Ownership and Competition*

Alessio Piccolo **Jan Schneemeier**

January 31, 2020

Abstract

We develop a model in which the ownership structure and the degree of competition of industry rivals are jointly determined. Competing more aggressively improves an individual firm's performance but has negative externalities for its peers. Two types of investors endogenously arise in equilibrium. *Common owners*, who acquire positions in all firms and decrease competition. *Undiversified investors*, who acquire a position in only one firm and increase competition. As financial markets become more efficient, common ownership increases and competition decreases, which can lead to a disconnect between stock market efficiency and welfare. We derive further testable implications for ownership structure, product market competition, and welfare.

Keywords: common ownership, competition, corporate governance, real effects of financial markets.

JEL Classification: D82, D83, G34.

*Both authors are from Indiana University, Kelley School of Business, Finance Department. Emails: apiccol@iu.edu and jschnee@iu.edu. We thank Liyan Yang and Xiaoyun Yu, and seminar participants at Indiana University and the University of Toronto for valuable comments.

1 Introduction

The last two decades have seen a massive increase in the degree of common ownership.[1] This structural change and its potential implications for firm behavior have attracted the interest of academics and regulators alike.[2] A recent empirical literature finds evidence that a firm's ownership structure influences important corporate actions such as competition in product markets (Azar et al., 2018), managerial incentives (Antón et al., 2018; Gilje et al., 2020), and corporate social responsibility (Dyck et al., 2019). This result is consistent with the idea that firms should primarily maximize shareholder welfare, which might differ from the firms' market values (see e.g., Hart and Zingales, 2017). At the same time, however, a firm's ownership structure itself is the outcome of traders' profit-maximizing behavior, and is thus also affected by the aforementioned corporate actions. While the existing literature has largely focused on the *effects* of common ownership, much less is known about its determinants.

In this paper, we model the two-way interaction between ownership structure and the degree of competition among industry rivals. We show that ex-ante identical investors may choose different portfolios in equilibrium, and only a subset acquires positions in all firms. These *common owners* decrease competition, as they encourage managers to internalize the negative externality to other firms in their portfolios. Higher market liquidity and lower trading costs make it more profitable to invest in multiple firms and, thus, increase common ownership in equilibrium. This leads to an inherent tension between the efficiency of financial markets and the degree of competition in product markets. We derive novel implications for product market outcomes, welfare, and the link between industry characteristics and ownership structure.

We consider a model with two competing firms, each run by a manager. Managers choose effort to maximize *shareholder value*. As a result, the composition of a firm's shareholder base influences its manager's choice of effort. Managerial effort improves an individual firm's performance but has a negative externality on the other firm, which reflects the competition between firms. The novel

[1]For example, Azar et al. (2019) show that five institutions form four out of the top five owners of each large U.S. bank. A similar pattern occurs in other industries (see e.g., Schmalz, 2018; Azar et al., 2018).

[2]As of today, the US Federal Trade Commission, the US department of justice, the OECD, and the European commission have conducted hearings about the potential anti-competitive effects. See Azar and Schmalz (2017) for a summary of the policy debate.

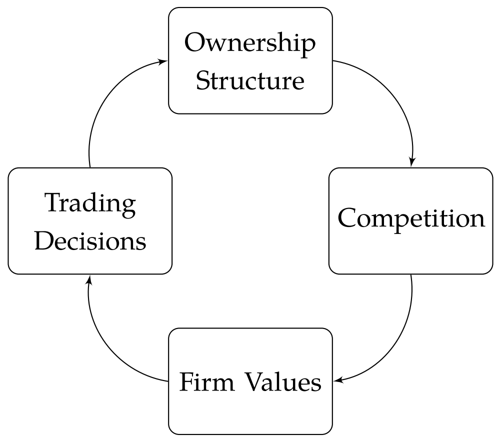


Figure 1: Two-way interaction between ownership and competition.

feature of our setting is that the composition of shareholder portfolios is endogenous. A mass of ex-ante identical informed investors trades against uninformed noise traders and a competitive market maker, in a financial market a' la Kyle (1985). Informed traders have private information about industry-wide and firm-specific shocks to firms' fundamentals. The firm-specific shocks are negatively correlated across firms, capturing shocks to the firms' competitive positions.[3] Informed traders observe their private information and then choose whether to acquire shares in both firms (common owners), only one (undiversified owners), or none.

The strategic interaction between ownership structure and competition is characterized by a two-way feedback. On the one hand, a manager in a firm with a pool of widely-diversified shareholders is less aggressive in its effort provision, to mitigate negative externalities to other firms in its shareholders' portfolios. As a result, common ownership reduces effort and thus competition between firms. On the other hand, informed investors choose their positions optimally, anticipating the effect of ownership on firm value. As a consequence, competition also affects ownership. This two-way interaction is illustrated in Figure 1.

In principle, when the industry-wide shock is positive, that is, when industry fundamentals are high, an informed trader could profit from acquiring shares in both firms, since the market maker is uncertain whether industry fundamentals are high or low. However, the market maker does not

[3]The distribution of the shocks is the same for both firms, even though firms can be ex-ante asymmetric. The assumption of negatively correlated shocks is not necessary for our results, as long as undiversified owners can achieve some degree of coordination in the choice of the stock they acquire.

have information about the firm-specific shock either. As a consequence, the shares of the firm for which the firm-specific shock was negative may be in expectation overvalued, making it not worth buying for informed traders. The equilibrium degree of common ownership is then pinned down by the trading profits of acquiring shares of the firm for which the firm-specific shock is negative.

Suppose firm A has slightly higher fundamentals and a subset of investors acquires shares only in firm A, making its ownership more undiversified and increasing A's effort. As the fraction of undiversified owners in firm A increases, there are two contrasting effects on the trading profits of acquiring shares in firm B. On the one hand, A's effort increases and, thus, B's value decreases via the negative externality between firms. On the other hand, fewer investors trade shares of firm B, which pushes its expected stock price down. The fact that these two effects move in opposite directions generates a rich equilibrium characterization. For example, trading in firm B may be profitable only when the fraction of undiversified owners in firm A is either small or large. In this case, multiple equilibria arise, one with a high level of common ownership and one with a low level of common ownership. It is worth emphasizing that informed traders are ex-ante identical in the model, i.e. they have the same preferences, trading opportunities, and information sets. Despite this assumption, they might separate in equilibrium, with some investors acquiring shares in both firms and others only in one.[4]

The joint determination of ownership and competition offers a rich set of novel results. First, we highlight a tension between the efficiency of financial markets and product market competition. When markets become more efficient (transaction costs go down and market liquidity goes up), the mass of common owners increases and, as a result, the degree of competition is reduced. This result is intuitive: when financial markets become more efficient, trading in multiple stock markets becomes cheaper or more profitable. As a result, common ownership becomes more attractive. We study the welfare and product market implications of this tension by embedding our model in two traditional IO (Industrial Organization) frameworks. We consider both a setting with a

[4]This result is intriguing, given the empirical finding that many firms are jointly held by investors with vastly different individual portfolios. Cvijanović et al. (2016) and He et al. (2019) study the heterogeneity in preferences of mutual funds that follow from differences in common ownership and conflicts of interest. Our analysis highlights that this phenomenon can be explained without any additional sources of heterogeneity among investors.

homogeneous product and competition in quantities and one with differentiated products and competition in prices. In both settings, common ownership incentivizes firms to compete less aggressively with each other, which in turn reduces consumer surplus. Perhaps surprisingly, we show that a reduction in trading costs or an increase in market liquidity can *decrease* total welfare. A reduction in trading costs has two contrasting effects. On the one hand, it reduces the costs traders incur to participate in the financial market, which has a positive effect on welfare. On the other hand, however, it also increases the equilibrium degree of common ownership, which in turn lowers industry output and consumer surplus. The net impact of these two opposing forces is ambiguous and depends on their relative magnitudes. A similar intuition holds for an increase in market liquidity.

Second, we find that similar firms may end up with different ownership structures and different values in equilibrium. There are two reasons why this may occur. First, even when firms have the same fundamentals, a subset of investors may target only one firm. The fraction of undiversified investors in the *targeted* firm is then larger than in its peers, and this firm competes more aggressively in the product market. This leads to higher profit and firm value for the targeted firm. Second, due to strategic complementarities across traders, we can have multiple equilibria. For example, both equilibria with high and low common ownership may arise for the same firm. In equilibria with large common ownership, firms compete less and, as a result, industry profits are larger. However, traders do not use their private information about the firms' relative competitive positions. This reduces the degree of informational asymmetry in the market and can bring share prices, on average, closer to fundamentals. As a result, trading profits may be larger in equilibria where common ownership is lower. This result is intriguing, since a typical narrative about common ownership is that it benefits investors, by softening competition between firms (see e.g., Posner et al., 2017).

