{if } p_1 = p_2 + \delta - \frac{1}{2}, \\ D_1 = 1, D_2 = 0 & \text{if } p_1 < p_2 + \delta - \frac{1}{2}. \end{cases}$$

Because firm 2 has no incentive to undercut price to compete for demand in segment (E, B), firm 1 is ensured a demand of 1/2 from segment (E, B). By charging a price of $q_1 - 1/2$, firm 1 obtains an ensured profit of $\pi_1^{ND^*} = (q_1 - 1/2) \cdot (1/2) = q_1/2 - 1/4$. Firm 1 can lower its price to compete for an additional demand of 1/2 from segment (E, G) consumers, and the lowest price it is willing to charge yields $\pi_1^{ND^*}$; that is, $\hat{p}_1 = \pi_1^{ND^*}/1 = q_1/2 - 1/4$. For (E, G) consumers, their willingness to pay for product 2 is lower than their willingness to pay for product 1 by $q_1 - q_2 - 1/2$. Therefore, to compete for demand in segment (E, G), the lowest price firm 2 needs to charge is $\hat{p}_2 = \hat{p}_1 - (q_1 - q_2 - 1/2) = q_2 - q_1/2 + 1/4$, at which price firm 2 obtains its equilibrium profit of $\pi_2^{ND^*} = (q_2 - q_1/2 + 1/4) \cdot (1/2) = q_2/2 - q_1/4 + 1/8$.

In equilibrium, both firms conduct mixed pricing strategies. Firm 1 randomizes its price over $[\hat{p}_1, q_1 - 1/2]$ and obtains a profit of $\pi_1^{ND^*}$. Firm 2 randomizes its price over $[\hat{p}_2, q_2]$ and obtains a profit of $\pi_2^{ND^*}$. We proceed to solve for the distribution functions below. Firm 1 always obtains a demand of 1/2 from segment (E, B) consumers and attracts a demand of 1/2 from (E, G) consumers with probability $1 - F_2(p - q_1 + q_2 + 1/2)$. Thus the profit to firm 1 from charging a price of p is

$$\tfrac{1}{2}p + \left[1 - F_2\left(p - q_1 + q_2 + \tfrac{1}{2}\right)\right]\tfrac{1}{2}p = \pi_1^{ND^*}, \; \hat{p}_1 \le p \le q_1 - \tfrac{1}{2}. \quad (1)$$

Firm 2 never obtains demand from segment (E, B) consumers and attracts a demand of 1/2 from (E, G) consumers with probability $1 - F_1(p + q_1 - q_2 - 1/2)$. Firm 2's profit from charging a price of p is thus

$$\left[1 - F_1\left(p + q_1 - q_2 - \tfrac{1}{2}\right)\right]\tfrac{1}{2}p = \pi_2^{ND^*}, \quad \hat{p}_2 \le p \le q_2. \quad (2)$$

Solving Equation (1) yields $F_2(p - q_1 + q_2 + 1/2) = 2 - (2q_1 - 1)/(2p)$; defining $x = p - q_1 + q_2 + 1/2$, we have $F_2(x) = 2 - (2q_1 - 1)/(2(x + q_1 - q_2) - 1)$. Similarly, solving Equation (2) yields $F_1(p + q_1 - q_2 - 1/2) = 1 - (1 + 4q_2 - 2q_1)/(4p)$; defining $x = p + q_1 - q_2 - 1/2$, we obtain $F_1(x) = 1 - (4q_2 - 2q_1 + 1)/(4(x - q_1 + q_2) + 2)$. We can thus write the distribution function as

$$F_1 = \begin{cases} 0 & \text{if } p < \hat{p}_1, \\ 1 - \dfrac{4q_2 - 2q_1 + 1}{4(p - q_1 + q_2) + 2} & \text{if } \hat{p}_1 \le p \le q_1 - \dfrac{1}{2}, \\ 1 & \text{if } p > q_1 - \dfrac{1}{2}; \end{cases}$$
$$F_2 = \begin{cases} 0 & \text{if } p < \hat{p}_2, \\ 2 - \dfrac{2q_1 - 1}{2(p + q_1 - q_2) - 1} & \text{if } \hat{p}_2 \le p \le q_2, \\ 1 & \text{if } p > q_2. \end{cases} \quad (3)$$

3. *When only the high-quality firm facilitates fit revelation* (*DN*). Consumer utilities are $U_1^{DN} = q_1 - p_1 - x_1$ and $U_2^{DN} = q_2 - p_2 - 1/2$, respectively, $x_1 \in \{0, 1\}$. In this case, firm 1's demands from (E, G) consumers and (E, B) consumers when $q_1 \le p_1$ are, respectively,

$$D_1^{GE}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta + \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_1 = p_2 + \delta + \frac{1}{2}, \\ \frac{1}{2} & \text{if } p_1 < p_2 + \delta + \frac{1}{2}; \end{cases}$$

$$D_1^{BE}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta - \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_1 = p_2 + \delta - \frac{1}{2}, \\ \frac{1}{2} & \text{if } p_1 < p_2 + \delta - \frac{1}{2}. \end{cases}$$

