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Beyond Profits: The Rise of Dual-Purpose Organizations and Its Consequences for Disclosure

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ABSTRACT: Organizations with a mission that extends "beyond profit" to achieve broader objectives are becoming increasingly common. This paper studies such hybrid entities—firms that value the profits they generate, as well as the utility they provide to customers—and details their implications for industry disclosure practices. The findings demonstrate that disclosure incentives are perturbed not just from being a hybrid entity, but also from competing with such entities. Accounting for both competitive and disclosure effects, the paper then assesses the circumstances under which a hybrid firm is economically viable and derives the ensuing equilibrium industry composition. As such, we show that the presence of firms with objectives beyond profit can be an endogenous characteristic of many industries.

Keywords: competition; disclosure; hybrid entity; strategic delegation.

I. INTRODUCTION

The once-clear line between for-profit organizations focused on generating returns for owners and government entities with an eye purely on social outcomes has blurred rapidly in recent years. The expanding sector of commercially viable nonprofit organizations, the rise of for-profit firms with charters recognizing diverse stakeholders (e.g., certified B Corporations), and the growth of social enterprises all point to the unmistakable presence of strategic players with a focus that is wider than financial returns. This burgeoning sector of hybrid entities with an emphasis "beyond profits" has piqued the interest of academics and practitioners alike, and the fundamental shifts they bring to the marketplace are just starting to be understood (e.g., Matsumura 1998; Hart 2003; Porter and Kramer 2006; Shediac, Abouchakra, Hammami, and Najjar 2008; Bromberger 2011; Kanter 2011; Friedman and Heinle 2016).

In this paper, we append the seminal model of disclosure and competition (e.g., Gal-Or 1985; Darrough 1993) to encompass hybrid entities. In doing so, we find that the presence of hybrid organizations notably alters disclosure incentives, even of pure for-profit rivals, in significant ways. Moreover, hybrid structures can arise endogenously since their strategic ramifications can actually yield higher profits than traditional structures.

To elaborate, we model a traditional (Cournot) duopoly in which each firm has access to private information about its production costs that it can publicly disclose. Each firm's information may also be indicative about its rival's costs due to information spillover (i.e., correlated costs). The novel aspect of the analysis is that we permit either organization (or both) to be a hybrid entity that values both the profit it creates and the benefits its consumers glean from its offerings. Such hybrid organizations include what Hansmann (1980) refers to as commercial nonprofits, entities that exist to help particular customers, but must also earn profit from such a relationship to be self-sustaining. Commercial nonprofits dominate many sectors, such as healthcare and education, but also have a footprint in traditionally for-profit sectors, such as food, fitness products, and entertainment. The hybrid entity we model also captures key features of many types of social enterprises and even CSR initiatives—we examine cases where the entity values consumers, and the activity is not one that creates gains via externalities

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tied to brand loyalty or "warm glow." The hybrid structure we model can also be interpreted broadly as being in line with stakeholder theory (e.g., Freeman 2010) that postulates a need for valuing and considering objectives of a firm's diverse stakeholders, not just its shareholders (e.g., its customers, employees, suppliers, financiers, etc.).

In the duopoly context, we examine how a hybrid organization's emphasis on its consumers affects competition between the firms, and the concomitant effects on disclosure policy. In a traditional game of disclosure incentives with for-profit firms, the reason a firm may *ex ante* commit to revealing its private information is that disclosures can undercut competitive pressures. By revealing favorable cost information, a firm convinces its rival it will take an aggressive posture; its rival responds by ceding market share. On the other hand, when the firm's cost information is revealed to be unfavorable, the rival will step in to take market share. We refer to this stochastic give-and-take as the competition effect of disclosure. This effect spurs disclosure since it permits the two firms to, roughly stated, agree to a coin-flip to determine one as a monopolist, rather than continually engaging in fierce competition. Put differently, the competition effect of disclosure benefits each firm since it gains market share precisely when it is most profitable.

Continuing with the traditional setting, to the extent that the cost structures of the two firms are (positively) correlated, disclosure also creates a countervailing force—one we refer to as the information spillover effect. In contrast to engaging in cooperative back-and-forth, this effect implies that the competing parties increase competitive pressure: favorable (unfavorable) cost information for one firm conveys favorable (unfavorable) news for the other party, as well, encouraging both firms to increase (decrease) production at the same time. In contrast to the competition effect, the information spillover effect implies that the firms compete most fiercely at the least opportune time. A firm's disclosure policy, then, depends on which of the two effects dominate: when the competition effect dominates, the firm discloses, and when the information spillover effect dominates, it keeps its information private.

The fundamental competition effect versus information spillover effect trade-off of disclosure is drastically altered for both firms even if only one is a hybrid entity. Since the hybrid has a keen focus on its own consumers' well-being, it responds to information of a low-cost environment even more aggressively because the low cost creates a dual opportunity to extract greater margins and to provide less expensive products to its consumers. This, in turn, implies that the competition effect of disclosure is more compelling and disclosure is more attractive for the hybrid firm. On the other hand, the rival's competition effect is muted: the rival knows that even if it discloses that its own costs are low, the hybrid entity is less compelled to back away because it is determined to aid its own consumers and can do so by ensuring low retail prices. Moreover, the disclosure-inhibiting information spillover effect is strengthened since favorable news is followed by even fiercer competition from the hybrid. The ensuing consequence is that the introduction of a hybrid entity means that the hybrid is more inclined to disclose, but its rival is less inclined to disclose.

Having established that the presence of a hybrid firm changes both the competition and disclosure incentives in an industry, the paper next takes a step back to ask whether being a hybrid firm is viable even from a profit standpoint. As in the strategic delegation literature (e.g., Fershtman and Judd 1987), the establishment of a hybrid charter can actually prove optimal because it signals a particular competitive posture. In this case, the benefit of placing emphasis on consumers is that it allows the firm to credibly develop an aggressive retail stance. However, the hybrid status also comes with the dual downsides of deviating from the desired profit maximization objective and dampening a rival's incentives to disclose. When the hybrid can tailor its focus on its dual "profit" and "consumer" goals, the paper derives the optimal such emphasis. The optimal weights account for the competitive stance the hybrid wants to convey to the rival, as well as the assurance it wants to provide the rival not to excessively curtail disclosure.

Finally, we generalize the model to examine the joint determination of hybrid status and disclosure practices by (*ex ante*) symmetric firms. The equilibrium in this case can be symmetric—firms choose the same emphasis on consumers and adopt the same disclosure practice (either both disclose or neither discloses). However, even with symmetric firms, the equilibrium can be asymmetric—one firm places greater emphasis on consumers and discloses more. This can provide justification for industries such as education, healthcare, and food provision that have entities with varied foci on financial viability and consumer access.

Our study borrows from and builds on two broad streams of literature pertaining to competition between firms: disclosure incentives and strategic delegation. In terms of the former, beginning with Gal-Or (1985) in economics and Darrough (1993) in accounting, several studies have examined how firms' incentives to share information are intrinsically linked to the nature and degree of retail competition. For a survey of the early work in this area, see Verrecchia (2001) and Dye (2001). Recent work in this area focuses on disclosure-related subtleties, including the role of bias in disclosure (Bagnoli and Watts 2010; Friedman, Hughes, and Saouma 2016), herding consequences of disclosures (Dye and Sridhar 1995; Arya and Mittendorf 2005), and disclosures of competitive intelligence (Bagnoli and Watts 2015a). The generalized setup of Bagnoli and Watts (2015a) provides the key trade-offs of competition and information spillover effects of disclosure. This paper layers in the role of hybrid firms and their incentives into these fundamental disclosure trade-offs.

The vast literature on strategic delegation, pioneered by Schelling (1960), examines whether "delegating" decision making to an individual whose objective deviates from pure profit maximization can be a strategic choice aimed at enhancing firm profits. The benefit of having decision makers whose behavior deviates from profit maximization is that the firm is able to commit to certain actions that would otherwise not be rational to stick with. As examples, studies have examined the viability of compensation structures (Vickers 1985; Fershtman and Judd 1987; Sklivas 1987), decentralized decision making (Arya and Mittendorf 2006; Ramanan and Bhargava 2014), strategic transfer pricing (Alles and Datar 1998; Göx and Schiller 2006), and even differential beliefs or preferences (Benabou and Tirole 2011; Fischer, Heinle, and Verrecchia 2016) due to their strategic effects. Mixed duopoly models, wherein the manager of one of the competing firms makes decisions to maximize a linear combination of profit and welfare, have also been shown to fall under this broad label of strategic delegation (Fershtman 1990; Jensen 2001; Hino and Zennyo 2017), suggesting that the presence of firms with an eye on social welfare can be equilibrium behavior. Recent studies on mixed duopoly have expanded the focus to issues of spatial competition (Brekke, Siciliani, and Straume 2012), organizational learning (Casadesus-Masanell and Ghemawat 2006), channel coordination (Goering 2012), and risk management (Godfrey, Merrill, and Hansen 2009).

The contribution here is in examining disclosure incentives in light of firms having nontraditional priorities. Other studies that bring together the literature in this manner include Bagnoli and Watts (2015b), Bova and Yang (2018), and Matsui (2016). Bova and Yang (2018) and Matsui (2016) consider how the incentives of State-Owned Enterprises (SOEs) alter disclosure in industries. In contrast, whereas SOEs focus on overall welfare, we examine hybrid entities whose focus is not social benevolence, but a two-part focus on profit and helping its own consumers. The result has not only different implications for disclosure policies, but also provides an opportunity to examine the equilibrium form such hybrid entities take in industries. To this end, our results are closest to Bagnoli and Watts (2015b), who consider endogenous delegation and incentive compensation that places additional weight on revenue as a strategic delegation tool. Among other things, Bagnoli and Watts (2015b) demonstrate how asymmetries among firms in an industry can influence differential compensation and disclosure practices. By examining a different incentive—an entity whose priority is placed on its customers' welfare, rather than compensation premia for sales volume—we identify distinct equilibria. Using this approach, the present study also provides a unique opportunity to examine how hybrid entities can arise in equilibrium and give conditions under which industries are even characterized by the joint presence of asymmetric hybrid entities, despite a symmetric environment.

The rest of this paper is organized as follows. Section II presents a model of disclosure between competing hybrid firms. Section III presents the effect of the hybrid structure on competition and disclosure. Section IV steps back to analyze whether the hybrid structure can arise endogenously and to what extent it is influenced by the information environment: we first present the benchmark of competition between two profit-maximizing firms; we next examine a mixed duopoly wherein a hybrid firm competes with a profit-maximizing firm; and we finally generalize the analysis by determining the hybrid structure and disclosure policies for all firms. Section V concludes.

II. MODEL

We model an industry consisting of two firms, firm 1 and firm 2. Each firm is (potentially) a hybrid entity, implying that its objective incorporates a combination of its own profit and the welfare of the consumers it serves. In particular, denoting the profit of firm i, $i \in \{1, 2\}$ by π_i and the surplus of its consumers by cs_i, the firm's objective is to maximize its utility function $u_i \equiv \pi_i + \beta_i \cdot cs_i$, where β_i, $\beta_i \in [0, 1)$ represents the degree of the firm's concern for its consumers. Without loss of generality, we let $\beta_1 \geq \beta_2$. Notice the case of $\beta_i = 0$ results in firm i being a traditional profit-maximizer.

Firm i's unit cost of production is $c_i = \bar{c} - \tilde{\delta}_i - r\tilde{\delta}_j$, $i, j \in \{1, 2\}$, $i \neq j$, where δ_1 and δ_2, $\delta_i \in [-\Delta, \Delta]$ are independent signals with mean 0 and variance $\sigma^2 > 0$. Thus, each firm's expected cost is $\bar{c}, \bar{c} > 0$. The parameter $r \in [0, 1]$ measures the degree to which the costs of the two firms are correlated. The two limiting cases of $r = 0$ and $r = 1$ represent the oft-studied private value (δ_i impacts only firm i's costs) and common value (δ_i impacts costs for both firm i and firm j equally) settings, respectively.

Firm i privately observes its cost signal δ_i prior to production. As such, each firm establishes a disclosure policy at the outset, i.e., decides whether it will disclose the ensuing cost parameter. As is typically the case, public disclosures are subject to audit and are, thus, presumed to be truthful.