Third, we establish novel links between industry characteristics and firms' ownership structure. We show that when industry-wide shocks are relatively more important compared to firm-specific fundamentals, the degree of common ownership is higher. Even when the effect of firm-specific shocks is negligible, we find that equilibria with a positive mass of undiversified investors are still possible, as long as the externality between firms is sufficiently large. This implies that, when firms are sufficiently homogeneous, common owners tend to concentrate in industries where negative externalities between firms are small. This result is in contrast with the idea that common ownership arises as a way to soften competition in highly competitive industries. We discuss the implications of our results for empirical work on common ownership in Section 5.

Our paper contributes to the growing literature on ownership structure and its impact on firm decisions. Edmans et al. (2019) study a model in which a large activist investor holds positions in multiple firms. They show that common ownership can strengthen governance because it increases price informativeness. In our paper, competition between firms leads common owners to internalize negative externalities of governance/effort. Moreover, investors' portfolios are endogenous, which allows us to study the equilibrium interactions between common owners and undiversified owners. López and Vives (2019) study an oligopoly setting with overlapping ownership and R&D spill-overs. They show that common ownership can increase welfare if these spill-overs are sufficiently large. We study the determinants and welfare consequences of common ownership in a setting with negative externalities.

Ownership is endogenous in Admati et al. (1994), who analyze the impact of an activist investor on the trade-off between risk-sharing and the free-rider problem. However, they do not model competition among firms and look at the interaction between a large investor and a mass of small diversified investors. Levit et al. (2020) investigate the interaction between ownership structure and shareholders' voting behavior, in a setting with one firm and heterogeneous investors. Strategic complementarities in voting and trading lead to multiple equilibria, which means that similar firms may end up with different shareholder bases and, thus, different decisions. This is similar to our finding that multiple ownership structures (with different degrees of common ownership) may arise as equilibrium outcomes. Investors are ex-ante identical in our setting but may choose to hold different portfolios ex-post.[5]

[5] There is also a recent literature on the role of passive investors on governance (Baker et al., 2020; Corum et al., 2020) and price efficiency (Buss and Sundaresan, 2020). Common owners in our model weaken governance and thus play a similar role to passive investors. However, we study the equilibrium composition of common owners and undiversified investors, which is fixed in these papers.

We also contribute to the theoretical literature on the real effects of financial markets (Bond et al., 2012). One strand of this literature highlights the positive impact of informative stock prices on firm's investment decisions (see e.g., Foucault and Frésard, 2012, 2014; Bond and Goldstein, 2015; Bai et al., 2016). We contribute to this literature by highlighting a potential cost associated with more efficient financial markets: a decrease in transaction costs and (under certain conditions) an increase in market liquidity increase the incentives to become common owners. This leads to less competition and lower welfare, which is consistent with the theoretical findings in Dow and Gorton (1997) and Heinle et al. (2018) that financial efficiency and real efficiency can be disconnected.

The rest of the paper is organized as follows. Section 2 describes the basic model. In Section 3, we describe the equilibrium effort levels and share prices, and characterize the equilibrium composition of ownership. Section 4 extends the main model and studies the implications of our analysis for product market outcomes and welfare in two traditional IO frameworks. Section 5 discusses the empirical implications of the model and Section 6 concludes. Detailed proofs are presented in the Appendix.

2 Model Setup

The model consists of two dates, $t \in \{1, 2\}$, and two publicly traded firms, $j \in \{A, B\}$. The two firms compete against each other in a product market. Both firms are run by a manager and owned by three different categories of investors: (i) inside owners, who hold a constant fraction of shares in each period; (ii) liquidity traders, who buy shares for investment purposes but will have to sell shares when unexpected events occur; and (iii) informed traders, who have information about the firms' future value and make money by trading on this information.

At date $t = 1$, liquidity traders, informed traders, and a competitive market maker for each firm trade shares of the two firms in a financial market. We show that there might be two types of informed traders in equilibrium. The first type acquires a position in both firms, while the second type only invests in one of the two firms. We will refer to the former as *common owners* (c) and to the latter as *undiversified owners* (u). At date $t = 2$, managers choose their effort levels; the firms' terminal values then realize and are distributed to shareholders. All agents in the model are rational and risk-neutral. For simplicity, we assume that there is no discounting and, therefore, the timing of payments is immaterial. Figure 2 provides a timeline of the main events in the model.

t = 1

1. shocks (x_d, x_κ) realize;
2. traders submit market orders y_{ij};
3. market maker sets stock price P_j.

t = 2

1. manager exerts effort e_j;
2. firm values Π_j realized.

Figure 2: Timeline for the main model.

2.1 Firm Values and Effort

The firms' terminal values are specified as:

$$\Pi_j = x_d + e_j - \gamma e_{-j} - C\left(e_j, \kappa_j\right). \tag{1}$$

Each firm's value is influenced by two factors. First, there is an industry-wide demand shock, which is captured by the random variable x_d, with $x_d \in \{0, \Delta_\mu\}$ and $\mathbb{P}\left(x_d = \Delta_\mu\right) = \frac{1}{2}$. If $x_d = \Delta_\mu$, product demand is high and both firms' values increase by a constant amount $\Delta_\mu > 0$. Second, each firm's value also depends on the effort choices (e_j, e_{-j}) of *both* managers, which captures the strategic interaction between the two firms. A firm's value increases with the effort exerted by its own manager and decreases with the effort exerted by the other firm's manager. The constant $\gamma \geq 0$ measures the extent of this negative externality and can be interpreted as a proxy for the degree of competition between the firms (e.g., the degree of substitutability of their products). Equation (1) captures competition in a general, reduced-form way. In Section 4, we consider two traditional frameworks in the IO literature and show that our main results continue to hold in both settings.[6]

The cost of effort is captured by $C\left(e_j, \kappa_j\right)$. To obtain closed-form solutions, we assume a tractable quadratic functional form and set $C(e_j, \kappa_j) = \frac{\kappa_j}{2} e_j^2$. One of the two firms has a competitive

[6]Section 4 considers both a model with price competition and differentiated products and one with homogeneous products and competition in quantities. Since the product market demand is endogenous in these settings, we discuss implications for product market outcomes and social welfare in Section 4.

advantage over the other firm, which is captured by a lower cost of effort $\kappa_j \in \{\underline{\kappa}, \overline{\kappa}\}$ with $\overline{\kappa} > \underline{\kappa} > 0$. The random variable $x_\kappa \in \{0, 1\}$ determines the realization of κ_j and is perfectly negatively correlated across the two firms, with $\mathbb{P}(x_\kappa = 1) = \mathbb{P}(x_\kappa = 0)$.[7] Formally, we let $\kappa_A = x_\kappa \underline{\kappa} + (1 - x_\kappa)\overline{\kappa}$, $\kappa_B = x_\kappa \overline{\kappa} + (1 - x_\kappa)\underline{\kappa}$, and define the difference in costs by $\Delta_\kappa \equiv \overline{\kappa} - \underline{\kappa}$. It is worth mentioning that all our qualitative results continue to hold when we consider the limit $\Delta_\kappa \to 0$. The assumptions of negative correlation for x_κ and $\Delta_\kappa > 0$ are not necessary for our results, as long as undiversified owners can achieve some degree of coordination in the choice of the stock they acquire.[8]

After having observed the realizations of x_d and x_κ, managers choose their effort levels. A manager's effort choice is influenced by the composition of its firm's shareholder base. More specifically, manager j chooses its effort level to maximize a weighted-average future payoff of firm j's shareholders. This specification is similar to López and Vives (2019) and captures different channels through which shareholders can influence managerial decisions, in proportion to their stake in the firm.[9] Examples of these channels include voting (see e.g., Levit and Malenko, 2011; Levit et al., 2020) or exit/voice (see e.g., Edmans and Manso, 2011; Brav et al., 2016). Importantly, the portfolio composition of the firms' shareholders is endogenous in our model. Shareholders may optimally choose to hold different portfolios in equilibrium, which leads to potentially diverging interests. Formally, we specify the manager's effort choice as follows:

$$\max_{e_j} U_j \equiv \Pi_j + \frac{n_j^c}{n_j^c + n_j^u + n_j^\iota} \Pi_{-j}. \tag{2}$$

In this expression: n_j^u and n_j^c denote the mass of undiversified owners and common owners in firm j, respectively; n_j^ι denotes the mass of inside owners in firm j. Equation (2) represents a weighted average of firm j's shareholders' future payoff, where the weights are proportional to the fraction of total shares owned by each category of owners.[10] Undiversified owners and inside owners hold shares only in firm j and receive a portfolio payoff equal to Π_j. Common owners

[7]Note that we could add a constant firm-specific term to the expression for Π_j in equation (1), so that the two firms are ex-ante asymmetric. This constant does not affect the traders' returns because it is priced-in by the market maker.