Firm 2's demands from (E, G) consumers and (E, B) consumers when $q_2 \le p_2 - 1/2$ are, respectively,

$$D_2^{GE}(p_1, p_2) = \begin{cases} 0 & \text{if } p_2 > p_1 - \delta - \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_2 = p_1 - \delta - \frac{1}{2}, \\ \frac{1}{2} & \text{if } p_2 < p_1 - \delta - \frac{1}{2}; \end{cases}$$

$$D_2^{BE}(p_1, p_2) = \begin{cases} 0 & \text{if } p_2 > p_1 - \delta + \frac{1}{2}, \\ \frac{1}{4} & \text{if } p_2 = p_1 - \delta + \frac{1}{2}, \\ \frac{1}{2} & \text{if } p_2 < p_1 - \delta + \frac{1}{2}. \end{cases}$$

Firms 1 and 2 price compete for demand in segment (G, E), but firm 1 has no incentive to undercut price to compete for demand in segment (B, E) since $q_1 < 2$. Firm 2 can thus fully exploit consumer surplus in segment (B, E) by charging a price of $q_2 - 1/2$ and achieve an ensured profit of

$\pi_2^{DN*} = (q_2 - 1/2) \cdot (1/2) = q_2/2 - 1/4$. Firm 2 can lower its price to compete for an additional demand of 1/2 from (B, E) consumers, and the lowest price it is willing to charge yields a profit of π_2^{DN*}; that is, $\hat{p}_2 = \pi_2^{DN*}/1 = q_2/2 - 1/4$. For segment (G, E) consumers, their willingness to pay for product 1 exceeds that for product 2 by $q_1 - q_2 + 1/2$. Therefore, to compete for demand in segment (G, E), the lowest price firm 1 needs to charge is $\hat{p}_1 = \hat{p}_2 + (q_1 - q_2 + 1/2) = q_1 - q_2/2 + 1/4$, which yields its equilibrium profit of $\pi_1^{DN*} = \hat{p}_1 \cdot (1/2) = q_1/2 - q_2/4 + 1/8$.

In equilibrium, both firms conduct mixed pricing strategies. Firm 1 randomizes its price over $[\hat{p}_1, q_1]$ and obtains a profit of π_1^{DN*}. Firm 2 randomizes its price over $[\hat{p}_2, q_2 - 1/2]$ and obtains a profit of π_2^{DN*}. We proceed to solve for the distribution functions below. We have

$$\left[1 - F_2\left(p - q_1 + q_2 - \tfrac{1}{2}\right)\right]\tfrac{1}{2}p = \pi_1^{DN*}, \quad \hat{p}_1 \le p \le q_1; \tag{4}$$

$$\tfrac{1}{2}p + \left[1 - F_1\left(p + q_1 - q_2 + \tfrac{1}{2}\right)\right]\tfrac{1}{2}p = \pi_2^{DN*}, \quad \hat{p}_2 \le p \le q_2 - \tfrac{1}{2}. \tag{5}$$

Solving (4) and (5) simultaneously, we obtain

$$F_1 = \begin{cases} 0 & \text{if } p < \hat{p}_1, \\ 2 - \dfrac{2q_2 - 1}{2(p - q_1 + q_2) - 1} & \text{if } \hat{p}_1 \le p \le q_1, \\ 1 & \text{if } p > q_1, \end{cases}$$
$$F_2 = \begin{cases} 0 & \text{if } p < \hat{p}_2, \\ 1 - \dfrac{4q_1 - 2q_2 + 1}{4(p + q_1 - q_2) + 2} & \text{if } \hat{p}_2 \le p \le q_2 - \tfrac{1}{2}, \\ 1 & \text{if } p > q_2 - \tfrac{1}{2}. \end{cases} \tag{6}$$

4. *When both the high-quality firm and the low-quality firm facilitate fit revelation* (*DD*). Consumer utilities from the two products are $U_1^{DD} = q_1 - p_1 - x_1$ and $U_2^{DD} = q_2 - p_2 - x_2$, respectively, $x_1, x_2 \in \{0, 1\}$. Firm 1's demands from (G, G), (G, B), (B, G), and (B, B) consumers when $p_1 \le q_1$ are, respectively,

$$D_1^{GG}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta, \\ \frac{1}{8} & \text{if } p_1 = p_2 + \delta, \\ \frac{1}{4} & \text{if } p_1 < p_2 + \delta; \end{cases}$$