Following any disclosure, the two firms simultaneously choose their production quantities q_1 and q_2. Market prices p_i are formed based on the standard (inverse) demand functions $p_i = a - q_i - kq_j$, $i, j \in \{1, 2\}$, $i \neq j$, where k, $k \in (0, 1]$, measures the degree of product differentiation, with higher k representing higher levels of product competition; the extreme values of $k = 0$ and $k = 1$ correspond to no competition and pure duopoly, respectively. The parameter a, $a > \bar{c} + 2\Delta$, is the familiar linear demand intercept. As is standard, we presume the model parameters are such that all prices and quantities are positive.

We split the familiar total consumer surplus expression (e.g., see Singh and Vives 1984) $cs = \frac{1}{2}\left[q_1^2 + kq_1q_2\right] + \frac{1}{2}\left[q_2^2 + kq_1q_2\right]$ into its constituent parts:

$$cs_1 = \tfrac{1}{2}\left[q_1^2 + kq_1q_2\right], \text{ and}$$

$$cs_2 = \tfrac{1}{2}\left[q_2^2 + kq_1q_2\right],$$

where cs_i denotes the surplus portion firm i cares about, in addition to caring about its own profit. Roughly stated, cs_i can be viewed as the surplus of customers served by firm i. The expression $\frac{1}{2}q_i^2$ represents the surplus of such consumers in the absence of firm j's production having any bearing on the market-clearing price for firm i's products. Of course, to the degree $k > 0$, higher production by firm j lowers the market-clearing price for firm i's customers, boosting their surplus. This is reflected by the additional term $\frac{1}{2}kq_1q_2$ in each surplus expression.

Given this basic setting, we examine how a firm's interest in consumer welfare alters equilibrium behavior, including disclosure policies and quantity decisions. Recognizing these informational and production consequences, we then ask whether this has ramifications for the efficacy of the hybrid structure as a business form in the first place. In other words, is a firm's interest in consumers a gesture of pure altruism, or can a hybrid structure be tinged with an eye toward obtaining a strategic edge?

III. COMPETITION AND DISCLOSURE

In this section, we derive the implications of the firms' interest in consumer welfare for (i) their disclosure decisions, and (ii) their competitive encounter. In conducting this analysis, denote the disclosure regime by the pair ($\wp_1$, $\wp_2$) where $\wp_i \in \{d, \phi\}$ represents firm i's disclosure policy; $\wp_i = d$ denotes disclosure; and $\wp_i = \phi$ denotes non-disclosure for firm i. Under ($\wp_1$, $\wp_2$), $U_i^{\wp_1\wp_2}$ and $\Pi_i^{\wp_1\wp_2}$ denote expected values of u_i and π_i, respectively.

Identifying the firms' optimal disclosure policies involves comparing their expected utilities under the different disclosure regimes. Thus, we begin by characterizing subgame competitive equilibria under each disclosure regime.

Competitive Outcome Under Regime (*d*, *d*)

Consider regime (d, d), wherein both firms disclose their respective signals δ_1 and δ_2. In this case, firm i, on learning both δ_i and δ_j and conjecturing its rival firm j's quantity to be $\hat{q}_j(\delta_1, \delta_2)$, chooses its quantity q_i to maximize its utility as follows:

$$\underset{q_i}{Max}\, \pi_i(\delta_1, \delta_2; \beta_1, \beta_2) + \beta_i cs_i(\delta_1, \delta_2; \beta_1, \beta_2) \equiv \underset{q_i}{Max}\left[a - q_i - k\hat{q}_j(\delta_1, \delta_2)\right]q_i - \left[\bar{c} - \delta_i - r\delta_j\right]q_i + \frac{\beta_i}{2}\left[q_i^2 + kq_i\hat{q}_j(\delta_1, \delta_2)\right],$$
$$i, j = \{1, 2\}, i \neq j. \tag{1}$$

Solving the first-order conditions of the firms' maximization problems simultaneously, and noting that in equilibrium, the conjectured and realized quantities must be equal, i.e., $\hat{q}_j(\delta_1, \delta_2) = q_j(\delta_1, \delta_2)$, yields the competitive quantities. Denoting the demand intercept net of average cost by α, i.e., $\alpha = a - \bar{c} > 0$, this solution can be expressed as follows (the superscript "*dd*" denotes that the solution is under regime (d, d)):

$$q_i^{dd}(\delta_1, \delta_2; \beta_1, \beta_2) = \alpha A_i^{dd} + \delta_i B_i^{dd} + \delta_j C_i^{dd}, \text{ where}$$
$$A_i^{dd} = \frac{2\left[2(2-\beta_j) - k(2-\beta_i)\right]}{[2-\beta_i]\left[2-\beta_j\right][4-k^2]},\ B_i^{dd} = \frac{2\left[2(2-\beta_j) - rk(2-\beta_i)\right]}{[2-\beta_i]\left[2-\beta_j\right][4-k^2]},\ \text{and } C_i^{dd} = \frac{2\left[2r(2-\beta_j) - k(2-\beta_i)\right]}{[2-\beta_i]\left[2-\beta_j\right][4-k^2]}. \tag{2}$$

Quantities vary with the δs and βs in intuitive fashion. To see the effects of δs on quantities, consider:

$$\frac{dq_i^{dd}(\delta_1, \delta_2; \beta_1, \beta_2)}{d\delta_i} = B_i^{dd} = \frac{2\left[2(2-\beta_j) - rk(2-\beta_i)\right]}{[2-\beta_i]\left[2-\beta_j\right][4-k^2]} \text{ and} \tag{3}$$

$$\frac{dq_i^{dd}(\delta_1, \delta_2; \beta_1, \beta_2)}{d\delta_j} = C_i^{dd} = -\frac{2k}{\left[2-\beta_j\right][4-k^2]} + \frac{4r}{[2-\beta_i][4-k^2]}. \tag{4}$$

As can be seen from (3), firm i's quantity is an increasing function of its signal δ_i, i.e., $\frac{dq_i^{dd}(\cdot)}{d\delta_i} > 0$. That is, the lower the cost for firm i, the higher is its quantity. In contrast, from (4), the relationship between firm j's disclosed signal δ_j and firm i's quantity is ambiguous because of two opposing effects. The first is the *competition effect,* wherein a high (low) value of δ_j indicates high (low) quantity for firm j, thus forcing firm i to be less (more) aggressive in its quantity choice. Due to this, firm i's quantity is decreasing in δ_j. The first term in (4) captures this effect, and is scaled by the degree of competition k. The second effect is the *information spillover effect,* wherein because costs for the two firms are positively correlated, a high (low) value of δ_j indicates low (high) cost not only for firm j, but also for firm i. Due to this, firm i can take advantage of its lower costs to produce more, so to that extent the quantity of firm i is increasing in δ_j. The second term in (4) captures this effect, and is scaled by the degree of information spillover r.

The above described quantity-to-signal sensitivity is affected by the degree to which each firm cares about its own consumers. In particular, as firm i's consumer focus β_i increases, its quantity becomes more reactive to information (both its own and the other firm's), whereas as firm j's consumer focus β_j increases, it becomes less reactive. Formally, $\frac{d}{d\beta_i}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_i}\right] > 0$, $\frac{d}{d\beta_i}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_j}\right] > 0$, $\frac{d}{d\beta_j}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_i}\right] < 0$, and $\frac{d}{d\beta_j}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_j}\right] < 0$. Intuitively, as β_i increases, firm i exploits cost reductions more for the benefit of its customers by producing more, i.e., $\frac{d}{d\beta_i}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_i}\right] > 0$. Further, as can be seen from (4), the magnitude of the information spillover effect increases with β_i. That is, since the cost environments of both firms are related, high δ_j indicates low cost for firm i. Thus, as β_i increases, firm i exploits the favorable cost information contained in δ_j for the benefit of its customers by producing more, i.e., $\frac{d}{d\beta_i}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_j}\right] > 0$. An increase in β_j has analogous effects on firm j, making it harder to dissuade firm j from production. Thus, when β_j increases, firm i is forced to back off on its use of information in order to avoid lowering the retail price significantly, i.e., $\frac{d}{d\beta_j}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_i}\right] < 0$ and $\frac{d}{d\beta_j}\left[\frac{dq_i^{dd}(\cdot)}{d\delta_j}\right] < 0$.

Beyond their impact on how the δs affects quantities, the βs also affect quantities more directly, as noted by their appearance in the A_i^{dd}-term in (2). Accounting for all effects, the bottom-line comparative statics with respect to the βs is unambiguous: $\frac{dq_i^{dd}(\cdot)}{d\beta_i} > 0$ and $\frac{dq_i^{dd}(\cdot)}{d\beta_j} < 0$. In short, the firm becomes more aggressive in competition when it increases its customer focus, and more hesitant in competition when its rival increases its customer focus.

The impact of these quantity choices on firms' expected profits and expected utilities is characterized in Lemma 1 below.

Lemma 1: Under disclosure regime (d, d), the firms' expected profits and expected utilities are as follows:

$$U_i^{dd}(\beta_1, \beta_2) = \left[\tfrac{2-\beta_i}{2}\right]\left[\alpha^2\left(A_i^{dd}\right)^2 + \sigma^2\left\{\left(B_i^{dd}\right)^2 + \left(C_i^{dd}\right)^2\right\}\right], \text{ and}$$
$$\Pi_i^{dd}(\beta_1, \beta_2) = U_i^{dd}(\beta_1, \beta_2) - \tfrac{\beta_i}{2}\left[\alpha^2 A_i^{dd}\left(A_i^{dd} + kA_j^{dd}\right) + \sigma^2\left\{B_i^{dd}\left(B_i^{dd} + kC_j^{dd}\right) + C_i^{dd}\left(C_i^{dd} + kB_j^{dd}\right)\right\}\right], i, j = \{1, 2\}, i \neq j.$$

Competitive Outcome under Regime (d, ϕ)

Consider regime (d, ϕ), wherein firm 1 discloses δ_1, but firm 2 withholds information about δ_2. In this case, firm 1, on observing δ_1 and conjecturing firm 2's quantity strategy for each δ_2 to be $\hat{q}_2(\delta_1, \delta_2)$ picks its quantity $q_1(\delta_1)$ to maximize its expected utility. Also, firm 2, on learning both δ_1 and δ_2 and conjecturing its rival firm's quantity to be $\hat{q}_1(\delta_1)$, chooses its quantity $q_2(\delta_1, \delta_2)$ to maximize its utility. These problems are as follows:

$$\underset{q_1(\delta_1)}{Max}\ E_{\delta_2}\{\pi_1(\delta_1, \delta_2; \beta_1, \beta_2) + \beta_1 cs_1(\delta_1, \delta_2; \beta_1, \beta_2)\} \equiv \underset{q_1(\delta_1)}{Max}\ E_{\delta_2}\left\{\begin{array}{c}[a - q_1(\delta_1) - k\hat{q}_2(\delta_1, \delta_2)]q_1(\delta_1) - [\bar{c} - \delta_1 - r\delta_2]q_1(\delta_1)\\ +\frac{\beta_1}{2}\left[q_1^2(\delta_1) + kq_1(\delta_1)\hat{q}_2(\delta_1, \delta_2)\right]\end{array}\right\} \text{ and}$$

$$\underset{q_2(\delta_1,\delta_2)}{Max}\ \pi_2(\delta_1, \delta_2; \beta_1, \beta_2) + \beta_2 cs_2(\delta_1, \delta_2; \beta_1, \beta_2) \equiv \underset{q_2(\delta_1,\delta_2)}{Max}\ \begin{array}{c}[a - q_2(\delta_1, \delta_2) - k\hat{q}_1(\delta_1)]q_2(\delta_1, \delta_2) - [\bar{c} - \delta_2 - r\delta_1]q_2(\delta_1, \delta_2)\\ +\frac{\beta_2}{2}\left[q_2^2(\delta_1, \delta_2) + k\hat{q}_1(\delta_1)q_2(\delta_1, \delta_2)\right].\end{array} \tag{5}$$

Solving the first-order conditions of both maximization problems simultaneously, and noting that each firm's conjectures hold true in equilibrium, i.e., $\hat{q}_1(\delta_1) = q_1(\delta_1)$ and $\hat{q}_2(\delta_1, \delta_2) = q_2(\delta_1, \delta_2)$, yields the competitive quantities. This solution is expressed as follows (the superscript "$d\phi$" denotes that the solution is under regime (d, ϕ)):

$$\begin{aligned}
&q_1^{d\phi}(\delta_1; \beta_1, \beta_2) = \alpha A_1^{d\phi} + \delta_1 B_1^{d\phi} \text{ and}\\
&q_2^{d\phi}(\delta_1, \delta_2; \beta_1, \beta_2) = \alpha A_2^{d\phi} + \delta_2 B_2^{d\phi} + \delta_1 C_2^{d\phi}, \text{ where}\\
&A_1^{d\phi} = \tfrac{2[2(2-\beta_2) - k(2-\beta_1)]}{[2-\beta_1][2-\beta_2][4-k^2]},\ B_1^{d\phi} = \tfrac{2[2(2-\beta_2) - rk(2-\beta_1)]}{[2-\beta_1][2-\beta_2][4-k^2]},\\
&A_2^{d\phi} = \tfrac{2[2(2-\beta_1) - k(2-\beta_2)]}{[2-\beta_1][2-\beta_2][4-k^2]},\ B_2^{d\phi} = \tfrac{1}{2-\beta_2},\ \text{and } C_2^{d\phi} = \tfrac{2[2r(2-\beta_1) - k(2-\beta_2)]}{[2-\beta_1][2-\beta_2][4-k^2]}.
\end{aligned} \tag{6}$$

As in the (d, d) regime, in this (d, ϕ) regime, each firm's quantity is an increasing function of its own δ-signal. However, there is one distinct difference. Firm 2 recognizes that its non-disclosure policy means δ_2 will not influence firm 1's quantity decision. As a consequence, firm 2's reaction to its own private information δ_2 is contingent on β_2, but not on β_1. Formally, the B_2^{dd} term in the q_2^{dd} expression in (2) depends on β_1, while the $B_2^{d\phi}$ term in the $q_2^{d\phi}$ expression in (6) is free of β_1.