[8]An alternative way to achieve coordination among undiversified owners would be to consider correlated equilibria, as in Bergemann and Morris (2016). If undiversified investors cannot coordinate and $\Delta_\kappa = 0$, then $\Pi_A = \Pi_B$ and all investors choose to be common owners in equilibrium.

[9]This is also the classic approach of modeling overlapping ownership in the industrial organization literature (see e.g., Gilo et al., 2006).

[10]We assume that liquidity traders and market makers do not engage in governance and, as a result, do not influence the managers' decisions, even though they may hold shares of the firms. This simplifies the analysis but does not affect our qualitative results.

hold one share in both firms and receive a portfolio payoff equal to $\Pi_j + \Pi_{-j}$. It follows that, as n_j^c increases, the manager internalizes more the negative impact of e_j on the other firm's value. As a result, an increase in common ownership reduces the manager's incentive to exert effort.

To simplify the exposition, we assume that the mass of inside owners in each firm is the same, that is, $n_j^\iota = n_{-j}^\iota = \beta > 0$. Therefore, any difference in the ownership composition of the two firms comes from the portfolio choices of the informed traders.

2.2 Financial Market

We model the trading stage at $t = 1$ in the spirit of Kyle (1985) and consider the following three types of traders. First, a unit continuum of risk-neutral informed traders that are indexed by $i \in [0, 1]$. Each trader privately observes the realization of x_d and x_κ. Traders can buy up to one unit of asset j through market order $y_{ij} \in [0, 1]$.[11] We do not allow for short sales to keep the equilibrium pricing function more compact, but all of our main results are robust to relaxing this assumption. By submitting a buy order all traders incur a proportional trading cost of $\lambda \geq 0$. This cost reflects both direct transactions costs as well as indirect costs, such as borrowing or opportunity costs. All of our main results regarding the determinants of common ownership hold with $\lambda = 0$. We will use the case with $\lambda > 0$ in some of our comparative statics to understand the impact of trading costs on equilibrium common ownership. Formally, trader i solves:

$$\max_{y_{iA}, y_{iB} \in [0,1]^2} U_i \equiv \sum_{j \in \{A,B\}} \mathbb{E}\left[y_{ij} \left(\Pi_j - P_j - \lambda \right) | x_d, x_\kappa \right], \tag{3}$$

where P_j denotes the equilibrium stock price for firm j.

Since traders are atomistic, they do not have price impact and will always trade up to the position limit, if they choose to trade.[12] The second group consists of noise or liquidity traders who collectively demand $z_j \sim U(0, L)$ in each asset. The constant L parameterizes the average demand of these traders, so we can use L as a proxy for market liquidity. To prevent total order

[11]We follow the existing literature, such as Goldstein and Guembel (2008) and Edmans et al. (2015), and assume that traders do not trade when indifferent. The assumption that informed traders face position limits is common in models featuring a continuum of risk-neutral traders (see e.g., Goldstein et al., 2013; Goldstein and Yang, 2019) and can be justified by borrowing constraints.

[12]It follows that informed investors trade $y_{ij} \in \{0, 1\}$ such that we could equivalently assume that the trading cost λ is fixed and not proportional to trade size.

flow from perfectly revealing information, we set $L > 1$. For simplicity, we assume that z_j is uncorrelated with all other random variables, including z_{-j}. The presence of these traders leads to non-fundamental variation in total order flow and renders equilibrium prices non-perfectly revealing. Finally, there is a risk-neutral competitive market maker for each firm, who sets the equilibrium stock price based on total order flow $Y_j \equiv \int_0^1 y_{ij} di + z_j$ to break-even in expectation:[13]

$$P_j = \mathbb{E}\left[\Pi_j | Y_j\right]. \tag{4}$$

We solve the model under the following conjecture about the investors' equilibrium trading strategies, and then verify that this conjecture is satisfied in equilibrium.

Conjecture 1 (Informed investors' strategy) *When the demand shock is low ($x_d = 0$), the informed investors do not participate in the financial market, that is, no informed investor trades either of the two firms. When the demand shock is high ($x_d = \Delta_\mu$), a mass $1 - \chi$ of informed investors only trades shares of the firm with the lower effort cost, i.e., firm A if $x_\kappa = 1$ and firm B if $x_\kappa = 0$, and the remaining mass χ trade shares of both firms.*

When the demand shock is positive, we refer to the fraction $1 - \chi$ of informed investors as undiversified investors (u) and to the remaining fraction as common owners (c). For ease of notation, we refer to the firm that is targeted by $u-$investors as τ ("targeted") and to the other firm as $-\tau$ ("non-targeted").

Assumption 1 (Parametric Assumptions) *We impose the following parameter restrictions:*

1. *The trading cost is sufficiently small, that is, $\lambda \leq \overline{\lambda}$;*
2. *The size of the demand shock Δ_μ is sufficiently large, that is, $\Delta_\mu \geq \overline{\Delta}_\mu$;*

The positive constants $\overline{\Delta}_\mu$ and $\overline{\lambda}$ are given in Appendix A.11.

The first part of Assumption 1 ensures that there always exists an equilibrium in which informed investors trade when $x_d = \Delta_\mu$. If the trading cost was too high, traders might be better off not

[13]Note that the market maker does not observe x_d or x_κ and sets P_j solely based on information derived from Y_j. We could alternatively assume that there is a single market maker, who observes order flows in both markets. This specification is slightly less tractable, but does not change our qualitative results.

trading. In this case, there would be no informed ownership and hence no relationship between ownership and competition, which is the focus of our analysis. The second part of the assumption makes sure that, when $x_d = 0$, both firms are sufficiently overvalued such that informed investors prefer not to trade. This condition allows us to focus on their trading strategies when $x_d = \Delta_\mu$, which simplifies the analysis of the equilibrium.

Our equilibrium concept is Perfect Bayesian Equilibrium ("PBE").

Definition 1 *A PBE consists of the following two sub-equilibria.*

1. *At $t = 2$, each manager chooses e_j to maximize shareholder payoffs.*

2. *At $t = 1$,*

   (i) informed traders choose their asset demands to maximize expected trading profits;

   (ii) market makers set stock prices conditional on total order flow to break even in expectation.

We assume that all agents have rational expectations in that each player's belief about the other players' strategies is correct in equilibrium.

3 Equilibrium Analysis

3.1 Preliminaries

We proceed by backward induction and first characterize the effort levels and equilibrium share prices for fixed masses of common owners and undiversified owners. We then characterize the informed traders' trade-off when the demand shock is high and they choose whether to invest in only one or both firms.

Managerial Effort. For a given composition $(n_j^u, n_j^c, n_j^\iota)$ of firm-j's ownership, the equilibrium value of effort solves the managers' optimization problem in program (2). The first order condition for this problem is:

$$\frac{\partial \Pi_j}{\partial e_j} + \frac{n_j^c}{n_j^c + n_j^u + n_j^i} \frac{\partial \Pi_{-j}}{\partial e_j} = 0. \tag{5}$$

An increase in e_j has a positive effect on firm j's profit $\left(\frac{\partial \Pi_j}{\partial e_j} \geq 0\right)$ and a negative spillover effect on the competing firm $\left(\frac{\partial \Pi_j}{\partial e_j} < 0\right)$.[14] A mass n_j^c of shareholders in firm j are common owners, who are invested in both firms and, thus, internalize this negative externality. This negative externality is then carried over by the manager via the objective function in program (2), since the manager sets e_j to maximize a weighted average of its shareholders' payoffs. As a consequence, the larger the share of common owners in a firm, the lower the manager's effort in that firm: that is, common ownership decreases competition. On the contrary, undiversified owners do not internalize the negative externality and, as a result, increase competition.

Lemma 1 (Equilibrium effort) *Given the informed investors' trading strategy in Conjecture 1, the equilibrium level of effort is characterized as follows:*

$$e_j(\Delta_\mu, \underline{\kappa}) = \frac{1}{\underline{\kappa}}\left[1 - \gamma\chi\left(1+\beta\right)^{-1}\right] \quad \textit{and} \quad e_j(\Delta_\mu, \overline{\kappa}) = \frac{1}{\overline{\kappa}}\left[1 - \gamma\chi\left(\chi+\beta\right)^{-1}\right];$$

and $e_j(0, \kappa_j) = \frac{1}{\kappa_j}$ *for* $\kappa_j \in \{\underline{\kappa}, \overline{\kappa}\}$.