$$D_1^{BB}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta, \\ \frac{1}{8} & \text{if } p_1 = p_2 + \delta, \\ \frac{1}{4} & \text{if } p_1 < p_2 + \delta; \end{cases}$$

$$D_1^{GB}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta + 1, \\ \frac{1}{8} & \text{if } p_1 = p_2 + \delta + 1, \\ \frac{1}{4} & \text{if } p_1 < p_2 + \delta + 1; \end{cases}$$

$$D_1^{BG}(p_1, p_2) = \begin{cases} 0 & \text{if } p_1 > p_2 + \delta - 1, \\ \frac{1}{8} & \text{if } p_1 = p_2 + \delta - 1, \\ \frac{1}{4} & \text{if } p_1 < p_2 + \delta - 1. \end{cases}$$

Firm 2's demands from (G, G), (G, B), (B, G), and (B, B) consumers when $p_1 \le q_2$ are, respectively,

$$D_2^{GG}(p_1, p_2) = \begin{cases} 0 & \text{if } p_2 > p_1 - \delta, \\ \frac{1}{8} & \text{if } p_2 = p_1 - \delta, \\ \frac{1}{4} & \text{if } p_2 < p_1 - \delta; \end{cases}$$

$$D_2^{BB}(p_1, p_2) = \begin{cases} 0 & \text{if } p_2 > p_1 - \delta, \\ \frac{1}{8} & \text{if } p_2 = p_1 - \delta, \\ \frac{1}{4} & \text{if } p_2 < p_1 - \delta; \end{cases}$$

$$D_2^{GB}(p_1, p_2) = \begin{cases} 0 & \text{if } p_2 > p_1 - \delta - 1, \\ \frac{1}{8} & \text{if } p_2 = p_1 - \delta - 1, \\ \frac{1}{4} & \text{if } p_2 < p_1 - \delta - 1; \end{cases}$$

$$D_2^{BG}(p_1, p_2) = \begin{cases} 0 & \text{if } p_2 > p_1 - \delta + 1, \\ \frac{1}{8} & \text{if } p_2 = p_1 - \delta + 1, \\ \frac{1}{4} & \text{if } p_2 < p_1 - \delta + 1. \end{cases}$$

Since $1/2 < q_2 < q_1 < 2$, firm 1 has no incentive to undercut price to compete for demand in either segment (B, G) or (B, B) but has incentive to undercut price to compete for demand in segments (G, G) and (G, B). Firm 1 thus will not charge a price lower than firm 2's price. On the other hand, firm 2 has no incentive to undercut price to compete for demand in either segment (G, B) or (B, B) but has incentive to undercut price to compete for demand in segments (G, G) and (B, G). The highest prices firm 1 and firm 2 can charge are q_1 and q_2, respectively. Therefore, firm 2 is ensured a demand of 1/4 from segment (B, G); it can then charge a price of q_2 to achieve an ensured profit of $\pi_2^{DD*} = q_2 \cdot (1/4)$. Firm 2 can lower its price to compete for additional demand from (G, G) consumers, and the lowest price it is willing to charge yields π_2^{DD*}; that is, $\hat{p}_2 = \pi_2^{DD*}/(1/2) = q_2/2$. For segment (G, G) consumers, their willingness to pay for the high-quality product exceeds that for the low-quality product by $q_1 - q_2$. Therefore, the lowest price firm 1 needs to charge to obtain demand in segment (G, G) is $\hat{p}_1 = \hat{p}_2 + (q_1 - q_2) = q_1 - q_2/2$, which yields its equilibrium profit of $\pi_1^{DD*} = (q_1 - q_2/2) \cdot (1/2) = q_1/2 - q_2/4$. Note that this price is higher than $q_1 - 1$ and does not allow it to sell to segment (B, B).

In equilibrium, both firms conduct mixed pricing strategies. Firm 1 randomizes its price over $[\hat{p}_1, q_1]$ and obtains a profit of π_1^{DD*}. Firm 2 randomizes its price over $[\hat{p}_2, q_2]$ and obtains a profit of π_2^{DD*}. We proceed to solve for the distribution functions below. We obtain

$$\tfrac{1}{4}p + [1 - F_2(p - q_1 + q_2)]\tfrac{1}{4}p = \pi_1^{DD*}, \quad \hat{p}_1 \le p \le q_1; \tag{7}$$

and

$$\tfrac{1}{4}p + [1 - F_1(p + q_1 - q_2)]\tfrac{1}{4}p = \pi_2^{DD*}, \quad \hat{p}_2 \le p \le q_2. \tag{8}$$