Moreover, under (d, ϕ), since firm 1 does not learn δ_2, its quantity $q_1^{d\phi}$ is independent of δ_2. In effect, for firm 1, the competition and information spillover effects induced by δ_2 are in play in the (d, d) regime, but not in the (d, ϕ) regime. Formally, this is reflected by the presence of the C_1^{dd} term in the q_1^{dd} expression in (2) and the absence of the corresponding $C_1^{d\phi}$ term in the $q_1^{d\phi}$ expression in (6).

The net effect, though, is as before: an increase in firm i's consumer focus β_i leads to an increase in its quantity $q_i^{d\phi}$, while an increase in firm j's consumer focus β_j leads to a decrease. That is, $\frac{dq_i^{d\phi}}{d\beta_i} > 0$ and $\frac{dq_i^{d\phi}}{d\beta_j} < 0$.

The impacts of these quantity choices on firms' expected profits and expected utilities are characterized in Lemma 2 below.

Lemma 2: Under disclosure regime (d, ϕ), the firms' expected profits and expected utilities are as follows:

$$U_1^{d\phi}(\beta_1,\beta_2) = \left[\tfrac{2-\beta_1}{2}\right]\left[\alpha^2\left(A_1^{d\phi}\right)^2 + \sigma^2\left(B_1^{d\phi}\right)^2\right],$$
$$U_2^{d\phi}(\beta_1,\beta_2) = \left[\tfrac{2-\beta_2}{2}\right]\left[\alpha^2\left(A_2^{d\phi}\right)^2 + \sigma^2\left\{\left(B_2^{d\phi}\right)^2 + \left(C_2^{d\phi}\right)^2\right\}\right],$$
$$\Pi_1^{d\phi}(\beta_1,\beta_2) = U_1^{d\phi}(\beta_1,\beta_2) - \tfrac{\beta_1}{2}\left[\alpha^2 A_1^{d\phi}\left(A_1^{d\phi} + kA_2^{d\phi}\right) + \sigma^2 B_1^{d\phi}\left(B_1^{d\phi} + kC_2^{d\phi}\right)\right], \text{ and}$$
$$\Pi_2^{d\phi}(\beta_1,\beta_2) = U_2^{d\phi}(\beta_1,\beta_2) - \tfrac{\beta_2}{2}\left[\alpha^2 A_2^{d\phi}\left(A_2^{d\phi} + kA_1^{d\phi}\right) + \sigma^2\left\{\left(B_2^{d\phi}\right)^2 + C_2^{d\phi}\left(C_2^{d\phi} + kB_1^{d\phi}\right)\right\}\right].$$

The outcomes under regime (ϕ, d) are analogous to those described in this subsection, i.e., the outcomes for firm i under regime (d, ϕ) apply to the outcomes for firm j under regime (ϕ, d).

Competitive Outcome under Regime (ϕ, ϕ)

Consider disclosure regime (ϕ, ϕ), wherein both firms withhold their cost information. In this case, firm i, on learning δ_i and conjecturing its rival firm's quantity strategy for each δ_j to be $\hat{q}_j(\delta_j)$, chooses its quantity $q_i(\delta_i)$ to maximize its expected utility as follows:

$$\max_{q_i(\delta_i)} E_{\delta_j}\{\pi_i(\delta_1,\delta_2;\beta_1,\beta_2) + \beta_i cs_i(\delta_1,\delta_2;\beta_1,\beta_2)\} \equiv \max_{q_i(\delta_i)} E_{\delta_j}\left\{\begin{array}{c}[a - q_i(\delta_i) - k\hat{q}_j(\delta_j)]q_i(\delta_i) - [\bar{c} - \delta_i - r\delta_j]q_i(\delta_i) \\ +\frac{\beta_i}{2}\left[q_i^2(\delta_i) + kq_i(\delta_i)\hat{q}_j(\delta_j)\right]\end{array}\right\},$$
$$i,j = \{1,2\}, i \neq j. \tag{7}$$

Solving the first-order conditions of the firms' maximization problems simultaneously, and noting that in equilibrium, the conjectured and realized strategies must be equal, i.e., $\hat{q}_j(\delta_j) = q_j(\delta_j)$, yields the competitive quantities. This solution can be expressed as follows (the superscript "$\phi\phi$" denotes that the solution is under regime (ϕ, ϕ)):

$$\begin{aligned} &q_i^{\phi\phi}(\delta_i;\beta_1,\beta_2) = \alpha A_i^{\phi\phi} + \delta_i B_i^{\phi\phi}, \text{ where} \\ &A_i^{\phi\phi} = \tfrac{2\left[2\left(2-\beta_j\right)-k(2-\beta_i)\right]}{[2-\beta_i]\left[2-\beta_j\right][4-k^2]} \text{ and } B_i^{\phi\phi} = \tfrac{1}{2-\beta_i}. \end{aligned} \tag{8}$$

As with the (d, d) and (d, ϕ) regimes, in this (ϕ, ϕ) regime, each firm's quantity is an increasing function of its own δ-signal. However, since there is no disclosure, firm i's δ-signal will not influence firm j's quantity decision. As a consequence, firm i's reaction to its own private information is contingent on β_i, but not on β_j. That is, the $B_i^{\phi\phi}$ term in the $q_i^{\phi\phi}$ expression in (8) is free of β_j.

Furthermore, in contrast to the other two regimes, the competition and information spillover effects of information are completely absent in this regime. Formally, this is reflected by the absence of the $C_i^{\phi\phi}$ term in the $q_i^{\phi\phi}$ expression in (8).

Consequently, while the effect of the βs on quantities are more direct in this regime, the net effect is as before: an increase in firm i's consumer focus β_i leads to an increase in its quantity $q_i^{\phi\phi}$, while an increase in firm j's consumer focus β_j leads to a decrease. That is, $\frac{dq_i^{\phi\phi}}{d\beta_i} > 0$ and $\frac{dq_i^{\phi\phi}}{d\beta_j} < 0$.

The impacts of these quantity choices on firms' expected profits and expected utilities are characterized in Lemma 3 below.

Lemma 3: Under disclosure regime (ϕ, ϕ), the firms' expected profits and expected utilities are as follows:

$$U_i^{\phi\phi}(\beta_1,\beta_2) = \left[\tfrac{2-\beta_i}{2}\right]\left[\alpha^2\left(A_i^{\phi\phi}\right)^2 + \sigma^2\left(B_i^{\phi\phi}\right)^2\right] \text{ and}$$
$$\Pi_i^{\phi\phi}(\beta_1,\beta_2) = U_i^{\phi\phi}(\beta_1,\beta_2) - \tfrac{\beta_i}{2}\left[\alpha^2 A_i^{\phi\phi}\left(A_i^{\phi\phi} + kA_j^{\phi\phi}\right) + \sigma^2\left(B_i^{\phi\phi}\right)^2\right], \; i,j = \{1,2\}, i \neq j.$$

Optimal Disclosure Policies

For given degrees of customer focus, β_i and β_j, this section determines each firm's disclosure policy. In particular, a firm chooses its disclosure policy based on the decision's impact on its expected utility. In particular, a firm chooses to disclose if and only if its expected utility under disclosure (weakly) exceeds its expected utility under non-disclosure. Proposition 1 identifies the condition for each firm to disclose.

Proposition 1: Firm i discloses if and only if its emphasis on consumer surplus is sufficiently large; in particular, if and only if $\beta_i \geq 2 - \frac{k}{2r}\left[2 - \beta_j\right]$.

Proposition 1 establishes that each firm's disclosure policy is a dominant strategy. That is, a firm's disclosure policy is independent of its rival's policy. However, it is tied to (i) the firm's emphasis on its own consumers, and (ii) the rival's emphasis on its consumers. Roughly stated, the firm discloses when it cares enough about its consumers relative to the rival's emphasis on its consumers.

To glean intuition behind this result, consider the impact of firm i's disclosure δ_i on firm j's quantity and, consequently, firm i's incentives to disclose. Recall, from (4), the sensitivity of firm j's quantity to firm i's disclosure is represented via a competition effect and an information spillover effect. From firm i's perspective, disclosure is desirable when the competition effect dominates the information spillover effect. The reason is simple and rooted in the convexity of firm payoffs. The competition effect implies that when firm i has favorable information (i.e., its cost is low), disclosure results in firm j reducing its quantity; of course, when the disclosed information is unfavorable, firm j increases its quantity. Such variability in firm j's quantity choice associated with disclosure is desirable for firm i since profit convexity implies that benefits from gaining market share when circumstances are more profitable outweighs costs of ceding market share under less profitable circumstances (i.e., payoff variance is valued *ex ante*). The information spillover effect implies the reverse. When firm i has favorable information, the similar information environments mean that both firms want to increase (decrease) quantities at the same time, resulting in aggressive (softer) competition when the circumstance is most favorable (unfavorable). The net effect is to compress *ex post* variation in payoffs, an eventuality that is unappealing *ex ante*. Formally, these arguments suggest that disclosure for firm i is desirable if the competition effect of disclosing its signal δ_i exceeds its information spillover effect. From (4), this condition yields precisely the same β_i-condition as that obtained by contrasting profit of firm i with and without disclosure in Proposition 1, confirming these arguments.

Further, from (4), note that the impact of firm i's disclosure on its rival's quantity is not affected by the rival's information signal δ_j. Thus, firm j's disclosure policy does not affect firm i's incentives to disclose, confirming firm i's disclosure decision as a dominant strategy.