Proof: *See Appendix A.1.*

Lemma 1 describes the equilibrium effort levels under Conjecture 1. The mass of inside owners is the same in both firms, that is, $n_\tau^\iota = n_{-\tau}^\iota = \beta$, for any realizations of x_d and κ_j; informed investors instead only trade when $x_d = \Delta_\mu$. As a result, when the demand shock is low, the only owners are insiders and each manager maximizes its own firm value, which implies $e_j(0, \kappa_j) = \frac{1}{\kappa_j}$. When the demand shock is high, a fraction χ of informed investors acquire a position in both firms and the remaining fraction trades only the low-cost firm τ: we have $n_\tau^u = 1 - \chi$ and $n_{-\tau}^u = 0$. The weight on Π_{-j} in manager j's optimization program is then equal to $\frac{\chi}{1+\beta}$ for $j = \tau$, and equal to $\frac{\chi}{\chi+\beta}$ for $j = -\tau$. Effort thus depends on the distribution of $c-$type and $u-$type traders across firms.

To simplify the notation, we define $e_\tau \equiv e_j(\Delta_\mu, \underline{\kappa})$ and $e_{-\tau} \equiv e_j(\Delta_\mu, \overline{\kappa})$, and let Π_τ and $\Pi_{-\tau}$ denote the two firms' values evaluated at e_τ and $e_{-\tau}$, respectively. When $\chi = 1$, all informed traders are common owners and both effort levels are the lowest, since managers internalize the common owners' preferences for lower competition. As χ decreases, some informed traders choose to trade

[14] In equilibrium, we always have $e_j \leq \frac{1}{\kappa_j}$, which implies $\frac{\partial \Pi_j}{\partial e_j} \geq 0$

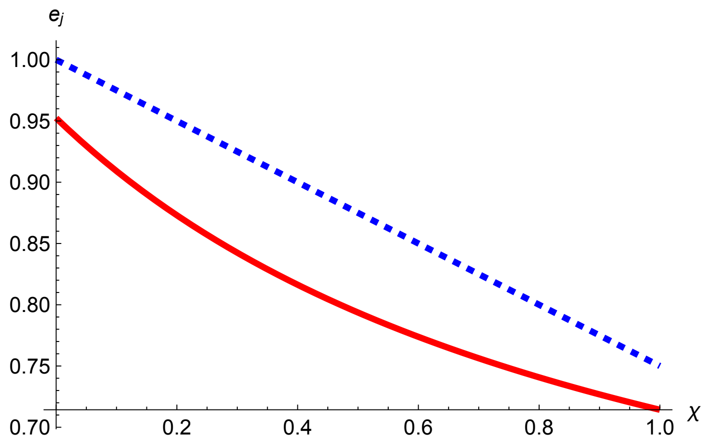


Figure 3: The dashed blue line corresponds to e_τ and the solid red line to $e_{-\tau}$ conditional on $x_d = \Delta_\mu$. Parameters: $\overline{\kappa} = 1.05$, $\underline{\kappa} = 1$, $\beta = 1$, and $\gamma = \frac{1}{2}$.

only shares of the target firm. Initially, this widens the gap between e_τ and $e_{-\tau}$, since the target firm gains a relatively larger fraction of undiversified owners and, as a result, it competes more aggressively. As χ approaches 0, however, the mass of common owners vanishes in both firms and the gap between firms narrows back again.[15] This effect is described in the example in Figure 3, which highlights that the difference $e_\tau - e_{-\tau}$ is hump-shaped in χ. The firm values Π_τ and $\Pi_{-\tau}$ follow the same pattern as the effort levels e_τ and $e_{-\tau}$, respectively.

Share Prices. In this step, we solve for the equilibrium share prices given proportions of $u-$type and $c-$type traders. We can then combine Π_j and P_j to compute trading profits $\sum_j y_{ij} \left(\Pi_j - P_j - \lambda\right)$ to solve for the equilibrium ownership structures.

Lemma 2 (Equilibrium share price) *Let $\Pi\left(x_d, \kappa_j\right)$ denote the firm value Π_j evaluated at the equilibrium effort levels in Lemma 1. Given the informed investors' trading strategy in Conjecture 1, the equilibrium*

[15]The weight $\frac{n_j^c}{n_j^c+n_j^u+n_j^t}$ converges to zero as χ approaches 0, for both $j = \tau$ and $j = -\tau$. Notice also that, at the corner values $\chi = 0$ and $\chi = 1$, the differences between e_τ and $e_{-\tau}$ are only due to the difference in effort costs Δ_κ.

share price is a step function of total order flow Y_j:

$$P_j = \begin{cases} \Pi\left(\Delta_\mu, \underline{\kappa}\right) & \text{if } Y_j \in [L+\chi, L+1) \\ \frac{1}{2}\left[\Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] & \text{if } Y_j \in [L, L+\chi) \\ \frac{1}{4}\left[\Pi(0, \overline{\kappa}) + \Pi\left(0, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] & \text{if } Y_j \in [1, L) \\ \frac{1}{4}\left[\Pi(0, \overline{\kappa}) + \Pi\left(0, \underline{\kappa}\right) + 2\Pi\left(\Delta_\mu, \overline{\kappa}\right)\right] & \text{if } Y_j \in [\chi, 1) \\ \frac{1}{2}\left[\Pi(0, \overline{\kappa}) + \Pi\left(0, \underline{\kappa}\right)\right] & \text{if } Y_j \in (0, \chi). \end{cases}$$

Proof: *See Appendix A.2.*

Lemma 2 shows that the equilibrium stock price is an increasing step function of Y_j. Intuitively, higher order flows convey more positive information about the unknown shocks x_d and x_κ to the market maker, and lead to a higher expected firm value. For instance, if Y_j is less than χ, the market maker rationally infers that no informed trader has submitted a buy order. He therefore concludes that industry demand is low and sets $P_j = \mathbb{E}[\Pi_j | x_d = 0] = \frac{1}{2}\left[\Pi(0, \overline{\kappa}) + \Pi\left(0, \underline{\kappa}\right)\right]$. At the other extreme, order flows greater than $L + \chi$ indicate that all informed traders, i.e. common owners and undiversified owners, have submitted buy orders, which indicates that industry demand is high and that firm j's cost of effort is low. As a result, the market maker sets $P_j = \Pi\left(\Delta_\mu, \underline{\kappa}\right)$ in this case.

Incentives to trade. Informed traders have two pieces of private information compared to the market maker in each market. First, they have information about the industry-wide demand shock x_d. Second, they have information about the firms' competitive advantage x_κ, which determines the manager's cost of effort. In principle, when industry demand is high ($x_d = \Delta_\mu$), an informed trader could profit from acquiring a share in both firms, since the market maker is uncertain whether demand is high or low. However, the market maker does not know which of the two firms has a competitive advantage. The non-targeted firm (the one with higher cost of effort) may be overvalued by the market maker and, thus, not worth buying for informed traders. As a result, the informed trader acquires a share in both firms if the following inequality is satisfied:

$$U_c - U_u \geq 0 \quad \Leftrightarrow \quad \Pi_{-\tau} - \mathbb{E}\left[P_{-\tau}\right] \geq \lambda, \tag{6}$$

where the expectation in equation (6) is conditional on $n^c_{-\tau} = \chi$, $n^u_{-\tau} = 0$, $n^\iota_{-\tau} = \beta$, and is taken with respect to liquidity trading $z_{-\tau}$. Otherwise, the informed trader only acquires a share in the firm with the lower effort cost. In other words, if inequality (6) holds, the informed trader chooses to be a common owner; otherwise, she chooses to be an undiversified owner.

3.2 Benchmark Equilibrium: No-Feedback

To isolate the impact of ownership on industry competition, we first solve a benchmark model in which ownership does not affect the managers' effort choices. To this end, we consider the limit $\beta \to \infty$, which implies that the equilibrium effort choices in Lemma 1 simplify to $e_j = \frac{1}{\kappa_j}$. Similarly, the terminal firm values are given by $\Pi_j = x_d + \frac{1}{2\kappa_j} - \frac{\gamma}{\kappa_{-j}}$. It follows that Π_j does not depend on the equilibrium ownership structure.

Proposition 1 (Equilibrium composition without feedback) *In the benchmark model where ownership does not affect competition ($\beta \to \infty$), a unique equilibrium exists. Conjecture 1 holds in equilibrium. Let χ^{**} denote the equilibrium mass of common owners when demand is high; we have:*

1. *In the limit $\Delta_\kappa \to 0$, all informed traders become common owners;*

2. *The following comparative statics results hold in equilibrium:*

    (a) *χ^{**} always decreases with the transaction cost λ and increases with the liquidity of the financial market L if χ^{**} is sufficiently large.*

    (b) *χ^{**} increases with the size of the demand shock Δ_μ and decreases with the difference in the firms' cost of effort Δ_κ.*

Proof: *See Appendix A.3.*

In the model without feedback, the equilibrium composition of ownership is unique and, when the firms are identical (i.e., when $\Delta_\kappa \to 0$), all informed investors become common owners. We will show below that neither of these results holds in the main model where ownership affects competition, which features multiple equilibria and heterogeneous ownership even for identical firms. The intuitions behind the results in Proposition 1 are described below.