Solving (7) and (8) simultaneously, we obtain

$$F_1 = \begin{cases} 0 & \text{if } p < \hat{p}_1, \\ 2 - \dfrac{q_1}{p - q_1 + q_2} & \text{if } \hat{p}_1 \le p \le q_1, \\ 1 & \text{if } p > q_1; \end{cases}$$
$$F_2 = \begin{cases} 0 & \text{if } p < \hat{p}_2, \\ 2 - \dfrac{2q_1 - q_2}{p + q_1 - q_2} & \text{if } \hat{p}_2 \le p \le q_2, \\ 1 & \text{if } p > q_2. \end{cases} \tag{9}$$

A.2. Proofs of Propositions 1, 3, and 4

We obtain equilibrium fit-revealing strategies of competitive firms by solving the fit-revealing game as shown in Table 2. To solve for the pure-strategy equilibrium, see that $\pi_1^{DN*} > \pi_1^{NN*}$ is satisfied if $\delta < \delta_{c1} = q_2/2 + 1/4 - 2c$ and $\pi_2^{ND*} > \pi_2^{NN*}$ is satisfied if $\delta < \delta_{c2} = q_2 + 1/2 - 4c$. Since $1/2 < q < 2$ and $c < 1/4$, we have $0 < \delta_{c1} < \delta_{c2}$. In addition, $\pi_1^{DD*} > \pi_1^{ND*}$ and $\pi_2^{DD*} > \pi_2^{DN*}$ are both satisfied if $q_2 < 1 - 4c$. We summarize the pure-strategy equilibrium in the following table.

	$q_2 \le q_{c1} = 1 - 4c$	$q_2 > q_{c1}$
$\delta > \delta_{c2} = q_2 + 1/2 - 4c$	*DD* and *NN* are both equilibria	*NN* is the unique equilibrium
$\delta_{c1} = q_2/2 + 1/4 - 2c < \delta \le \delta_{c2}$	*DD* is the unique equilibrium	*ND* is the unique equilibrium
$\delta \le \delta_{c1}$	*DD* is the unique equilibrium	*DN* and *ND* are both equilibria

Setting $\delta = 0$, Proposition 1 is supported.

In parameter regions where more than one pure-strategy equilibrium exists, we can derive the mixed-strategy equilibrium. In particular, we set the profit between revealing fit and not revealing for a firm as being equal, which implies the following equilibrium condition:

$$\pi_1^{DD*}\mathrm{Pr}_2 + \pi_1^{DN*}(1-\mathrm{Pr}_2) = \pi_1^{ND*}\mathrm{Pr}_2 + \pi_1^{NN*}(1-\mathrm{Pr}_2), \tag{10}$$

$$\pi_2^{DD*}\mathrm{Pr}_1 + \pi_2^{ND*}(1-\mathrm{Pr}_1) = \pi_2^{DN*}\mathrm{Pr}_1 + \pi_2^{NN*}(1-\mathrm{Pr}_1). \tag{11}$$

Solving (10) and (11) simultaneously, we obtain $\mathrm{Pr}_1 = (2q_2 - 2\delta + 1 - 8c)/(4q_2 - 1 - 2\delta)$ and $\mathrm{Pr}_2 = (2q_2 - 4\delta + 1 - 8c)/(4q_2 - 1 - 4\delta)$. It can be proven that $0 < \mathrm{Pr}_2 < \mathrm{Pr}_1 < 1$ is satisfied if $q_2 > 1 - 4c$ and $\delta < q_2/2 + 1/4 - 2c$. Thus the proof for Proposition 3 is complete.

To prove Proposition 4, note that if a unique equilibrium exists in simultaneous disclosure, the same equilibrium will arise in sequential disclosure regardless of the decision sequence. We thus only examine two parameter regions in which no unique equilibrium exists in simultaneous disclosure: (1) $q_2 > q_{c1}$ and $\delta < \delta_{c1}$, where both *DN* and *ND* could be the equilibrium in simultaneous disclosure. It is easy to obtain that $\pi_1^{DN*} > \pi_1^{ND*}$ is satisfied if $q_2 < 3/2 - 4c$ and $\pi_2^{DN*} > \pi_2^{ND*}$ is satisfied if $\delta > 3/2 - q_2 - 4c$. (2) $q_2 < q_{c1}$ and $\delta > \delta_{c2}$, where both *DD* and *NN* could be the equilibrium in simultaneous disclosure. It is easy to obtain that $\pi_1^{DD*} > \pi_1^{NN*}$ is satisfied if $\delta < q_2/2 - 2c$ and $\pi_2^{DD*} > \pi_2^{NN*}$ is satisfied if $q_2 > 4c$. Summarizing the above discussion, we provide the proof for Proposition 4.

A.3. Proof of Proposition 5

We first solve firms' equilibrium strategies and payoffs under various fit-revealing scenarios and then derive the equilibrium fit-revealing strategies. Note that the equilibrium firm strategies and payoffs when neither firm discloses information (*NN*) are the same as in the main model. We consider below the other three fit-revealing scenarios, *ND*, *DN*, and *DD*, separately.