The above intuition also suggests that as the degree of information spillover r increases (since the circumstances of both firms become increasingly similar) the information spillover effect becomes more pressing, thereby derailing the firms' incentives to disclose and coordinate by taking turns to dominate at opportune times. In line with this intuition, the disclosure incentives of Proposition 1 can also be expressed in terms of r-cutoffs as follows:

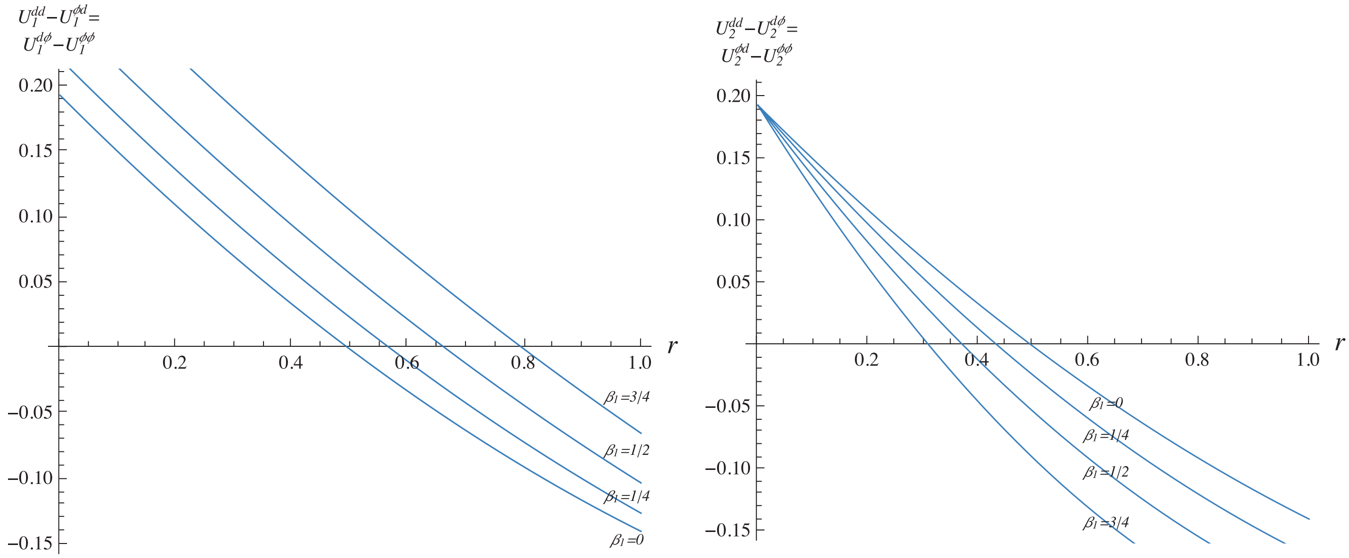
$$\begin{aligned}&\text{Firm 1 discloses if and only if: } r \leq \frac{k}{2} + \frac{[\beta_1 - \beta_2]k}{2[2-\beta_1]}, \text{ and}\\ &\text{Firm 2 discloses if and only if: } r \leq \frac{k}{2} - \frac{[\beta_1 - \beta_2]k}{2[2-\beta_2]}.\end{aligned} \tag{9}$$

From (9) and Proposition 1, sufficiently low r-values and/or sufficiently high β_i-values favor disclosure by firm i. Low r-values imply that the magnitude of the information spillover effect is small, while high β_i-values imply that the magnitude of the competition effect is large, both spurring disclosure incentives for firm i. As can be inferred from (9), this relationship between the degree of information spillover r and consumer focus β_i is such that an increased emphasis on consumer welfare by firm i leads to increased disclosure by firm i and decreased disclosure by its rival, firm j, i.e., as β_i increases, firm i discloses for a wider range of r values and firm j for a narrower range.

The roles of the degree of information spillover and firms' consumer focus on disclosure decisions are illustrated for an example in Figure 1. The left and the right panels of the figure present disclosure incentives for firm 1 and firm 2, respectively. The following observations follow: (i) the disclosure decision of each firm is a dominant strategy—thus, the y-axes in the left and right panels are labeled $U_1^{dd} - U_1^{\phi d} = U_1^{d\phi} - U_1^{\phi\phi}$ and $U_2^{dd} - U_2^{d\phi} = U_2^{\phi d} - U_2^{\phi\phi}$, respectively; (ii) as the degree of information spillover r increases, disclosure is less attractive for both firms—disclosure is optimal for firm 1 only for $r < 1/[2 - \beta_1]$, and for firm 2 only for $r < [2 - \beta_1]/4$; and (iii) as firm 1's consumer focus β_1 increases, it changes disclosure incentives for both firm 1 and firm 2, but in contrasting fashion—higher β_1-values increase the r-threshold in the left panel (boosting firm 1's disclosure incentives) while decreasing the r-threshold in the right panel (stifling firm 2's disclosure incentives).

The above analysis establishes the criticality of the trade-offs between firms' focus on consumer surplus and the degree of information spillover. These trade-offs remain unchanged even with asymmetric information spillover effects. To see this argument, allow r_i to be the extent to which the signal of firm i impacts firm j's costs, i.e., $c_j = \bar{c} - \delta_j - r_i\delta_i$. The following corollary establishes that the disclosure cutoff for each firm, even in this setting, is essentially identical to that presented above (we thank the editor for suggesting this analysis).

FIGURE 1
Role of β-Values and r on Disclosure Incentives



The panel on the left presents disclosure incentives for firm 1, and the panel on the right for firm 2. Values used for the plots: $\alpha = 10$, $\sigma^2 = 1$, $k = 1$, and $\beta_2 = 0$.

Corollary 1: With asymmetric information spillover, firm i discloses if and only if its emphasis on consumer surplus is sufficiently large, i.e., $\beta_i \geq 2 - \frac{k}{2r_i}\left[2 - \beta_j\right]$, or, equivalently, if and only if the information spillover r_i from its disclosure is sufficiently low, i.e., $r_i \leq \frac{k}{2} + \frac{\left[\beta_i - \beta_j\right]k}{2[2-\beta_i]}$.

A low r_i value indicates that good news for firm i does not translate to good news for firm j. In such cases, firm i can engage in collusive back-and-forth with firm j by disclosing its signal.

IV. IMPLICATIONS FOR FIRM STRUCTURE

The analysis thus far considers the economic consequences for firms given any β-values. This section considers the setting where the firms can select their organizational form (β-values). In doing so, we presume that each firm selects its organizational form to optimize its ensuing expected profit—as opposed to its expected utility. Put differently, we seek to address whether a firm will deviate from $\beta = 0$ in setting up organizational form purely for strategic reasons.

In conducting this analysis, it is important to recognize that the extent of a firm's consumer focus can affect both its and its rival's disclosure policy. The nature of this interaction depends on the type of rival it competes against—on whether it faces a hybrid or a for-profit rival. To this end, this section considers all combinations of firm types, and analyzes each scenario in terms of the endogenous β-choices and the disclosure policies that arise in equilibrium: first, we consider the benchmark setting of competition between two profit-maximizing firms; next, we provide intuition by examining a mixed duopoly setting; and finally, we detail the general solution by characterizing the firm structure and disclosure policy for all entities.

Benchmark: Competition between Profit-Maximizing Firms

In order to understand the interaction between the hybrid structure and disclosure policies, we present a familiar benchmark where both firms are traditional for-profit firms. Corollary 2 establishes the equilibrium.

Corollary 2: When both firms are for-profit entities, both firms disclose if the degree of information spillover is low, i.e., for $r \leq k/2$, and neither firm discloses when the degree of information spillover is high, i.e., for $r > k/2$.

As already alluded to in Proposition 1, a disclosing firm benefits from the disclosure's competition effect, but loses from its information spillover effect. Thus, a firm will disclose if and only if the competition effect exceeds the information spillover effect. The condition for this is $r \leq k/2$, as can be seen by setting $\beta_1 = \beta_2 = 0$ in (9).

Intuition: The Viability of the Hybrid Firm

To examine whether a firm can boost its profit from establishing itself as a hybrid, we consider a simple setting where the economic forces are easy to appreciate. In particular, we study a mixed duopoly wherein firm 1 determines the optimal emphasis on its consumers when competing with a profit-maximizing firm 2.

Proposition 2 determines all circumstances in which, by establishing itself as a hybrid, firm 1 can improve its performance from a profit-maximization standpoint.

Proposition 2: The expected profit for firm 1 is greater with a hybrid structure than if it were established as a for-profit entity if:

(i) $r \leq \frac{k}{2}$ and $0 < \beta_1 \leq \min\left\{2 - \frac{4r}{k}, \frac{2\left[\alpha^2(2-k)+2\sigma^2\left(1+r^2-rk\right)\right]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]}\right\}$; or

(ii) $r \leq \frac{k}{2}$ and $2 - \frac{4r}{k} < \beta_1 \leq \beta^{\dagger}$, where $\beta^{\dagger}$ is the larger of the two (real) β_1-values that solves $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{dd}(0,0) = 0$; or

(iii) $r > \frac{k}{2}$ and $0 < \beta_1 < \min\left\{2 - \frac{k}{r}, \frac{8\alpha^2[2-k]k^2}{4\alpha^2[4-k^3]+\sigma^2[4-k^2]^2}\right\}$; or

(iv) $r > \frac{k}{2}$ and $2 - \frac{k}{r} \leq \beta_1 \leq \beta^{\ddagger}$, where $\beta^{\ddagger}$ is the larger of the two (real) β_1-values that solves $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0) = 0$.

Proposition 2 characterizes circumstances wherein firm 1 emerges with an overall improvement in its expected profit by adopting a stance that puts an added focus on consumer welfare. There are two cases to consider, namely, $r \leq k/2$ and $r > k/2$, corresponding to whether profit-maximizing firms disclose or withhold their private information. Parts (i) and (ii) of the proposition deal with the two different disclosure regimes that arise in the $r \leq k/2$ case when firm 1 is a hybrid. In particular, from (9), when $\beta_1 \leq 2 - 4r/k$, both firms disclose and part (i) of the proposition applies; when $\beta_1 > 2 - 4r/k$, firm 1 continues to disclose, but firm 2 ceases to disclose and part (ii) of the proposition applies.

To see the impact of the hybrid structure on competition, note that when firm 1 emphasizes consumer welfare, it selects a quantity level that exceeds what it would have chosen were it focused solely on profits. In particular, under disclosure regime (d, d), given its conjecture $\hat{q}_2^{dd}$ of firm 2's quantity, a utility-maximizing firm 1 chooses quantity $\frac{2\alpha+2[\delta_1+r\delta_2]-k\hat{q}_2^{dd}[2-\beta_1]}{2[2-\beta_1]}$, while a profit-maximizing one would have selected the lower quantity $\frac{\alpha+[\delta_1+r\delta_2]-k\hat{q}_2^{dd}}{2}$. Thus, for a given (fixed) rival quantity, a utility-maximizing firm 1 bears a cost of excessive self-production. However, in equilibrium, rival quantity is not fixed, but itself influenced by the quantity incentives of firm 1. Due to such inherent interlinkage in demand functions of competing firms, the boost in own production of firm 1 provides the strategic benefit of dampening the rival's quantity. As consumer focus β_1 increases above 0, expected profit $\Pi_1^{dd}(\beta_1, 0)$ initially increases because the marginal strategic benefit of reducing rival quantities exceeds the marginal cost of the firm's own slightly excessive quantity. However, for higher values of β_1, the forces reverse and $\Pi_1^{dd}(\beta_1, 0)$ decreases in β_1. Thus, under disclosure policy (d, d), the hybrid structure is worthwhile for firm 1 from a profitability perspective as long as $\Pi_1^{dd}(\beta_1, 0) \geq \Pi_1^{dd}(0,0)$, i.e., as long as $\beta_1 \leq \frac{2\left[\alpha^2(2-k)+2\sigma^2(1-r[k-r])\right]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]}$, the β_1-value that solves $\Pi_1^{dd}(\beta_1, 0) = \Pi_1^{dd}(0,0)$. Part (i) of the proposition characterizes these parameter values.

For the higher β_1-values, $\beta_1 > 2 - 4r/k$, as discussed above, firm 2 stops disclosing against such a hybrid, whereas firm 2 would have disclosed when facing a traditional for-profit firm 1. Accounting for such informational change, Proposition 2(ii) identifies the β_1-threshold, $\beta_1^{\dagger}$, below which the hybrid structure can increase firm 1's profitability by solving $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{dd}(0,0) = 0$.

Notice, in the $r \leq k/2$ case, when: $min\left\{2 - \frac{4r}{k}, \frac{2\left[\alpha^2(2-k)+2\sigma^2\left(1+r^2-rk\right)\right]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]}\right\} = 2 - \frac{4r}{k}$, there are feasible β_1 values that satisfy both parts (i) and (ii) of the proposition, whereas when the minimum is $\frac{2\left[\alpha^2(2-k)+2\sigma^2\left(1+r^2-rk\right)\right]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]}$, only part (i) has feasible β_1-values. To understand this argument, note that when the minimum is $2 - \frac{4r}{k}$, firm 1 is better off as a hybrid structure than as a for-profit entity for all $\beta_1 \leq 2 - \frac{4r}{k}$, including at $\beta_1 = 2 - \frac{4r}{k}$. A small increase in β_1 above $2 - \frac{4r}{k}$ does shift the disclosure regime (firm 2 stops disclosing), but the hybrid still continues to beat the benchmark profit $\Pi_1^{dd}(0,0)$ as long as β_1 is not too large. Part (ii) of the proposition explicitly notes this "not-too-large" β_1-value as $\beta^{\dagger}$.