The profit from trading in the non-targeted firm ($\Pi_{-\tau} - \mathbb{E}[P_{-\tau}] - \lambda$) always decreases with χ in the benchmark model. As χ increases, more investors become common owners and acquire shares of firm $-\tau$, which pushes its expected price up and reduces trading profits. The equilibrium is then unique: we either have that trading profits are always positive or always negative, in which case we have $\chi^{**} = 1$ and $\chi^{**} = 0$, respectively, or an interior equilibrium $\chi^{**} \in (0, 1)$ such that $\Pi_{-\tau} - \mathbb{E}[P_{-\tau}] = \lambda$. If the two firms have the same effort costs, there is no reason to trade only one of them, as the value of the firms does not change with their ownership. As a consequence, all informed investors become common owners when $\Delta_\kappa \to 0$.

The second part of Proposition 1 discusses the comparative statics of χ^{**}. These comparative statics will be qualitatively the same in the main model. We start with the impact of the trading cost λ. An increase in the trading cost always (weakly) reduces $\Pi_{-\tau} - \mathbb{E}[P_{-\tau}] - \lambda$, since neither $\Pi_{-\tau}$ nor $\mathbb{E}[P_{-\tau}]$ depend on λ. Therefore, the mass of common owners decreases with λ in equilibrium, i.e. $\frac{\partial \chi^*}{\partial \lambda} \leq 0$. Intuitively, a higher trading cost hurts common owners more because they trade in both firms and have to pay this cost for trades in both assets.

Next, we analyze the impact of financial market liquidity, measured by L.[16] Since the (average) mass of liquidity traders is proportional to L and the mass of informed traders is set to one, the ratio of these two masses captures the ability of informed traders to camouflage their informed trades and prevent the market maker from inferring this information from order flows. We find that more liquidity can either increase or decrease common ownership. In particular, it always increases common ownership if χ is sufficiently large. Intuitively, in a market with high levels of common ownership total order flow is particularly informative about the demand shock and less informative about the firm-level cost shock. As a result, an increase in liquidity has a particularly high benefit for common owners who can better hide their trades from the market maker.

An increase in Δ_μ makes it more profitable to trade on the industry-wide demand shock and, thus, for informed investors to acquire shares in *both* firms. As a result, an increase in Δ_μ renders it more attractive to be a common owner, i.e. $\frac{\partial \chi^*}{\partial \Delta_\mu} \geq 0$. Similarly, an increase in Δ_κ - the difference

[16]We model an increase in market liquidity as an increase in the expected demand by noise traders. As L (or $\frac{1}{2}L$) increases, noise trades account for a relatively larger fraction of total trades. This implies that the market maker reacts less to the order flow and, as a result, the price impact of a trade order is lower.

in the effort costs for the two firms, makes it more profitable to trade in the targeted firm and less profitable to trade in the other firm. This decreases $\Pi_{-\tau} - \mathbb{E}[P_{-\tau}]$ and leads to a reduction in the equilibrium mass of common owners, i.e. $\frac{\partial \chi^*}{\partial \Delta_\kappa} \leq 0$.

3.3 Main Equilibrium

Continuing our way backward, we can now characterize the equilibrium composition of informed trading in the main model.

Proposition 2 (Equilibrium composition) *In the model where ownership affects competition, an equilibrium always exists and there may be more than one. Conjecture 1 always holds in equilibrium. Let χ^* denote the equilibrium mass of common owners when demand is high; we have:*

1. *In the limit $\Delta_\kappa \longrightarrow 0$, there exist parameter values such that common owners and undiversified owners coexist in equilibrium ($\chi^* \in (0, 1)$).*
2. *The same comparative statics results as in Part 2 of Proposition 1 hold in all stable equilibria; moreover, we have $\lim_{\gamma \to 0} \chi^* = 1$.*

Proof: *See Appendix A.4.*

Proposition 2 characterizes the equilibrium composition of informed traders (χ^*). There are three possible types of equilibria: $\chi^* = 0$, in which case all informed traders only invest in one firm; $\chi^* = 1$, where all informed traders become common owners; and interior equilibria $\chi^* \in (0, 1)$, in which case identical investors acquire different portfolios ex-post. Interior equilibria can occur even if the two firms have the same effort costs ($\Delta_\kappa \longrightarrow 0$), so that identical firms end up with different ownership structures and different values in equilibrium.

Figure 4 describes the equilibrium characterization for a fixed set of parameters. In this specific example, we obtain an equilibrium at $\chi^* = 1$ and two interior equilibria. When multiple interior equilibria arise, we follow the existing literature (see e.g., Goldstein et al., 2014; Dugast and Foucault, 2018) and only focus on stable interior equilibria, that is, such that $\frac{\partial(\Pi_{-\tau} - \mathbb{E}[P_{-\tau}])}{\partial \chi}\Big|_{\chi = \chi^*} < 0$. As a result, the two stable equilibria in this example are the one at $\chi^* = 1$ and the one at $\chi^* \approx 0.15$.

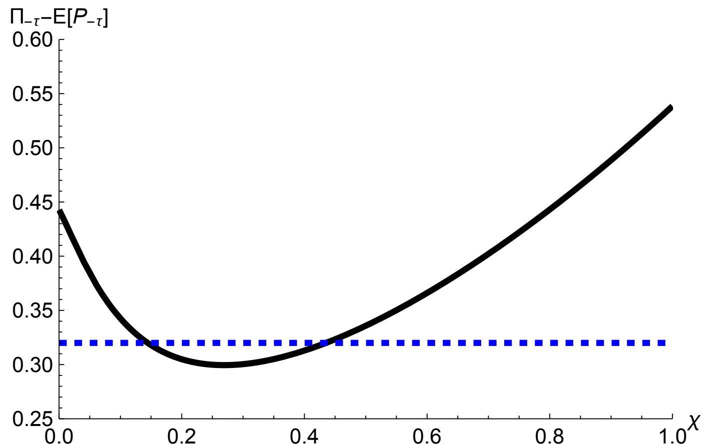


Figure 4: The solid black line corresponds to $\Pi_{-\tau} - \mathbb{E}[P_{-\tau}]$, the dashed blue line corresponds to $\lambda = 0.32$. Parameters: $\overline{\kappa} = 1.1$, $\underline{\kappa} = 1$, $L = 5$, $\beta = \frac{1}{10}$, $\gamma = \frac{9}{10}$, and $\Delta_{\mu} = 1$.

To build intuition for our results, consider the example depicted in Figure 4, starting from $\chi = 1$ and then moving backward towards $\chi = 0$. At $\chi = 1$, all informed traders become common owners and invest in both firms. The two firm managers internalize the cross-ownership and exert little effort. This allocation constitutes a stable equilibrium, since here a small reduction in common ownership and more undiversified ownership in firm τ do not reduce firm $-\tau$'s value enough to discourage investors from purchasing both firms. As χ further decreases, however, the difference $\Pi_{\tau} - \Pi_{-\tau}$ goes up and the trading profit in firm $-\tau$ decreases, as firm τ becomes increasingly more competitive than $-\tau$. Eventually, the trading profit in firm $-\tau$ becomes equal to the trading cost λ, which renders informed traders indifferent between common and undiversified ownership. This outcome corresponds to $\chi \approx 0.45$ in Figure 4. Note, however, that this allocation is not stable because any small perturbation around this point leads to a divergence to either $\chi^* = 1$ or $\chi^* \approx 0.15$.

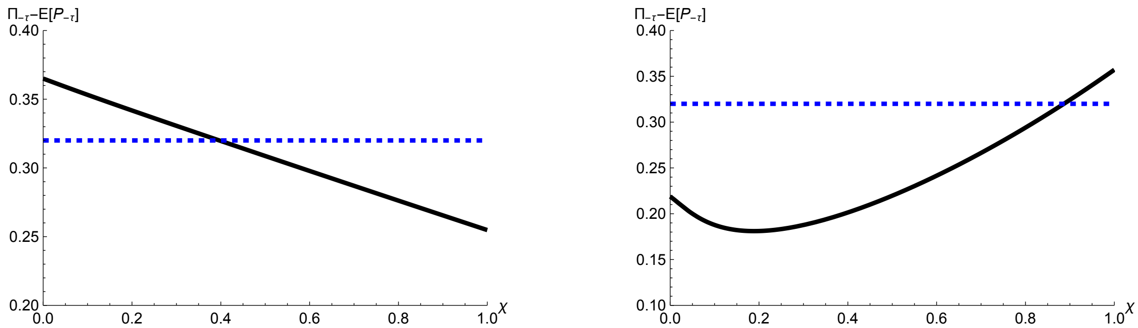
The reason that $\Pi_{-\tau} - \mathbb{E}[P_{-\tau}]$ increases again at some point as χ moves towards 0 is two-fold. First, as χ approaches 0, the mass of common owners vanishes and the difference between Π_{τ} and $\Pi_{-\tau}$ narrows back again, as discussed earlier. Second, a decrease in χ also lowers informed traders' demand for firm $-\tau$, which reduces its equilibrium stock price. For these two reasons, at some point, it becomes profitable again for informed traders to purchase both firms. At $\chi^* \approx 0.15$, they are again indifferent between common and undiversified ownership, so that this allocation represents the second stable equilibrium in this example. Any further decrease in χ, renders common ownership more profitable, which is of course inconsistent with $\chi^* < 1$.