1. *When only the low-quality firm facilitates fit revelation* (*ND*). In this case, half of the consumers find a good fit with product 2 (segment (E, G)), and the other half of the consumers find a bad fit (segment (E, B)). Segment (E, G) consumers expect to find a good fit with product 1 with probability $(1 - r)/2$ and to find a bad fit with probability $(1 + r)/2$. The utilities of these consumers from the two products are thus $U_1^{ND} = q_1 - p_1 - (1 + r)/2$ and $U_2^{ND} = q_2 - p_2$. Segment (E, B) consumers expect to find a good fit with product 1 with probability $(1 + r)/2$ and to find a bad fit with probability $(1 - r)/2$. The utilities of these consumers are thus $U_1^{ND} = q_1 - p_1 - (1 - r)/2$ and $U_2^{ND} = q_2 - p_2 - 1$. Similar to the main model, firm 2 has no incentive to undercut price by $1 + r$ to compete for demand in segment (E, B). Therefore, firm 1 can fully exploit consumer surplus in segment (E, B) by charging a price of $q_1 - (1 - r)/2$; firm 1's lowest profit is thus $[q_1 - (1-r)/2]/2 = q_1/2 - (1-r)/4$. The lowest price firm 1 would like to charge to obtain demand in segments (E, G) and (E, B) is thus $q_1/2 - (1 - r)/4$; note that this price is lower than segment (E, G) consumers' highest willingness to pay for product 1, $q_1 - (1+r)/2$, only if $r < (2q_1 - 1)/3$. We then obtain firm 1's lower price:

$$\hat{p}_1 = \begin{cases} q_1/2 - (1-r)/4 & \text{if } r < (2q_1 - 1)/3, \\ q_1 - (1+r)/2 & \text{if otherwise.} \end{cases}$$

Also note that when $r > 2q_1 - 1$, $\hat{p}_1 < 0$, and firm 1 has no incentive to sell to (E, G) consumers.

We first consider the case when $r \le 2q_1 - 1$. In this case, segment (E, G) consumers' willingness to pay for product 2 is lower than their willingness to pay for product 1 by $q_1 - q_2 - (1 + r)/2$. Therefore, to compete for demand in segment (E, G), the lowest price firm 2 needs to charge is

$$\hat{p}_2 = \hat{p}_1 - (q_1 - q_2 - (1+r)/2) = \begin{cases} q_2 - q_1/2 + (1+3r)/4 & \text{if } r < (2q_1 - 1)/3, \\ q_2 & \text{if otherwise.} \end{cases}$$

Both firms conduct mixed pricing strategies. Firm 1 randomizes its price over $[\hat{p}_1, q_1 - 1/2]$ and obtains a profit of $\pi_1^{ND*} = q_1/2 - (1 - r)/4$. Firm 2 randomizes its price over $[\hat{p}_2, q_2]$ and obtains a profit of $\pi_2^{ND*} = \hat{p}_2/2$. The distribution functions can be derived accordingly. We next consider the case when $r > 2q_1 - 1$. In this case, firm 1 sells to (E, B) consumers only, and therefore firm 2 can fully exploit consumer surplus in segment (E, G). In this case, firms' equilibrium strategies are $p_1^* = q_1 - (1 - r)/2$ and $p_2^* = q_2$; firms' equilibrium payoffs are $\pi_1^{ND*} = q_1/2 - (1 - r)/4$ and $\pi_2^{ND*} = q_2/2$.

2. *When only the high-quality firm facilitates fit revelation* (*DN*). In this case, half of the consumers find a good fit with product 1 (segment (G, E)), and the other half of the consumers find a bad fit (segment (B, E)). Segment (G, E) consumers expect to find a good fit with product 2 with probability $(1 - r)/2$ and to find a bad fit with probability $(1 + r)/2$. The utilities of these consumers from the two products are thus $U_1^{DN} = q_1 - p_1$ and $U_2^{DN} = q_2 - p_2 - (1 + r)/2$. Segment (B, E) consumers expect to find a good fit with product 2 with probability $(1 + r)/2$ and to find a bad fit with probability $(1 - r)/2$. The utilities of these consumers from the two products are thus $U_1^{DN} = q_1 - p_1 - 1$

and $U_2^{DN} = q_2 - p_2 - (1-r)/2$. Similar to the main model, firm 1 has no incentive to undercut price by $1+r$ to compete for demand in segment (B, E). Firm 2 can thus fully exploit consumer surplus in segment (B, E) by charging a price of $q_2 - (1-r)/2$, and so its lowest profit is $[q_2 - (1-r)/2]/2 = q_2/2 - (1-r)/4$. The lowest price firm 2 would like to charge to obtain demand in segments (G, E) and (B, E) is thus $q_2/2 - (1-r)/4$, which is lower than (G, E) consumers' willingness to pay for product 2 only if $r < (2q_2 - 1)/3$. Therefore, the lowest price of firm 2 is

$$\hat{p}_2 = \begin{cases} q_2/2 - (1-r)/4 & \text{if } r < (2q_2 - 1)/3, \\ q_2 - (1+r)/2 & \text{if otherwise.} \end{cases}$$

Note that if $r > 2q_2 - 1$, firm 2 has no incentive to compete for consumers in (G, E) segment.