In contrast, when:

$$min\left\{2-\frac{4r}{k},\frac{2[\alpha^2(2-k)+2\sigma^2(1+r^2-rk)]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]}\right\}=\frac{2[\alpha^2(2-k)+2\sigma^2(1+r^2-rk)]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]},$$

in the β_1-range $\left(\frac{2\left[\alpha^2(2-k)+2\sigma^2\left(1+r^2-rk\right)\right]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]},2-\frac{4r}{k}\right]$, while disclosure regime (d, d) is sustained, firm profit is lower than $\Pi_1^{dd}(0,0)$. An increase in β_1 above $2-\frac{4r}{k}$ again changes the disclosure regime, but continues to fall short of the benchmark profit $\Pi_1^{dd}(0,0)$.

Parts (iii) and (iv) of the proposition deal with the two different disclosure regimes that arise in the $r > k/2$ case when firm 1 is a hybrid. In particular, from (9), when $\beta_1 < 2 - k/r$, neither firm discloses, and part (iii) of the proposition applies; when $\beta_1 \geq 2 - k/r$, firm 2 continues to withhold, but firm 1 now discloses and part (iv) of the proposition applies. The arguments for the minimum expression in part (iii) and the $\beta^{\ddagger}$ expression in part (iv) are analogous to those provided in the preceding discussion, merely adjusted for the disclosure regime differences.

Given the result that firm 1 can influence both the information and competitive environments via its consumer-focused posture, we next identify the β_1-value that maximizes the expected profit of firm 1. The sequence of events is as follows. First, firm 1 chooses its consumer focus β_1. Second, the two firms determine the disclosure policies that maximize their respective utilities. Third, the firms disclose in accordance with policy. Finally, the firms make quantity decisions that maximize their expected utilities. Proposition 3 presents the optimal consumer focus, along with its implications for the disclosure environment.

Proposition 3: Equilibrium behavior in the mixed duopoly model can be characterized as follows:

(i) For $r \in [0, \underline{r}']$, firm 1 chooses $\beta_1 = \beta_1'^{dd} > 0$, and this results in both firms disclosing, i.e., results in regime (d, d);

(ii) For $r \in (\underline{r}', \bar{r}']$, firm 1 chooses $\beta_1 = \beta_1'^{d\phi} > 0$, and this results in firm 1 disclosing and firm 2 withholding, i.e., results in regime (d, ϕ); and

(iii) For $r \in (\bar{r}', 1]$, firm 1 chooses $\beta_1 = \beta_1'^{\phi\phi} > 0$, and this results in both firms withholding, i.e., results in regime (ϕ, ϕ), where:

$$\beta_1'^{dd}=\frac{2[\alpha^2(2-k)+2\sigma^2(1+r^2-rk)]k^2}{\alpha^2[8-(2+k)k^2]+2\sigma^2[(4-k^2)(1+r^2)-rk^3]},$$

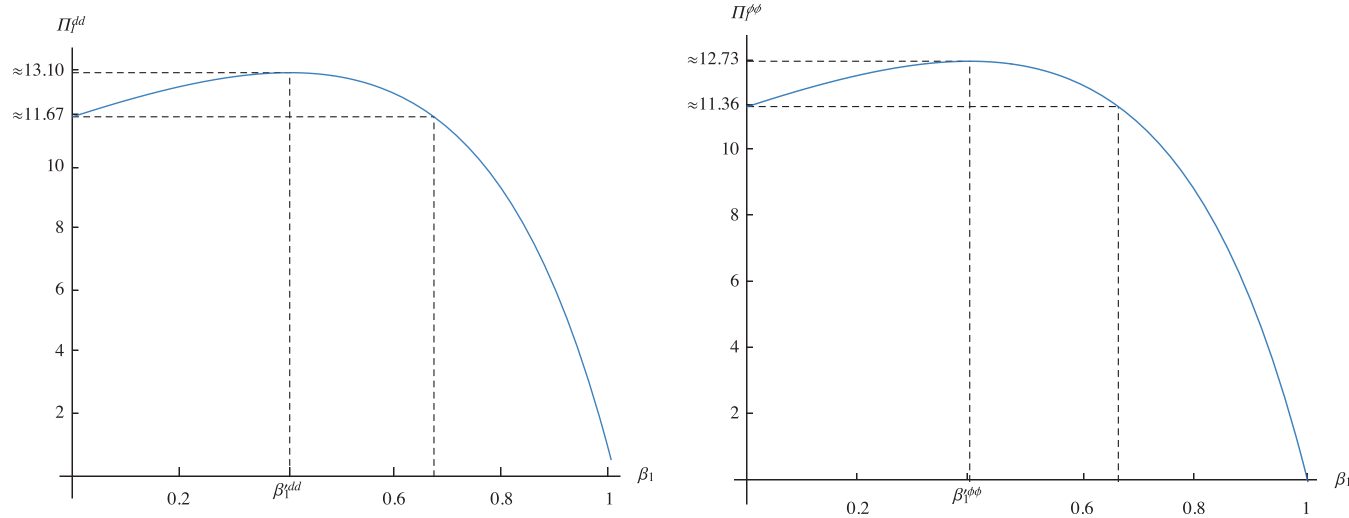
$$\beta_1'^{d\phi}=\frac{2[\alpha^2(2-k)+\sigma^2(2-rk)]k^2}{\alpha^2[8-(2+k)k^2]+\sigma^2[8-(2+rk)k^2]},$$

$$\beta_1'^{\phi\phi}=\frac{4\alpha^2[2-k]k^2}{2\alpha^2[8-(2+k)k^2]+\sigma^2[4-k^2]^2},$$

$\underline{r}'$ is the unique r-value in (0, $k/2$) that solves $\Pi_1^{dd}(\beta_1'^{dd},0)-\Pi_1^{d\phi}\left(\beta_1'^{d\phi},0\right)=0$, and $\bar{r}'$ is the unique r-value in ($k/2$,1) that solves $\Pi_1^{\phi\phi}\left(\beta_1'^{\phi\phi},0\right)-\Pi_1^{d\phi}\left(\beta_1'^{d\phi},0\right)=0$.

The interaction between strategic considerations and the anticipated disclosure environment determines firm 1's optimal consumer focus β_1. In the regime where both firms disclose, the β_1-value that maximizes $\Pi_1^{dd}(\beta_1,0)$ is the optimal consumer focus β_1. As indicated earlier, the benefit to firm 1 from a consumer-oriented posture is that it is able to be more aggressive in competition and, consequently, force firm 2 to cede market share. This advantage is similar, in spirit, to the advantage derived by a Stackelberg leader. If firm 1 were a Stackelberg leader, it would choose different quantities for each (δ_1, δ_2) realization with an eye toward influencing the follower's quantity choice. To mimic the advantage of a Stackelberg leader, firm 1 would have to choose a different β_1 for each realization of the pair (δ_1, δ_2). However, that is not possible since β_1 is chosen prior to the δs being realized. As a consequence, the firm does the "next best thing." In particular, the optimal consumer focus β_1 in this case is the β_1-value that minimizes the least square deviation from the Stackelberg leader's quantities. In other words, $\beta_1'^{dd}$, the β_1-value that maximizes $\Pi_1^{dd}(\beta_1,0)$, is also the value that minimizes $\int\limits_{\delta_2}\int\limits_{\delta_1}\left[q_{sl}^{dd}-q_1^{dd}(\beta_1,0)\right]^2 h(\delta_1)h(\delta_2)d\delta_1 d\delta_2$, where q_{sl}^{dd} is the quantity a Stackelberg leader would choose for the realized δ-values, and $h(\cdot)$ is the probability density function of the δ-signals. Notice, also, that the firm's disclosed information complements its consumer focus in driving the strategic advantage. That is, as can be seen from Proposition 3, the greater the volatility of the disclosed information, the higher the optimal consumer focus β_1, i.e., $d\beta_1'^{dd}/d\sigma^2 > 0$.

FIGURE 2
Effect of β-Choices on Disclosure Policies and Firm 1's Profit



The panel on the left presents the relationship between β_1 and firm 1's profit for the private value case, i.e., for $r = 0$, and the panel on the right presents the same relationship for the common value case, i.e., for $r = 1$. Other values used for the plots: $\alpha = 10$, $\sigma^2 = 1$, $k = 1$, and $\beta_2 = 0$.

In the regime where firm 1 alone discloses, the optimal β_1-value, denoted $\beta_1'^{d\phi}$, is one that maximizes $\Pi_1^{d\phi}(\beta_1, 0)$. The intuition for the optimal value in this regime and its correspondence with the Stackelberg leader's choice is similar to that discussed above. Again, firm 1 leverages the complementary nature of its disclosure with its consumer focus, so that $d\beta_1'^{d\phi} \big/ d\sigma^2 > 0$.

In the regime in which no disclosure is made, the optimal β_1-value, denoted $\beta_1'^{\phi\phi}$, is one that maximizes $\Pi_1^{\phi\phi}(\beta_1, 0)$. Since there is no disclosure to take advantage of, $d\beta'^{\phi\phi} \big/ d\sigma^2 < 0$. As a consequence, the optimal consumer focus is lower in this regime compared to the regimes in which firm 1 discloses, i.e., $\beta_1'^{\phi\phi} < \beta_1'^{dd}$ and $\beta_1'^{\phi\phi} < \beta_1'^{d\phi}$.

The disclosure regimes that arise in equilibrium are themselves outcomes of firm 1's chosen β_1-value. This interaction is captured by the r-cutoffs, $\underline{r}'$ and $\bar{r}'$, which are functions of the optimal β_1-value.

Figure 2 graphically illustrates the discussion so far: accounting for disclosure and strategic effects, a degree of focus on consumer welfare can be in the best interest of a firm even from the point of view of maximizing its profit. The left panel presents this result for the private value case ($r = 0$), and the right panel for the common value case ($r = 1$). For all β-values, both firms disclose in the private value case, while both firms withhold in the common value case—hence, the left panel plots Π_1^{dd} and the right panel plots $\Pi_1^{\phi\phi}$ as a function of β_1. As expected, in each case, firm 1's profit increases with consumer focus β_1, reaches a peak, and then decreases. The peak values are denoted $\beta_1'^{dd}$ and $\beta_1'^{\phi\phi}$, and correspond to the expressions presented in Proposition 3. Also, up to the identified upper bounds for β_1, firm 1 prefers the hybrid structure over the traditional for-profit structure. These upper bounds correspond to the expressions presented in Proposition 2(i) and (iii), respectively.

In addition to the impact on profits, the focus on consumers perturbs disclosure incentives not just for the hybrid firm, but also for the traditional profit-maximizing firm it competes against. The following corollary characterizes the effect.

Corollary 3: In the mixed duopoly setting, the hybrid firm discloses more and the profit-maximizing firm discloses less relative to their respective disclosures in the traditional setting, wherein both firms are profit-maximizers.

A key takeaway from Corollary 3 is that being consumer-focused facilitates disclosure, whereas facing a consumer-focused competitor stifles disclosure. That is, compared to its disclosure policy in the benchmark setting, the hybrid firm discloses more, i.e., it discloses for $r \le \bar{r}'$, where $\bar{r}' > k/2$, whereas in the benchmark, it discloses for $r \le k/2$. In contrast, compared to the disclosure policy in the benchmark setting, the traditional profit-maximizing firm discloses less, i.e., it discloses for $r \leq \underline{r}'$, where $\underline{r}' < k/2$, whereas in the benchmark, it discloses for $r \leq k/2$.

Equilibrium: Hybrid Structure and Disclosure Policies

Having established demand for the hybrid structure when competing against a for-profit firm, we now consider the general setting in which both firms can opt to structure themselves as hybrids. The sequence of events in this setting is as before, except that now, both firms simultaneously select their respective customer focus (β-value) up front. In this setting, interactions are expansive: β_i and β_j each impact the ensuing disclosure and competitive landscape.

In conducting this analysis, we make use of the following notation. Given disclosure regime ($\wp_1$, $\wp_2$), define firm i's best response to a given β_j by $\beta_i^{\wp_1\wp_2}(\beta_j)$. That is, $\beta_i^{\wp_1\wp_2}(\beta_j)$ is the β_i value that maximizes firm i's expected profit $\Pi_i^{\wp_1\wp_2}(\beta_1, \beta_2)$. Proposition 4 identifies equilibrium behavior in this setting.