In summary, when ownership affects competition, the strategic interaction across traders is characterized by two different effects. First, there is a direct effect on trading profit, which is the same as in the benchmark model. An increase in common ownership reduces profits from trading in the non-targeted firm, as more investors acquire shares of firm $-\tau$, pushing its expected price up. This direct effect implies that the incentives to become common owners decrease with χ (*strategic substitutability*).

Second, there is an indirect effect on trading profits, through the effect of ownership on firm value. As χ moves from 0 towards intermediate values, the ownership structures of the two firms become more different from each other, with τ having a large fraction of undiversified owners and $-\tau$ a large fraction of common owners. Firm τ then competes more aggressive while $-\tau$ internalizes more of the externality and holds back. This reduces $\Pi_{-\tau}$ and, as a consequence, the profit from acquiring shares in this firm. As χ continues to move towards 1, the difference in ownership structure vanishes (as all investors become common owners) and the profit from trading in $-\tau$ increases again. This second effect implies that, for intermediate values of χ, the incentives to become common owners increase with χ (*strategic complementarity*). The interaction between the direct and indirect effects leads to the rich equilibrium characterization described above.

The second part of Proposition 2 discusses the comparative statics of χ^*. It is worth emphasizing that competition across firms is crucial for our results: in the limit $\gamma \to 0$, there are no externalities between firms and it is always better for informed investors to become common owners, i.e. $\chi^* = 1$. The other comparative statics are the same as in the benchmark model, so we refer back to the discussion of Proposition 1 for the intuition.

Equilibrium Multiplicity. One interesting implication of our model is that there can be multiple equilibria, so that similar firms may end up with different ownership structures and, as a result, different effort levels in equilibrium. This is the case in the numerical examples in Figure 4 and



(a) Unique (interior) equilibrium.

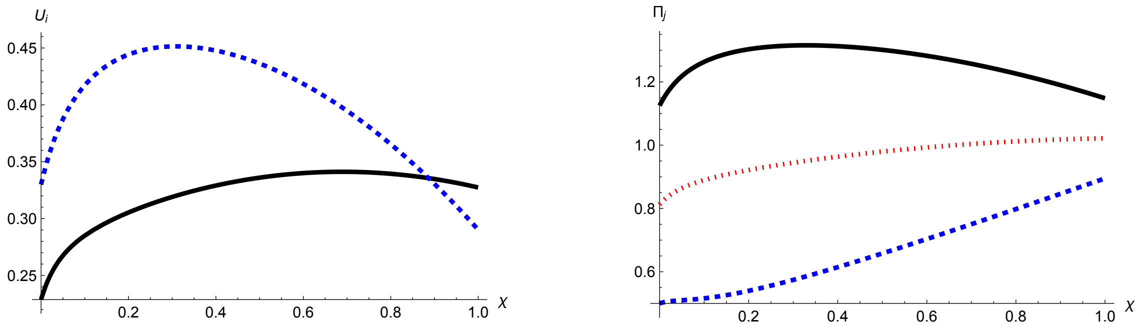
(b) Two (corner) equilibria.

Figure 5: In both panels, the solid black line corresponds to $\Pi_{-\tau} - \mathbb{E}[P_{-\tau}]$ and the dashed blue line corresponds to the transaction cost $\lambda = 0.32$. Parameters: $\overline{\kappa} = 2$, $\underline{\kappa} = 1$, $\beta = \frac{1}{10}$, $L = 5$, and $\Delta_\mu = 1$. In Panel (a) we set $\gamma = \frac{1}{10}$, in Panel (b) we set $\gamma = \frac{3}{4}$.

Panel (b) in Figure 5.[17] When multiple equilibria arise, one question is which equilibrium is more likely to be played by the agents. A natural criterion for equilibrium selection is to play the equilibrium in which informed traders' trading profits are larger. In equilibria where χ^* is large, firms compete less and, as a result, industry profits $\Pi_\tau + \Pi_{-\tau}$ are larger. However, traders are not using their private information about the firms' relative competitive positions. This reduces the degree of informational asymmetry in the market, and can make the market makers' prices, on average, closer to fundamentals. As a result, trading profits may be larger in equilibria where χ^* is small, even though industry profits are smaller. This outcome is described in Figure 6, which plots informed traders' profits and firm values as a function of χ.

The results on equilibrium selection are intriguing. One common narrative on the widespread diffusion of common ownership is that it benefits shareholders, by softening competition between firms (see e.g., Posner et al., 2017). An implication of our analysis is that this may not always be the case, as common ownership may arise as the result of coordination failure. Equilibria with a high degree of common ownership may lead to less asymmetric information and, as a result, lower trading profits for informed traders. However, undiversified investors can have an impact on a firm's effort level only if a sufficient fraction of the firm's owners are also undiversified and have the same incentive to increase effort. This strategic complementarity across agents leads to the possibility of coordination failure.

[17] It is worth emphasizing that multiple equilibria do not always occur and that the equilibrium may be instead unique, which is the case in the example in Panel (a) of Figure 5.



(a) Trading profits.

(b) Firm values.

Figure 6: Panel (a) plots trading profits against the mass of common owners. The solid black line corresponds to U_u and the dashed blue line to U_c. Panel (b) plots firm values against the mass of common owners. The solid black line corresponds to Π_τ, the dashed blue line to $\Pi_{-\tau}$, and the dotted red line to $\frac{\Pi_\tau+\Pi_{-\tau}}{2}$. Parameters: $\overline{\kappa} = 2$, $\underline{\kappa} = 1$, $\beta = \frac{1}{10}$, $\gamma = \frac{3}{4}$, $L = 5$, $\lambda = 0.32$, and $\Delta_\mu = 1$.

4 Product Market and Welfare

The baseline model captures competition between firms in a reduced-form way and is thus not suited to explore implications for welfare and product market outcomes, such as equilibrium prices and quantities. In this section, we extend the baseline model and allow firms' competition to follow two traditional frameworks in the IO literature. We show that our results continue to hold in these settings and derive new implications for welfare and product market outcomes.

As a measure of welfare, we consider the expected total surplus generated in the economy, which we denote by S. This measure comprises the sum of firm values and consumer surplus, minus the total trading costs sustained by all traders.[18] The consumer surplus is the area under the product demand curve and above the equilibrium price, and is denoted by $\mathcal{CS}$. We can write S as follows:[19]

$$S \equiv \mathbb{E}\left[\sum_j \Pi_j + \mathcal{CS} - \sum_j \left(\int_0^1 y_{ij} di + z_j\right)\lambda\right]. \tag{7}$$

We are primarily interested in the effect that financial market parameters, namely, the transaction cost λ and market liquidity L, have on social surplus. We show that there may be a tension between financial market efficiency, that is, lower λ and higher L, and social surplus S. This tension arises via the effect that these financial market conditions have on the firms' equilibrium ownership. We now proceed to describe and analyze the two frameworks.

[18] We assume that informed traders and liquidity traders incur the transaction cost λ when trading. Notice also that, since prices are transfers in the model, they do not affect welfare.

[19] Note that in this expression the expectation is taken over x_d and z_j. We provide the explicit expression for S in the Appendix.

4.1 Cournot Competition

In this extension of the model, firms compete in selling a homogeneous product to costumers, in a setting where managers simultaneously choose the quantities produced by each firm. The demand for the product is captured by the indirect demand function $\rho = x_d + \gamma(q_j + q_{-j})$, where ρ is the product's price and (q_j, q_{-j}) are the quantities produced by the two firms. The parameter $\gamma \in (0, 1)$ captures the elasticity of demand. The random variable $x_d \in \{0, \Delta_\mu\}$ captures the stochastic size of the product market. The firms' terminal values are specified as:

$$\Pi_j = [x_d - \gamma(q_j + q_{-j})]q_j - C\left(q_j, \kappa_j\right). \tag{8}$$

An increase in one firm's production has a negative externality (increasing with γ) on the other firm's value, since it expands the total supply of the good and, as a result, reduces its equilibrium price. For simplicity, we assume $C\left(q_j, \kappa_j\right) = \kappa_j q_j$.[20] The random variable $\kappa_j \in \{\underline{\kappa}, \overline{\kappa}\}$ has the same distribution and interpretation as in the baseline model. It is worth emphasizing that the parameter γ and the random variables x_d and x_κ, all have a similar interpretation as in the baseline model. The manager chooses the quantity q_j to solve the following problem:

$$\max_{q_j} U_j \equiv \Pi_j + \frac{n_j^c}{n_j^c + n_j^u + n_j^\iota}\Pi_{-j}. \tag{9}$$

The manager's optimization problem in program (9) is the same as in the baseline model, except that here the manager chooses the quantity produced by the firm instead of effort. The modeling of the financial market is the same as in the baseline model.