We first consider the case when $r \le 2q_2 - 1$. In this case, segment (G, E) consumers' willingness to pay for product 1 exceeds that for product 2 by $q_1 - q_2 + (1+r)/2$. Therefore, to compete for demand in segment (G, E), the lowest price firm 1 would like to charge is

$$\hat{p}_1 = \hat{p}_2 + (q_1 - q_2 + (1+r)/2) = \begin{cases} q_1 - q_2/2 + (1+3r)/4 & \text{if } r < (2q_2 - 1)/3, \\ q_1 & \text{if otherwise.} \end{cases}$$

In equilibrium, both firms conduct mixed pricing strategies. Firm 1 randomizes its price over $[\hat{p}_1, q_1]$ and obtains a profit of $\pi_1^{DN*} = \hat{p}_1/2$. Firm 2 randomizes its price over $[\hat{p}_2, q_2 - 1/2]$ and obtains a profit of $\pi_2^{DN*} = q_2/2 - (1-r)/4$. The distribution functions can be derived accordingly. We next consider the case when $r > 2q_2 - 1$. In this case, firm 2 has no incentive to compete for consumers in (G, E) segment, and firm 1 can fully exploit consumer surplus in this segment. The two firms' equilibrium strategies are $p_1^* = q_1$ and $p_2^* = q_2 - (1-r)/2$; firms' equilibrium payoffs are $\pi_1^{DN*} = q_1/2$ and $\pi_2^{DN*} = q_2/2 - (1-r)/4$.

3. *When both the high-quality firm and the low-quality firm facilitate fit revelation* (*DD*). In this case, consumers know the fits of both products. The market can be divided into segments (G, G), (G, B), (B, G), and (B, B), with sizes of $(1-r)/4$, $(1+r)/4$, $(1+r)/4$, and $(1-r)/4$, respectively. Note that when r is larger, it is less likely that consumers find the same fits with both products (segments (G, G) and (B, B) become smaller). Similar to the main model, firm 1 has no incentive to cut its price to compete for demand in segment (B, G) or (B, B), and firm 2 has no incentive to cut prices to compete for demand in segment (G, B) or (B, B). Firm 2's lowest profit is $q_2(1+r)/4$, which it obtains by charging q_2 and selling to segment (B, G) consumers only. So firm 2 will not charge a price lower than $\hat{p}_2 = q_2(1+r)/2$ to acquire demand from segments (B, G) and (G, G). For segment (G, G) consumers, their willingness to pay for the high-quality product exceeds that for the low-quality product by $q_1 - q_2$. Therefore, the lowest price firm 1 would like to charge to compete for demand in segment (G, G) is $\hat{p}_1 = \hat{p}_2 + (q_1 - q_2) = q_2(1+r)/2 + \delta$. In equilibrium, both firms conduct mixed pricing strategies. Firm 2 randomizes its price over $[\hat{p}_2, q_2]$ and obtains a profit of $\pi_2^{DD*} = \hat{p}_2/2$. Firm 1 randomize its price over $[\hat{p}_1, q_1]$ and obtains a profit of $\pi_1^{DD*} = \hat{p}_1/2$. The distribution functions can be solved accordingly.

The results of this discussion are presented in Table 3.

Equilibrium Fit-Revealing Strategies. From Table 3, we see that for firm 1, $\pi_1^{DN*} > \pi_1^{NN*}$ if (1) $\delta < (2q_2 + 1 - 8c + 3r)/4$ and $r \le (2q_2 - 1)/3$ or (2) $\delta < q_2 - 2c$ and $r > (2q_2 - 1)/3$; and $\pi_1^{DD*} > \pi_1^{ND*}$ if $q_2 < q_{c1} = (1 - 4c - r)/(1-r)$, which decreases with r. For firm 2, $\pi_2^{ND*} > \pi_2^{NN}$ if (1) $\delta < (2q_2 + 1 - 8c + 3r)/2$ and $r \le (2q_1 - 1)/3$ or (2) $q_2 > 2c$ (which is always satisfied under our assumption that $c \le 1/4$ and $q_2 \ge 1/2$) and $r > (2q_1 - 1)/3$; and $\pi_2^{DD*} > \pi_2^{DN*}$ if $q_2 < q_{c1} = (1 - 4c - r)/(1-r)$. We solve firms' fit-revealing strategies in three cases.