Proposition 4: Equilibrium behavior in the general model can be characterized as follows:

(i) For $r \in [0, \underline{r}^*]$, firm i chooses $\beta_i = \beta_i^{*dd}$, with $\beta_1^{*dd} = \beta_2^{*dd} > 0$, and this results in both firms disclosing, i.e., results in regime (d, d);
(ii) For $r \in (\underline{r}^*, \bar{r}^*]$, firm i chooses $\beta_i = \beta_i^{*d\phi}$, with $\beta_1^{*d\phi} > \beta_2^{*d\phi} > 0$, and this results in firm 1 disclosing and firm 2 withholding, i.e., results in regime (d, ϕ); and
(iii) For $r \in (\bar{r}^*, 1]$, firm i chooses $\beta_i = \beta_i^{*\phi\phi}$, with $\beta_1^{*\phi\phi} = \beta_2^{*\phi\phi} > 0$, and this results in both firms withholding, i.e., results in the regime (ϕ, ϕ), where:

$$\beta_i^{*dd} = \frac{[\alpha^2(2-k) + 2\sigma^2(1 - rk + r^2)]k^2}{[4-k^2][\alpha^2 + \sigma^2(1+r^2)]},$$

$$\beta_2^{*d\phi} = \frac{8[2-k^2][\alpha^2+\sigma^2][\alpha^2 + r^2\sigma^2]k^2 - 2[4-k^2][\alpha^2+\sigma^2][\alpha^2 + r\sigma^2]k^3 + [(\alpha^2 + r\sigma^2)k^3]^2}{[4-k^2][\alpha^2+\sigma^2][4(2-k^2)(\alpha^2 + \sigma^2[1+r^2]) - \sigma^2(2-k^2)k^2 - (\alpha^2 + r\sigma^2)k^3]},$$

$$\beta_1^{*d\phi} = \frac{2\left[(\alpha^2+\sigma^2)\left(2 - \beta_2^{*d\phi}\right) - (\alpha^2 + r\sigma^2)k\right]k^2}{[\alpha^2+\sigma^2]\left[8 - 2k^2 - \beta_2^{*d\phi}(4-k^2)\right] - [\alpha^2 + r\sigma^2]k^3},$$

$$\beta_i^{*\phi\phi} = \frac{4\alpha^2k^2}{[2+k][4\alpha^2 + \sigma^2(4-k^2)]},$$

$\underline{r}^*$ is the unique r-value in $\left(0, \frac{k}{2}\right)$ that solves: $\Pi_2^{dd}\left(\beta_1^{*dd}, \beta_2^{*dd}\right) - \Pi_2^{d\phi}\left(\beta_1^{*dd}, \beta_2^{d\phi}\left(\beta_1^{*dd}\right)\right) = 0$, and $\bar{r}^*$ is the unique r-value in $\left(\frac{k}{2}, 1\right)$ that solves: $\Pi_1^{\phi\phi}\left(\beta_1^{*\phi\phi}, \beta_2^{*\phi\phi}\right) - \Pi_1^{d\phi}\left(\beta_1^{d\phi}\left(\beta_2^{*\phi\phi}\right), \beta_2^{*\phi\phi}\right) = 0$

Each firm's consumer focus balances strategic considerations, the anticipated information environment, and the influence of its rival firm's consumer focus. In regime (ϕ, ϕ), wherein neither firm discloses, information considerations do not come into play. Thus, for a given level of consumer focus β_j, firm i solves for the β_i that maximizes its expected profit $\Pi_i^{\phi\phi}(\cdot)$ to obtain $\beta_i^{\phi\phi}(\beta_j)$. Importantly, firm i's strategic advantage from its customer focus is counteracted by its rival's consumer focus β_j, so the marginal benefit to firm i from β_i is decreasing in β_j. As a consequence, firm i's consumer focus is lower than what it would be were it the only hybrid entity, i.e., $\beta_i^{*\phi\phi} < \beta_i'^{\phi\phi}$.

In regime (d, d), wherein both firms disclose, firm i similarly solves for the β_i that maximizes its expected profit $\Pi_i^{dd}(\cdot)$, taking into account firm j's optimal choice, to obtain β_i^{*dd}. The firm's disclosure plays a crucial role in its preferred β-choice, as disclosure complements the firm's consumer focus in providing strategic gains. Thus, each firm increases its consumer focus beyond the level chosen in regime (ϕ, ϕ), i.e., $\beta_i^{*dd} > \beta_i^{*\phi\phi}$. Further, complementarity with the disclosed information ensures that the level of consumer focus increases with the information content of the disclosure, i.e., $d\beta_i^{*dd}/d\sigma^2 > 0$. Of course, the negative impact of the rival's customer focus again tempers each firm's consumer focus, i.e., $\beta_i^{*dd} < \beta_i'^{dd}$.

In regime (d, ϕ), wherein firm 1 alone discloses, firm 2 does not derive the complementarity benefit of its own disclosure, so it chooses a level of consumer focus lower than that chosen in regime (d, d), i.e., $\beta_2^{*d\phi} < \beta_2^{*dd}$. This lower β_2-choice enhances the strategic benefits of consumer focus for firm 1, leading it to choose a β-value higher than that chosen in regime (d, d), i.e., $\beta_1^{*d\phi} > \beta_1^{*dd}$. Finally, the adverse effect of the competitor's consumer focus dampens the firm's β-choice, i.e., $\beta_1^{*d\phi} < \beta_1'^{d\phi}$.

The disclosure regimes that arise in equilibrium are again themselves outcomes of the firms' consumer focus. For low levels of information spillover, i.e., for $r \leq \underline{r}^*$, firm 1 prefers regime (d, d) and chooses β_1^{*dd}. Anticipating this correctly, firm 2 chooses β_2^{*dd}, leading to regime (d, d). For high levels of information spillover, i.e., for $r \geq \bar{r}^*$, firm 2 prefers regime (ϕ, ϕ) and chooses $\beta_2^{*\phi\phi}$. Anticipating this correctly, firm 1 chooses $\beta_1^{*\phi\phi}$, leading to regime (ϕ, ϕ). For all moderate levels of information spillover, i.e., for r-values that lie between $\underline{r}^*$ and $\bar{r}^*$, regime (d, ϕ) arises with firm 1 and firm 2 choosing $\beta_1^{*d\phi}$ and $\beta_2^{*d\phi}$, respectively. The r-threshold $\underline{r}^*$ corresponds to the level of information spillover at which firm 2 is indifferent between disclosing and withholding given firm 1 is disclosing and choosing $\beta_1 = \beta_1^{*dd}$. The r-threshold $\bar{r}^*$ corresponds to the level of information spillover at which firm 1 is indifferent between disclosing and withholding given firm 2 is withholding and choosing $\beta_2 = \beta_2^{*\phi\phi}$. A key takeaway from Proposition 4 is that the demand for the hybrid structure in equilibrium is influenced not just by its capacity to communicate an aggressive stance in the product market, but also by its ability to influence the information environment.

In contrast to the mixed duopoly setting, in this general setting, notice that a firm's gain from adopting a hybrid stance can be undercut by its rival's ability to do the same. As a consequence, competition can be "excessive" in that firms could be better off if they did not have the option to structure as hybrids. This scenario is akin to the race among firms to be a Stackelberg leader, with neither gaining the early mover advantage, i.e., the equilibrium results in simultaneous (Cournot) early play (see, e.g., Hamilton and Slutsky 1990). We ask two related questions.

First, what are the implications of the hybrid structure on total welfare? The fact that firms engage in severe competition is, of course, good news for the consumers. That is, consumers not only benefit directly because of the firms' focus on them, but also indirectly because of more intense retail rivalry that ensues with hybrids. As a consequence, under the optimal hybrid structure identified in Proposition 4, consumer surplus is always greater than that obtained with profit-maximizing (i.e., $\beta_i = 0$) firms. In fact, the gain in consumer surplus is sufficiently pronounced that it more than offsets any losses firms suffer due to the intense competition. Thus, the standard welfare metric, the sum of firm profits and consumer surplus, is greater under the optimal hybrid structure.

Second, how does the aggressive stance communicated by a hybrid structure (wherein firm i places a β_i-weight on consumer surplus) contrast with that communicated by the delegated structure proposed by Fershtman and Judd (1987) (wherein firm i places a γ_i-weight on revenues)? To see the possible difference between the two forms of strategic posturing crisply, note that this paper's β-hybrid formulation applies unchanged if the modeled uncertainty pertains to the demand intercept and firm costs are zero; of course, with zero costs, there is no difference between firm profits and revenues, rendering the approach of placing a γ_i-weight on revenues to influence firm aggressiveness meaningless.

Returning to the modeled setting of non-zero costs, note that absent cost uncertainty, the equilibrium outcomes under the β_i-weight on consumer surplus and the γ_i-weight on revenue are identical: in each case, firm quantities are $2[a-\bar{c}]/5$ and firm profits are $2[a-\bar{c}]^2/25$ resulting from the optimal choice of $\beta_i = 1/3$ and $\gamma_i = [a-\bar{c}]/[6\bar{c}-a]$, respectively.

With cost uncertainty, however, whether incentives are provided via the β_i-weight on consumer surplus or the γ_i-weight on revenue has differing equilibrium implications and, depending on parameters, either can yield more "high powered" incentives. To see this, consider the familiar private-value information case with homogenous products (i.e., $r = 0$ and $k = 1$). With $r = 0$, both firms disclose even as profit-maximizing entities, and so this is also the disclosure outcome whether the firms are formulated as hybrids or as delegated structures. Thus, in this setting, firm quantities and profits under the hybrid and delegated structures differ only due to the degree that they create divergent incentives for the firms to be aggressive in competition. In particular, the optimal weights and expected profits under the two arrangements are as follows:

	Optimal Weights	**Expected Firm Profit**
Hybrid Structure	$\dfrac{[a-\bar{c}]^2 + 2\sigma^2}{3\left[(a-\bar{c})^2 + \sigma^2\right]}$	$\dfrac{2\left[(a-\bar{c})^2+\sigma^2\right]\left[(a-\bar{c})^4 + 8(a-\bar{c})^2\sigma^2 + 6\sigma^4\right]}{\left[5(a-\bar{c})^2 + 4\sigma^2\right]^2}$
Delegated Structure	$\dfrac{a\bar{c} - [\bar{c}^2 + 2\sigma^2]}{6[\bar{c}^2+\sigma^2] - a\bar{c}}$	$\dfrac{1}{9[5\bar{c}^2+4\sigma^2]^2}\Big\{a^2\left[18\bar{c}^4 + 35\bar{c}^2\sigma^2 + 16\sigma^4\right] - 36a\bar{c}\left[\bar{c}^2+\sigma^2\right]^2 + 18\left[\bar{c}^6 + 9\bar{c}^4\sigma^2 + 14\bar{c}^2\sigma^4 + 6\sigma^6\right]\Big\}$

Notice that for $a = 6$ and $\sigma^2 = 1$, firm profits are greater under the hybrid structure for $\bar{c} = 3$, while for $\bar{c} = 2$, firm profits are greater under the delegated arrangement, confirming that the results can go in either direction. This suggests that in the presence of uncertainty and disclosure, the issue of incentives, including the design of corporate structures that embody optimal deviations from profit-maximization, is not a clear-cut issue and one that warrants further study.

V. CONCLUSION

Many view the presence of social enterprises and other hybrid entities in traditionally hyper-competitive industries with skepticism—seeing it as either lip service or a marketing ploy to boost brand recognition. Yet the growth and persistence of hybrid firms that have an explicit mission reaching beyond pure profit signals a more complex competitive ecosystem at work.

In this paper, we examine the consequences of hybrid entities on competition and their concomitant effect on disclosure practices. The paper provides two key takeaways. First, a focus on consumers facilitates a firm's voluntary disclosures of decision-relevant cost information, but stifles those of its rival's. Second, a viable industry equilibrium can entail firms deviating from pure profit-maximizing behavior toward an objective where they also value the surplus that they generate for their consumers. Beyond demonstrating that an entity's focus on consumers boosts its own, and dampens its competitors', incentives for voluntary disclosure, we also show that such structures can be part of a viable industry equilibrium. Future work could consider how this more complex ecosystem of competition and disclosure may have implications for the development of internal accounting systems and/or the regulatory environment that oversees disclosure in light of the varied firm types that make up many industries.