Assumption 2 (Parametric Assumptions - Cournot) *We assume $\lambda \leq \overline{\lambda}^c$ and $\Delta_\mu \geq \overline{\Delta}_\mu^c$, where the positive constants $\overline{\Delta}_\mu^c$ and $\overline{\lambda}^c$ are given in Appendix A.5.*

Assumption 2 ensures that, when $x_d = \Delta_\mu$, there always exists an equilibrium in which informed investors trade, as the trading cost is sufficiently small, and we have an interior solution for both equilibrium quantities, since the market is sufficiently large for both firms to produce positive quantities. This assumption replaces Assumption 1 in the main model.

[20] Since the firm's revenue function ρq_j is concave in the manager's choice variable q_j, we can assume a linear cost function in this extension of the model. In the baseline model, we need a convex cost of effort to satisfy concavity of the manager's objective function.

Lemma 3 (Equilibrium Quantities) *Given the informed investors' trading strategy in Conjecture 1, the equilibrium prices are given by* $q_{-\tau} \equiv q_j\left(\Delta_\mu, \overline{\kappa}\right)$ *and* $q_\tau \equiv q_j\left(\Delta_\mu, \underline{\kappa}\right)$ *with* $q_\tau > q_{-\tau} > q_j(0, \kappa_j) = 0$ *for* $\kappa_j \in \{\underline{\kappa}, \overline{\kappa}\}$*. The explicit expressions for* $q_{-\tau}$ *and* q_τ *are given in the Appendix.*

Proof: *See Appendix A.5.*

When $x_d = \Delta_\mu$, the targeted firm competes more aggressively in equilibrium, capturing a larger fraction of the market and earning higher profits ($q_\tau > q_{-\tau}$ and $\Pi_\tau > \Pi_{-\tau}$). When $x_d = 0$, there is no demand for the product and both firms produce zero quantities. The following proposition characterizes the equilibrium composition of informed trading.

Proposition 3 (Equilibrium with Cournot Competition) *In the extension with Cournot competition, an equilibrium always exists and there may be more than one. Conjecture 1 always holds in equilibrium. Let* χ^* *denote the equilibrium mass of common owners when demand is high; we have:*

1. *Let* $\Pi\left(x_d, \kappa_j\right)$ *denote the firm value* Π_j *evaluated at the equilibrium quantities in Lemma 3; the equilibrium stock prices are the same as in Lemma 2;*

2. *In all stable equilibria we have: the same comparative statics results as in Part 2(a) of Proposition 1 hold;* χ^* *always decreases with* Δ_κ*, and increases with* Δ_μ *if we consider* $\Delta_\kappa \to 0$ *and* $\beta > 1$.

Proof: *See Appendix A.6.*

Proposition 3 summarizes the financial market equilibrium in this extension. We first show that the equilibrium share prices and trading profits are the same as in Proposition 2, with the only difference that the functional form for Π_j has changed. As before, we can obtain three different types of equilibria: (i) all traders are undiversified owners ($\chi^* = 0$), (ii) all traders are common owners ($\chi^* = 1$), and (iii) traders are indifferent between both choices ($\chi^* \in (0, 1)$).

The comparative statics on the equilibrium mass of common owners (χ^*) is similar to our results for the baseline model. In particular, χ^* decreases with the transaction cost λ and can either increase or decrease with market liquidity L. We also show that χ^* increases with Δ_κ and, other certain conditions, decreases with Δ_μ.[21]. Next, we study the welfare implications ensuing from the

[21] The equilibrium quantities depend on Δ_μ. As a consequence, χ^* always increases with Δ_μ if $\Delta_\kappa \to 0$ and $\beta > 1$, while it may increase or decrease with Δ_μ otherwise.

equilibrium composition of informed traders.

Lemma 4 (Welfare with Cournot Competition) *In the extension with Cournot competition, the following comparative statics results hold for all stable equilibria:*

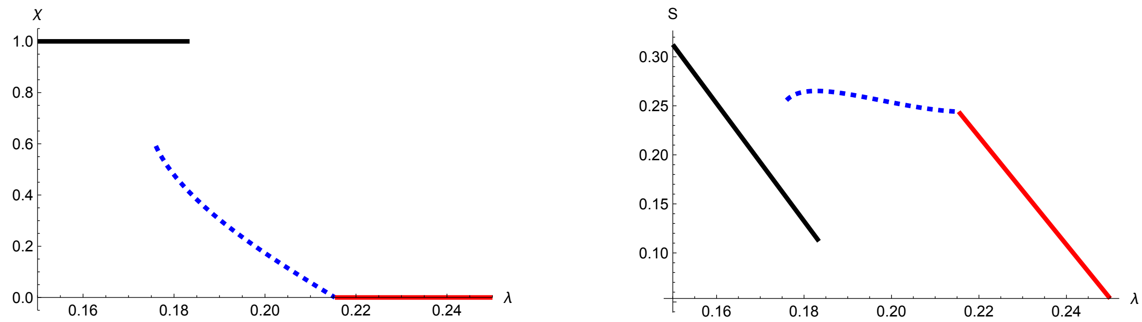
1. *The equilibrium product market price ρ^* always decreases with the transaction cost λ, and it increases with the liquidity of the financial market L if χ^* is sufficiently large;*
2. *Total surplus S may increase or decrease with λ and L.*

Proof: *See Appendix A.7.*

Lemma 4 describes the effects of financial market efficiency on product market prices and total surplus S. When the transaction cost λ goes down, there are two contrasting effects on S. First, there is a direct positive effect on S, since trading becomes less costly. Second, there is an indirect effect, since the degree of common ownership increases when λ goes down. As a consequence of the increase in common ownership, firms compete less aggressively in the product market, which leads to lower total supply and a higher product price in equilibrium. This increases the deadweight loss (the gains from trades that do not realize due to the product price being above the marginal cost of producing the good) and, as a result, reduces S.

Perhaps surprisingly, the negative effect can dominate, and total surplus S may decrease when the transaction cost λ goes down. This is the case in the example described in Figure 7. Panel (a) shows that for values of λ smaller than ≈ 0.18 and greater than ≈ 0.22, χ^* does not change with λ because it is either equal to zero or one. In this range, an increase in λ decreases surplus due to the direct effect mentioned above. For values of λ between ≈ 0.18 and ≈ 0.22, however, an increase in λ leads to less common ownership and more aggressive competition, which overturns the direct effect and increases surplus.[22] A similar logic applies to an increase in market liquidity L, which may lead to more common ownership and lower surplus. We discuss the effect of L in the extension with price competition.

[22] Also note that we obtain two stable equilibria in the example depicted in Figure 7: for λ between ≈ 0.18 and ≈ 0.19 there is a stable equilibrium with $\chi^* = 1$ and with $\chi^* \in (0, 1)$.



(a) Trader composition.

(b) Surplus.

Figure 7: Cournot Competition. Panel (a) plots the equilibrium mass of undiversified owners against the trading cost. Panel (b) plots surplus against the trading cost. Parameters: $\overline{\kappa} = .11$, $\underline{\kappa} = .10$, $\gamma = \frac{9}{10}$, $L = 5$, $\beta = 1$, and $\Delta_\mu = 2$.

4.2 Price Competition

In this extension of the model, firms compete in selling differentiated products to costumers, in a setting where managers simultaneously choose the prices set by each firm. The demand for product j is captured by the demand function $q_j = x_d - \rho_j + \gamma\rho_{-j}$, where ρ_j and ρ_{-j} are the prices set by the two firms. The parameter $\gamma \in (0, 1)$ captures the degree of substitutability between products. Like before, the demand for each product is stochastic and depends on the realization of the random variable $x_d \in \{0, \Delta_\mu\}$. The firms' terminal values are then specified as:

$$\Pi_j = (x_d - \rho_j + \gamma\rho_{-j})\rho_j - C\left(q_j, \kappa_j\right). \tag{10}$$

A decrease in the price ρ_j has a negative externality on the other firm's value, since it reduces its demand by capturing some of j's costumers. The assumptions about the cost function $C\left(q_j, \kappa_j\right)$ are the same as in the Cournot model. The manager chooses the price ρ_j to solve the following problem:

$$\max_{\rho_j} U_j \equiv \Pi_j + \frac{n_j^c}{n_j^c + n_j^u + n_j^\iota}\Pi_{-j}. \tag{11}$$

Finally, Assumption 2 suffices to guarantee that informed trading occurs and both firms' quantities are strictly positive in equilibrium when $x_d = \Delta_\mu$.