(1) If $r \le (2q_2 - 1)/3$, the pure-strategy equilibrium can be solved as shown in the following table.

	$q_2 \le q_{c1} = (1-4c-r)(1-r)$	$q_2 > q_{c1}$
$\delta > \delta_{c2} = q_2 + 1/2 - 4c + 3r/2$	*DD* and *NN* are both equilibria	*NN* is the unique equilibrium
$\delta_{c1} = q_2/2 + 1/4 - 2c + 3r/4 < \delta \le \delta_{c2}$	*DD* is the unique equilibrium	*ND* is the unique equilibrium
$\delta \le \delta_{c1}$	*DD* is the unique equilibrium	*DN* and *ND* are both equilibria

In regions where more than one pure-strategy equilibrium exists, we solve for the mixed-strategy equilibrium and obtain $\Pr_1 = (-1 + 8c - 2q_2 - 3r + 2\delta)/(1 - 4q_2 - 5r + 2q_2 r + 2\delta)$ and $\Pr_2 = (-1 + 8c - 2q_2 - 3r + 4\delta)/(1 + 2q_2(-2+r) - 5r + 4\delta)$. It can be proven, that $0 < \Pr_2 < \Pr_1 < 1$ is satisfied if $\delta \le \delta_{c1} = q_2/2 + 1/4 - 2c + 3r/4$ and $q_2 > q_{c1} = (1-4c-r)/(1-r)$, where the parameter region becomes larger when r increases.

(2) If $(2q_2 - 1)/3 < r \le (2q_1 - 1)/3$, the equilibrium fit-revealing strategies can be solved as shown in the table below.

	$q_2 \le q_{c1} = (1-4c-r)/(1-r)$	$q_2 > q_{c1}$
$\delta > \delta_{c2} = q_2 + 1/2 - 4c + 3r/2$	*DD* and *NN* are both equilibria	*NN* is the unique equilibrium
$\delta_{c1} = q_2 - 2c$	*DD* is the unique equilibrium	*ND* is the unique equilibrium
$\delta \le \delta_{c1}$	*DD* is the unique equilibrium	*DN* and *ND* are both equilibria

In regions where more than one pure-strategy equilibrium exists, we solve for the mixed-strategy equilibrium and obtain $\Pr_1 = (-1 + 8c - 2q_2 - 3r + 2\delta)/(1 - 4q_2 - 5r + 2q_2 r + 2\delta)$ and $\Pr_2 = 2(2c - q_2 + \delta)/(1 - 3q_2 - r + q_2 r + 2\delta)$. It can be proven that $0 < \Pr_2 < \Pr_1 < 1$ is satisfied if $q_2 > q_{c1} = (1 - 4c - r)/(1-r)$ and $\delta \le \delta_{c1} = q_2 - 2c$, where the parameter region becomes larger when r increases.

(3) If $r > (2q_1 - 1)/3$, the equilibrium fit-revealing strategies can be solved as shown in the following table.

	$q_2 \le q_{c1} = (1-4c-r)/(1-r)$	$q_2 > q_{c1}$
$\delta > q_2 - 2c$	*DD* is the unique equilibrium	*ND* is the unique equilibrium
$\delta \le q_2 - 2c$	*DD* is the unique equilibrium	*DN* and *ND* are both equilibria

In regions where more than one pure-strategy equilibria exist, we solve for the mixed-strategy equilibrium and obtain $\Pr_1 = (4c - 2q_2)/(1 - 3q_2 - r + q_2 r)$ and $\Pr_2 = (4c - 2q_2 + 2\delta)/(1 - 3q_2 - r + q_2 r + 2\delta)$. It can be proven that $0 < \Pr_2 < \Pr_1 < 1$ when $q_2 > q_{c1} = (1-4c-r)/(1-r)$ and $\delta \le q_2 - 2c$, where the parameter region becomes larger when r increases.

A.4. Proof of Proposition 6

We first solve firms' equilibrium pricing strategies and market payoffs under different fit-revelation scenarios (*NN*, *ND*, *DN*, and *DD*), and then we solve the information-revealing game.

If neither firm 1 nor firm 2 facilitates fit revelation (*NN*), firm 1 charges a price slightly lower than $\delta = q_1 - q_2$ and obtains all market demand. In equilibrium, the two firms' profits are $\pi_1^{NN^*} = \delta - mc$ and $\pi_2^{NN^*} = 0$, respectively.