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APPENDIX A

Proofs

Proof of Lemma 1

Under regime (d, d), the firms' quantity decisions are represented in (1). The solution obtained from solving the two first-order conditions associated with these problems, with each firm's conjecture of its rival's strategy holding true in equilibrium, are presented in (2). Using $q_i^{dd}(\cdot)$ from (2) in $u_i(\cdot)$ and $\pi_i(\cdot)$, and taking expectations over δ_1 and δ_2, yields expected utility, $U_i^{dd}(\beta_1, \beta_2)$, and expected profit, $\Pi_i^{dd}(\beta_1, \beta_2)$, respectively.

Proof of Lemma 2

Under regime (d, ϕ), the firms' quantity decisions are represented in (5). The solution obtained from solving the two first-order conditions associated with these problems, with each firm's conjecture of its rival's strategy holding true in equilibrium, are presented in (6). Using $q_i^{d\phi}(\cdot)$ from (6) in $u_i(\cdot)$ and $\pi_i(\cdot)$, and taking expectations over δ_1 and δ_2, yields expected utility, $U_i^{d\phi}(\beta_1, \beta_2)$, and expected profit, $\Pi_i^{d\phi}(\beta_1, \beta_2)$, respectively.

Proof of Lemma 3

Under regime (ϕ, ϕ) the firms' quantity decisions are represented in (7). The solution obtained from solving the two first-order conditions associated with these problems, with each firm's conjecture of its rival's strategy holding true in equilibrium, are presented in (8). Using $q_i^{\phi\phi}(\cdot)$ from (8) in $u_i(\cdot)$ and $\pi_i(\cdot)$, and taking expectations over δ_1 and δ_2, yields expected utility, $U_i^{\phi\phi}(\beta_1, \beta_2)$, and expected profit, $\Pi_i^{\phi\phi}(\beta_1, \beta_2)$, respectively.

Proof of Proposition 1

Given β_1 and β_2, and taking firm 2's disclosure policy as given, firm 1 will disclose if and only if its expected utility from disclosure (weakly) exceeds its expected utility from non-disclosure.

First, given firm 2 discloses, firm 1 discloses if and only if:

$$U_1^{dd}(\beta_1, \beta_2) \geq U_1^{\phi d}(\beta_1, \beta_2).$$

Substituting for the utility values from Lemmas 1 and 2 and simplifying, firm 1 discloses if and only if:

$$r \leq \frac{[2-\beta_2]k}{2[2-\beta_1]}.$$

Next, given firm 2 withholds, firm 1 discloses if and only if:

$$U_1^{d\phi}(\beta_1, \beta_2) \geq U_1^{\phi\phi}(\beta_1, \beta_2).$$

Substituting the utility values from Lemmas 2 and 3 and simplifying, again, firm 1 discloses if and only if:

$$r \leq \frac{[2-\beta_2]k}{2[2-\beta_1]}.$$

The disclosure decision for firm 2 is analogous. Thus, independent of the other firm's disclosure policy, firm i discloses if and only if $r \leq \frac{[2-\beta_j]k}{2[2-\beta_i]}$. Noting that $r \leq \frac{[2-\beta_j]k}{2[2-\beta_i]}$ is equivalent to $\beta_i \geq 2 - \frac{k}{2r}\left[2-\beta_j\right]$ establishes the proof.

Proof of Corollary 1

The proof of the corollary follows the arguments presented in Lemmas 1–3 and Proposition 1, with the only change that $c_i = \bar{c} - \delta_i - r_j\delta_j$.

Proof of Corollary 2

By setting $\beta_1 = \beta_2 = 0$ in the threshold derived in Proposition 1, we get the disclosure condition for this scenario as $r \leq k/2$.

Proof of Proposition 2

From Proposition 1, accounting for both firms' disclosure policies, the expected profit of firm 1 as a function of β_1 is as follows:

$$\text{Expected profit for Firm 1} = \begin{cases} \Pi_1^{dd}(\beta_1, 0) \text{ for } r \leq k/2 \text{ and } \beta_1 \leq 2 - 4r/k \\ \Pi_1^{d\phi}(\beta_1, 0) \text{ for } r \leq k/2 \text{ and } \beta_1 > 2 - 4r/k \\ \Pi_1^{d\phi}(\beta_1, 0) \text{ for } r > k/2 \text{ and } \beta_1 \geq 2 - k/r \\ \Pi_1^{\phi\phi}(\beta_1, 0) \text{ for } r > k/2 \text{ and } \beta_1 < 2 - k/r. \end{cases}$$

The proposition is proved by comparing these four expected profit values with their corresponding benchmark values for $\beta_1 = \beta_2 = 0$. In particular, in the benchmark case, from Corollary 2, both firms disclose for $r \leq k/2$ and do not disclose for $r > k/2$. Thus, the benchmark for comparison of profit for firm 1 is $\Pi_1^{dd}(0,0)$ for $r \leq k/2$ and $\Pi_1^{\phi\phi}(0,0)$ for $r > k/2$.

(i) Consider $r \leq k/2$ and $\beta_1 \leq 2 - 4r/k$. We establish part (i) by noting that the expression $\Pi_1^{dd}(\beta_1, 0) - \Pi_1^{dd}(0,0)$ is concave in β_1, and that solving $\Pi_1^{dd}(\beta_1, 0) - \Pi_1^{dd}(0,0) = 0$ for β_1 gives two roots, namely, $\beta_1 = 0$ and $\beta_1 = \frac{2\left[\alpha^2(2-k)+2\sigma^2(1-r[k-r])\right]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]}$. For β_1 values that fall between these two roots, as long as the condition $\beta_1 \leq 2 - 4r/k$ is satisfied, $\Pi_1^{dd}(\beta_1, 0) - \Pi_1^{dd}(0,0) > 0$ is satisfied. Hence, for $0 < \beta_1 \leq \min\left\{2 - \frac{4r}{2}, \frac{2\left[\alpha^2(2-k)+2\sigma^2(1-r[k-r])\right]k^2}{\alpha^2[4-k^3]+2\sigma^2[2(1+r^2)-rk^3]}\right\}$, $\Pi_1^{dd}(\beta_1, 0) - \Pi_1^{dd}(0,0) > 0$.

(ii) Consider $r \leq k/2$ and $\beta_1 > 2 - 4r/k$. We establish part (ii) by noting the expression $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{dd}(0,0)$ is concave in β_1, and $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{dd}(0,0) = 0$ yields two roots in β_1. Either the roots are both real or they are both imaginary. In the imaginary case, $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{dd}(0,0) < 0$. In the real case, the smaller root is less than $2 - 4r/k$ and the larger root, denoted $\beta^\dagger$, is less than 1. Hence for $2 - 4r/k < \beta_1 \leq \beta^\dagger$, $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{dd}(0,0) > 0$.

(iii) Consider $r > k/2$ and $\beta_1 < 2 - k/r$. We establish part (iii) by noting the expression $\Pi_1^{\phi\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0)$ is concave in β_1, and $\Pi_1^{\phi\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0) = 0$ yields two roots, namely, $\beta_1 = 0$ and $\beta_1 = \frac{8\alpha^2[2-k]k^2}{4\alpha^2[4-k^3]+\sigma^2[4-k^2]^2}$. For β_1 values that fall between these two roots, as long as the condition $\beta_1 < 2 - k/r$ is satisfied, $\Pi_1^{\phi\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0) > 0$. Hence, for:

$$0 < \beta_1 < \min\left\{2 - k/r,\ \frac{8\alpha^2[2-k]k^2}{4\alpha^2[4-k^3] + \sigma^2[4-k^2]^2}\right\},\ \Pi_1^{\phi\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0) > 0.$$

(iv) Consider $r > k/2$ and $\beta_1 \geq 2 - k/r$. We establish part (iv) by noting the expression $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0)$ is concave in β_1, and $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0) = 0$ yields two roots in β_1. Either the roots are both real or they are both imaginary. In the imaginary case, $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0) < 0$. In the real case, the smaller root is less than $2 - k/r$ and larger root, denoted $\beta^{\ddagger}$, is less than 1. Hence, for $2 - k/r \leq \beta_1 \leq \beta^{\ddagger}$, $\Pi_1^{d\phi}(\beta_1, 0) - \Pi_1^{\phi\phi}(0,0) \geq 0$.

Proof of Proposition 3

For an exogenously specified disclosure regime, we first identify the interior β_1-value that maximizes the expected profit of firm 1. This is done by setting the appropriate first-order condition to zero (the appropriate second-order conditions are satisfied):

Regime (d, d): solving $\frac{d\Pi_1^{dd}(\beta_1,0)}{d\beta_1} = 0$ yields the unique root $\beta_1 = \beta_1'^{dd}$.

Regime (d, ϕ): solving $\frac{d\Pi_1^{d\phi}(\beta_1,0)}{d\beta_1} = 0$ yields the unique root $\beta_1 = \beta_1'^{d\phi}$.

Regime (ϕ, ϕ): solving $\frac{d\Pi_1^{\phi\phi}(\beta_1,0)}{d\beta_1} = 0$ yields the unique root $\beta_1 = \beta_1'^{\phi\phi}$.

Regime (ϕ, d): given $\beta_1 \geq \beta_2 = 0$, from Proposition 1, regime (ϕ, d) does not arise in equilibrium.

We now propose an equilibrium in which there are r-cutoffs, $\underline{r}'$ and $\bar{r}'$, such that the disclosure regimes are (d, d), (d, ϕ), and (ϕ, ϕ) in the r-regions separated by the two cutoffs, with firm 1's β-choice being the β-values characterized above for the corresponding regimes.

We establish the proposed equilibrium r-cutoffs by initially assuming that the above derived β-values indeed lead to the regimes whose expected profits they purport to maximize. Subsequently, we establish that is indeed the case in equilibrium.

We note a unique r-value in (0, 1) solves $\Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right) - \Pi_1^{dd}\left(\beta_1'^{dd}, 0\right) = 0$; denote this r-value by $\underline{r}'$. The existence and uniqueness of $\underline{r}'$ is established by the observations that $\Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right) - \Pi_1^{dd}\left(\beta_1'^{dd}, 0\right)$ is concave in r, that $\Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right) - \Pi_1^{dd}\left(\beta_1'^{dd}, 0\right)|_{r=0} < 0$, and $\Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right) - \Pi_1^{dd}\left(\beta_1'^{dd}, 0\right)|_{r=k/2} > 0$. Thus, $\underline{r}' \in (0, k/2)$ represents the r-cutoff above which firm 1 prefers regime (d, ϕ) to regime (d, d).

Also, a unique r-value in (0, 1) solves $\Pi_1^{\phi\phi}\left(\beta_1'^{\phi\phi}, 0\right) - \Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right) = 0$; denote this r-value by $\bar{r}'$. The existence and uniqueness of $\bar{r}'$ is established by the observations $\Pi_1^{\phi\phi}\left(\beta_1'^{\phi\phi}, 0\right) - \Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right)$ is concave in r, $\Pi_1^{\phi\phi}\left(\beta_1'^{\phi\phi}, 0\right) - \Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right)|_{r=k/2} < 0$, and $\Pi_1^{\phi\phi}\left(\beta_1'^{\phi\phi}, 0\right) - \Pi_1^{d\phi}\left(\beta_1'^{d\phi}, 0\right)|_{r=1} > 0$. Thus, $\bar{r}' \in (k/2, 1)$ represents the r-cutoff above which firm 1 prefers regime (ϕ, ϕ) to regime (d, ϕ).

Finally, the proof of the equilibrium is completed by establishing the chosen β-values indeed lead to the presumed disclosure regimes.

(i) $\beta_1 = \beta_1'^{dd}$ and $\beta_2 = 0$ for $r \leq r'$ leads to regime (d, d): the required condition for regime (d, d) to be sustained as equilibrium is $\beta_1'^{dd} < 2 - \frac{4r}{k}$. This condition ensures firm 2 discloses and, from Proposition 1, it implies that firm 1 also discloses. The proof then follows from the fact that $2 - \frac{4r}{k} - \beta_1'^{dd}$ is a decreasing function of r and $2 - \frac{4r}{k} - \beta_1'^{dd}|_{r=\underline{r}'} > 0$.