If only firm 2, offering the low-quality product, facilitates fit revelation (*ND*), firm 1 can fully exploit consumer surplus in segment (E, B) by charging a price of $q_1 - 1/2$; firm 1's lowest profit is $(q_1 - 1/2 - mc)/2 = q_1/2 - 1/4 - mc/2$, and the lowest price it would like to charge to obtain demand in segments (E, G) and (E, B) is $\hat{p}_1 = q_1/2 - 1/4 + mc/2$. To compete for demand in segment (E, G), the lowest price firm 2 needs to charge is $\hat{p}_2 = \hat{p}_1 - (q_1 - q_2 - 1/2) = q_2/2 - \delta/2 + 1/4 + mc/2$. In equilibrium, firm 1 randomizes its price over $[\hat{p}_1, q_1 - 1/2]$ and obtains a profit of $\pi_1^{ND^*} = q_2/2 + \delta/2 - 1/4 - mc/2$. Firm 2 randomizes its price over $[\hat{p}_2, q_2]$ and obtains a profit of $\pi_2^{ND^*} = \hat{p}_2/2$. The distribution functions can be derived accordingly.

If firm 1, offering the high-quality product, facilitates fit revelation (*DN*), firm 2 can fully exploit consumer surplus in segment (B, E) by charging a price of $q_2 - 1/2$; firm 2's lowest profit is $(q_2 - 1/2)/2 = q_2/2 - 1/4$, and the lowest price it would like to charge to obtain demand in segments (G, E) and (B, E) is $\hat{p}_2 = q_2/2 - 1/4$. To compete for demand in segment (G, E), the lowest price firm 1 would like to charge is $\hat{p}_1 = \hat{p}_2 + (q_1 - q_2 + 1/2) = q_2/2 + \delta + 1/4$. In equilibrium, both firms conduct mixed pricing strategies. Firm 1 randomizes its price over $[\hat{p}_1, q_1]$ and obtains a profit of $\pi_1^{DN^*} = \hat{p}_1/2 - mc/2$. Firm 2 randomizes its price over $[\hat{p}_2, q_2 - 1/2]$ and obtains a profit of $\pi_2^{DN^*} = \hat{p}_2$. The distribution functions can be derived accordingly.

If both firms 1 and 2 facilitate fit revelation (*DD*), firm 2's lowest profit is $q_2/4$, which is obtained by charging q_2 and selling to segment (B, G) consumers only, and the lowest price it would charge to obtain demand in segments (B, G) and (G, G) is $\hat{p}_2 = q_2/2$. The lowest price firm 1 would like to charge to compete for demand in segment (G, G) is thus $\hat{p}_1 = \hat{p}_2 + (q_1 - q_2) = q_1 - q_2/2 = q_2/2 + \delta$. In equilibrium, both firms conduct mixed pricing strategies. Firm 2 randomizes its price over $[\hat{p}_2, q_2]$ and obtains a profit of $\pi_2^{DD^*} = \hat{p}_2/2$. Firm 1 randomizes its price over $[\hat{p}_1, q_1]$ and obtains a profit of $\pi_1^{DD^*} = \hat{p}_1/2 - mc/2$. The distribution functions can be derived accordingly.

Summarizing the above discussion, we obtain the fit-revealing game as shown in Table 4. It is easy to obtain that $\pi_1^{DN^*} > \pi_1^{NN^*}$ is satisfied if $\delta < \delta_{c1} = q_2/2 + 1/4 - 2c + mc$, and $\pi_2^{ND^*} > \pi_2^{NN^*}$ is satisfied if $\delta < \delta_{c2} = q_2 + 1/2 - 4c + mc$. When $mc < q_2/4 + 1/8 - 4c$, $\delta_{c1} < \delta_{c2}$. In addition, $\pi_1^{DD^*} > \pi_1^{ND^*}$ and $\pi_2^{DD^*} > \pi_2^{DN^*}$ are both satisfied if $q_2 < 1 - 4c$. The firms' pure-strategy equilibrium is summarized in the following table.

	$q_2 \le 1 - 4c$	$q_2 > 1 - 4c$
$\delta > \delta_{c2} = q_2 + 1/2 - 4c + mc$	*DD* and *NN* are both equilibria	*NN* is the unique equilibrium
$\delta_{c1} = q_2/2 + 1/4 - 2c + mc < \delta \le \delta_{c2}$	*DD* is the unique equilibrium	*ND* is the unique equilibrium
$\delta \le \delta_{c1}$	*DD* is the unique equilibrium	*DN* and *ND* are both equilibria

In parameter regions where more than one pure-strategy equilibrium exists, we solve for the mixed-strategy equilibrium and obtain $\Pr_1 = (1 - 8c + 2mc + 2q_2 - 2\delta)/(-1 + 2mc + 4q_2 - 2\delta)$ and $\Pr_2 = (1 - 8c + 4mc + 2q_2 - 4\delta)/(-1 + 4mc + 4q_2 - 4\delta)$. It can be proven that $0 < \Pr_2 < \Pr_1 < 1$ when $q_2 > 1 - 4c$ and $\delta \le \delta_{c1} = q_2/2 + 1/4 - 2c + mc$, where the parameter region becomes larger when mc increases.

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