(ii) $\beta_1 = \beta_1'^{d\phi}$ and $\beta_2 = 0$ for $r \in (\underline{r}', \bar{r}']$ leads to regime (d, ϕ): the required conditions $\beta_1'^{d\phi} > 2 - \frac{4r}{k}$ and $\beta_1'^{d\phi} > 2 - \frac{k}{r}$ for regime (d, ϕ) to be sustained as equilibrium follow from noting that (a) $\beta_1'^{d\phi} - 2 + \frac{4r}{k}$ is an increasing function of r and $\beta_1'^{d\phi} - 2 + \frac{4r}{k}|_{r=\underline{r}'} > 0$, and that (b) $\beta_1'^{d\phi} - 2 + \frac{k}{r}$ is a decreasing function of r and $\beta_1'^{d\phi} - 2 + \frac{k}{r}|_{r=\bar{r}'} > 0$.

(iii) $\beta_1 = \beta_1'^{\phi\phi}$ and $\beta_2 = 0$ for $r > \bar{r}'$ leads to regime (ϕ, ϕ): the required condition for regime (ϕ, ϕ) to be sustained as equilibrium is $\beta_1'^{\phi\phi} < 2 - \frac{k}{r}$. This condition ensures firm 1 does not disclose and, from Proposition 1, it implies that firm 2 also does not disclose. The proof then follows from the fact that $\beta_1'^{\phi\phi} - 2 + \frac{k}{r}$ is a decreasing function of r and $\beta_1'^{\phi\phi} - 2 + \frac{k}{r}|_{r=\bar{r}'} < 0$.

Proof of Corollary 3

The proof follows directly from comparing the firm's r-thresholds for disclosure in Corollary 2 and Proposition 3.

Proof of Proposition 4

For an exogenously specified disclosure regime, we first identify the interior β-value that maximizes the expected profit for each firm. This is done by setting the appropriate first-order condition to zero (the appropriate second-order conditions are satisfied):

Regime $(d,\ d)$: solving firm i's first order condition $\frac{d\Pi_i^{dd}(\beta_1,\beta_2)}{d\beta_i}=0$ yields:

$$\beta_i^{dd}\left(\beta_j\right)=\frac{2k^2\left[\alpha^2\left(2-\beta_j-k\right)+\sigma^2\left(\left[1-2rk+r^2\right]+\left[1-\beta_j\right]\left[1+r^2\right]\right)\right]}{\alpha^2\left[\left(2-\beta_j\right)\left(4-k^2\right)-k^3\right]+\sigma^2\left[\left(2-\beta_j\right)\left(4-k^2\right)\left(1+r^2\right)-2rk^3\right]}.$$

Solving $\beta_1^{dd}(\beta_2)=\beta_1$ and $\beta_2^{dd}(\beta_1)=\beta_2$ for $(\beta_1,\ \beta_2)$ yields $\beta_1=\beta_1^{*dd}$ and $\beta_2=\beta_2^{*dd}$, where $\beta_1^{*dd}=\beta_2^{*dd}$.

Regime $(d,\ \phi)$: solving firm 1's first order condition $\frac{d\Pi_1^{d\phi}(\beta_1,\beta_2)}{d\beta_1}=0$ yields $\beta_1^{d\phi}(\beta_2)=\frac{2k^2\left[\alpha^2(2-\beta_2-k)+\sigma^2(2-\beta_2-rk)\right]}{\alpha^2[(2-\beta_2)(4-k^2)-k^3]+\sigma^2[(2-\beta_2)(4-k^2)-rk^3]}$; similarly, solving firm 2's first order condition yields:

$$\beta_2^{d\phi}(\beta_1)=\frac{8k^2[\alpha^2(2-\beta_1-k)+\sigma^2r([2-\beta_1]r-k)]}{4\alpha^2[(4-k^2)(2-\beta_1)-k^3]+\sigma^2\left[(2-\beta_1)(4-k^2)^2+4(2-\beta_1)(4-k^2)r^2-4rk^3\right]}.$$

Solving $\beta_1^{d\phi}(\beta_2)=\beta_1$ and $\beta_2^{d\phi}(\beta_1)=\beta_2$ for $(\beta_1,\ \beta_2)$ yields $\beta_1=\beta_1^{*d\phi}$ and $\beta_2=\beta_2^{*d\phi}$, where $\beta_1^{*d\phi}>\beta_2^{*d\phi}$.

Regime $(\phi,\ \phi)$: solving firm i's first order condition $\frac{d\Pi_i^{\phi\phi}(\beta_1,\beta_2)}{d\beta_i}=0$ yields $\beta_i^{\phi\phi}\left(\beta_j\right)=\frac{8\alpha^2k^2\left[2-\beta_j-k\right]}{4\alpha^2\left[\left(2-\beta_j\right)(4-k^2)-k^3\right]+\sigma^2\left[2-\beta_j\right][4-k^2]^2}$. Solving $\beta_1^{\phi\phi}(\beta_2)=\beta_1$ and $\beta_2^{\phi\phi}(\beta_1)=\beta_2$ for $(\beta_1,\ \beta_2)$ yields $\beta_1=\beta_1^{*\phi\phi}$ and $\beta_2=\beta_2^{*\phi\phi}$, where $\beta_1^{*\phi\phi}=\beta_2^{*\phi\phi}$.

Regime $(\phi,\ d)$: given $\beta_1\geq\beta_2$, from Proposition 1, regime $(\phi,\ d)$ does not arise in equilibrium.

We now propose an equilibrium in which there are r-cutoffs, $\underline{r}^*$ and $\bar{r}^*$, such that the disclosure regimes are $(d,\ d)$, $(d,\ \phi)$, and $(\phi,\ \phi)$ in the r-regions separated by the two cutoffs, with the firms' β-choices being the β-values characterized above for the corresponding regimes.

We establish the proposed equilibrium r-cutoffs by initially assuming that the above derived β-values indeed lead to the regimes whose expected profits they purport to maximize. Subsequently, we establish that is indeed the case in equilibrium.

We note that a unique r-value in (0, 1) solves: $f(r)\equiv\Pi_2^{dd}\left(\beta_1^{*dd},\beta_2^{*dd}\right)-\Pi_2^{d\phi}\left(\beta_1^{*dd},\beta_2^{d\phi}\left(\beta_1^{*dd}\right)\right)=0$; denote this r-value by $\underline{r}^*$. The existence and uniqueness of $\underline{r}^*$ is established by the observations $f(0)>0, f\left(\frac{k}{2}\right)<0$, and $\frac{df(r)}{dr}<0$ for all $r\in[0,1]$. Thus, $\underline{r}^*\in(0,k/2)$ represents the r-cutoff above which firm 2 prefers regime $(d,\ \phi)$ to regime $(d,\ d)$. This ensures that $(d,\ d)$ is an equilibrium for $r\leq\underline{r}^*$.

We note that a unique r-value in (0,1) solves $g(r)\equiv\Pi_1^{\phi\phi}\left(\beta_1^{*\phi\phi},\beta_2^{*\phi\phi}\right)-\Pi_1^{d\phi}\left(\beta_1^{d\phi}\left(\beta_2^{*\phi\phi}\right),\beta_2^{*\phi\phi}\right)=0$; denote this r-value by $\bar{r}^*$. The existence and uniqueness of $\bar{r}^*$ is established by the observations $g\left(\frac{k}{2}\right)<0$, $g(1)>0$, and $\frac{dg(r)}{dr}>0$ for all $r\in[0,1]$. Thus, $\bar{r}^*\in(k/2,1)$ represents the r-cutoff below which firm 1 prefers regime $(d,\ \phi)$ to regime $(\phi,\ \phi)$. This ensures that $(\phi,\ \phi)$ is an equilibrium for $r>\bar{r}^*$.

In the interval $\underline{r}^*\leq r\leq\bar{r}^*$, $(d,\ \phi)$ is an equilibrium. This is established by noting:

$\Pi_1^{d\phi}\left(\beta_1^{*d\phi},\beta_2^{*d\phi}\right)>\Pi_1^{\phi\phi}\left(\beta_1^{\phi\phi}\left(\beta_2^{*d\phi}\right),\beta_2^{*d\phi}\right)$ for all $r\in(\underline{r}^*,\bar{r}^*]$ and

$\Pi_2^{d\phi}\left(\beta_1^{*d\phi},\beta_2^{*d\phi}\right)>\Pi_2^{dd}\left(\beta_1^{*d\phi},\beta_2^{dd}\left(\beta_1^{*d\phi}\right)\right)$ for all $r\in(\underline{r}^*,\bar{r}^*]$.

Finally, the proof of the equilibrium is completed by establishing the chosen β-values indeed lead to the presumed disclosure regimes.

(i) $\beta_1=\beta_1^{*dd}$ and $\beta_2=\beta_2^{*dd}$ for $r\leq\underline{r}^*$ leads to regime $(d,\ d)$: the required condition for regime $(d,\ d)$ to be sustained in equilibrium is (since $\beta_1^{*dd}=\beta_2^{*dd}$): $\beta_i^{*dd}>2-\frac{k\left(2-\beta_i^{*dd}\right)}{2r}$. The proof then follows from the observations $\underline{r}^*<k/2$ and:

$$\beta_i^{*dd}-\left[2-\frac{k\left(2-\beta_i^{*dd}\right)}{2r}\right]=\frac{\left[\frac{k}{2}-r\right]\left[(\alpha^2+2r\sigma^2)k^3+4(2-k^2)(\alpha^2+\sigma^2[1+r^2])\right]}{r[4-k^2][\alpha^2+\sigma^2(1+r^2)]}>0.$$

(ii) $\beta_1=\beta_1^{*d\phi}$ and $\beta_2=\beta_2^{*d\phi}$ for $r\in(\underline{r}^*,\bar{r}^*]$ leads to regime $(d,\ \phi)$: the required conditions for regime $(d,\ \phi)$ to be sustained in equilibrium are $\beta_2^{*d\phi}<2-\frac{k\left[2-\beta_1^{*d\phi}\right]}{2r}$ and $\beta_1^{*d\phi}>2-\frac{k\left[2-\beta_2^{*d\phi}\right]}{2r}$ or, equivalently, $r>\frac{k\left[2-\beta_1^{*d\phi}\right]}{2\left[2-\beta_2^{*d\phi}\right]}$ and $r<\frac{k\left[2-\beta_2^{*d\phi}\right]}{2\left[2-\beta_1^{*d\phi}\right]}$ for all $r\in(\underline{r}^*,\bar{r}^*]$.

Note that $f\left(\frac{k\left[2-\beta_1^{*d\phi}\right]}{2\left[2-\beta_2^{*d\phi}\right]}\right) > 0$, with the limiting minimum value of 0 as $a \to \infty$. Given that we have already established $f(r)$ is decreasing in r and that $f(\underline{r}^*) = 0$, it follows that: $\frac{k\left[2-\beta_1^{*d\phi}\right]}{2\left[2-\beta_2^{*d\phi}\right]} < \underline{r}^*$. Hence, $r > \frac{k\left[2-\beta_1^{*d\phi}\right]}{2\left[2-\beta_2^{*d\phi}\right]}$ for all $r > \underline{r}^*$.

Note that $g\left(\frac{k\left[2-\beta_2^{*d\phi}\right]}{2\left[2-\beta_1^{*d\phi}\right]}\right) > 0$ with the limiting minimum value of 0 as $a \to \infty$. Given that we have already established $g(r)$ is increasing in r and that $g(\bar{r}^*) = 0$, it follows that $\frac{k\left[2-\beta_2^{*d\phi}\right]}{2\left[2-\beta_1^{*d\phi}\right]} > \bar{r}^*$. Hence, $r < \frac{k\left[2-\beta_2^{*d\phi}\right]}{2\left[2-\beta_1^{*d\phi}\right]}$ for all $r < \bar{r}^*$.

(iii) $\beta_1 = \beta_1^{*\phi\phi}$ and $\beta_2 = \beta_2^{*\phi\phi}$ for $r > \bar{r}^*$ leads to regime (ϕ, ϕ): the required condition for regime (ϕ, ϕ) to be sustained in equilibrium is (since $\beta_1^{*\phi\phi} = \beta_2^{*\phi\phi}$): $\beta_i^{*\phi\phi} < 2 - \frac{k\left[2-\beta_i^{*\phi\phi}\right]}{2r}$. The proof then follows from the observations $\bar{r}^* > k/2$ and:

$$\beta_i^{*\phi\phi} - \left[2 - \frac{k\left[2-\beta_i^{*\phi\phi}\right]}{2r}\right] = -\frac{2\left[r-\frac{k}{2}\right]\left[2(4-k^2)(\alpha^2+\sigma^2)+(4\alpha^2+\sigma^2[4-k^2])k\right]}{r[2+k][4\alpha^2+\sigma^2(4-k^2)]} < 0.$$