Lemma 5 (Equilibrium Prices) *Given the informed investors' trading strategy in Conjecture 1, the equilibrium prices are given by $\rho_{-\tau} \equiv \rho_j\left(\Delta_\mu, \overline{\kappa}\right)$ and $\rho_\tau \equiv \rho_j\left(\Delta_\mu, \underline{\kappa}\right)$ with $\rho_{-\tau} > \rho_\tau > \rho_j(0, \kappa_j) = 0$ for $\kappa_j \in \{\underline{\kappa}, \overline{\kappa}\}$. The explicit expressions for $\rho_{-\tau}$ and ρ_τ are given in the Appendix.*

Proof: *See Appendix A.8.*

When $x_d = \Delta_\mu$, the targeted firm sets a lower price in equilibrium, capturing a larger fraction of the market and earning higher profits ($\rho_\tau < \rho_{-\tau}$, which implies $q_\tau > q_{-\tau}$ and $\Pi_\tau > \Pi_{-\tau}$). When $x_d = 0$, there is no demand and both firms earn zero profits. The following proposition characterizes the composition of informed trading in equilibrium.

Proposition 4 (Equilibrium with Price Competition) *In the extension with price competition, an equilibrium always exists and there may be more than one. Conjecture 1 always holds in equilibrium. Let χ^* denote the equilibrium mass of common owners when demand is high; we have:*

1. *Let $\Pi\left(x_d, \kappa_j\right)$ denote the firm value Π_j evaluated at the equilibrium prices in Lemma 5; the equilibrium stock prices are the same as in Lemma 2;*

2. *In all stable equilibria we have: the same comparative statics results as in Part 2(a) of Proposition 1 hold; χ^* increases with Δ_μ if we consider $\Delta_\kappa \to 0$ and $\beta > 1$.*

Proof: *See Appendix A.9.*

We can again show that the financial market equilibrium derived in the baseline model is robust to this extended model with price competition. In particular, we confirm that that the mass of common owners continues to decrease in λ also in this setting, while market liquidity continues to have an ambiguous effect on χ^*.

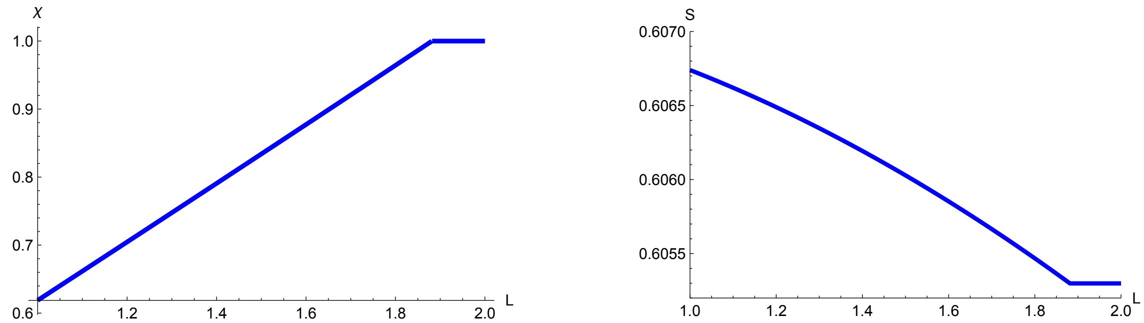
Lemma 6 (Welfare with Price Competition) *In the extension with price competition, the following comparative statics results hold for all stable equilibria:*

1. *The equilibrium (average) price $\frac{\rho_\tau+\rho_{-\tau}}{2}$ always decreases with the transaction cost λ, and it increases with the liquidity of the financial market L if χ^* is sufficiently large;*

2. *Total surplus S may increase or decrease with λ and L.*

Proof: *See Appendix A.10.*

Lemma 6 investigates the welfare consequences of our analysis in the extension with price competition. Similarly to the model with Cournot competition, we find that lower transaction



(a) Trader composition.

(b) Surplus.

Figure 8: Price Competition. Panel (a) plots the equilibrium mass of undiversified owners against market liquidity. Panel (b) plots surplus against market liquidity. Parameters: $\overline{\kappa} = 0.35$, $\underline{\kappa} = 0.10$, $\gamma = 0.5$, $\beta = 2$, $\Delta_\mu = 1.06$, and $\lambda = 0$.

costs do not necessarily increase surplus. Even when transaction costs are zero and an increase in trading does not directly affect welfare, total surplus may decrease with market liquidity.[23] This occurs when the increase in liquidity leads to more common ownership and less competition in equilibrium, as is the case in the numerical example in Figure 8. In this example, λ is set to 0 and, for values of L between 1 and ≈ 1.9, we obtain a unique equilibrium $\chi^* \in (0, 1)$ with χ^* increasing in L. Surplus is reduced then when L goes up, as common ownership increases with L.

5 Empirical Implications

Our model offers a rich set of empirical implications regarding the determinants of common ownership over time and in the cross-section. Our main predictions are summarized in Proposition 2 and reflect the joint equilibrium determination of ownership and effort. Below we discuss these predictions in detail and highlight how they can be tested empirically.

First, we predict that common ownership increases in the size of the industry-wide demand shock and decreases in the size of the firm-specific cost shock. It follows that common ownership should be more prevalent in relatively more homogeneous industries in which the informational rent from industry-wide information dominates. Alternatively, one could directly measure demand uncertainty, as in Banker et al. (2014), and test whether it is positively associated with common ownership.

[23] As we discussed earlier, we model an increase in market liquidity as an increase in the average demand of noise traders $\frac{L}{2}$. Expected trading then goes up when L increases; assuming $\lambda > 0$, this has a direct negative effect on welfare.

Our second set of implications relates to the impact of transaction costs on common ownership and predicts a negative relationship between these two variables. This result is intriguing, as it suggests that a secular decrease in transactions costs might have contributed to the rise common ownership over the last two decades (Schmalz, 2018; Gilje et al., 2020). This prediction could also be tested in the cross-section of firms by estimating the effective cost of trading, as for instance in Hasbrouck (2009). Our model predicts that firms with a lower cost measure have a greater proportion of common owners.

We also establish a link between stock market liquidity and a firm's ownership structure. In particular, the impact of liquidity depends on the level of common ownership. For firms with a high proportion of common owners, we predict that an increase in liquidity should further increase common ownership, while the opposite is true for firms with a low proportion. The existing literature has identified several shocks to liquidity such as decimalization (Edmans et al., 2013), rule changes for corporate bond ETFs (Dannhauser, 2017), mechanical corporate bond index rules (Dick-Nielsen and Rossi, 2019), and the implementation of the Volcker Rule (Bao et al., 2018), which might be used to test this prediction.

Finally, our model also predicts that common ownership should be more prevalent in less competitive industries (in terms of our model, industries with low γ). This result highlights a potential selection bias for empirical work on the effects of common ownership on product market competition. More specifically, we show that industries where there is less competition across firms attract more common owners. As a result, a negative correlation between competition and common ownership should, to some extent, reflect this selection effect and cannot be interpreted as a causal effect of common ownership on competition. Furthermore, this finding also suggests that caution is warranted with regards to the external validity of such a relationship in certain industries, as the effect of common ownership across industries cannot be treated as random. Future empirical work could study the impact of shocks to the competitive environment on the extent of common ownership in this industry. For instance, one could identify a competition shock, as in Hombert and Matray (2018), and analyze its impact on common ownership.

6 Conclusion

In our model, the ownership structure and the degree of competition are jointly determined in equilibrium. We emphasize a critical feedback effect between both choices. More aggressive competition by one firm, increases its own value and decreases that of its rival. Hence, common ownership in both firms becomes less profitable. At the same time, incentives to compete are also affected by a firm's ownership structure because firm managers maximize shareholder welfare and internalize their cross-holdings in other firms.

We show that this interaction leads to several novel results. For instance, common owners and diversified owners can co-exist in equilibrium even though they are ex ante identical. Moreover, an increase in financial market efficiency leads to more common ownership and less competition. Perhaps surprisingly, we also find that welfare can decrease in this case.

References

Admati, A. R., P. Pfleiderer, and J. Zechner (1994). Large shareholder activism, risk sharing, and financial market equilibrium. *Journal of Political Economy 102*(6), 1097–1130.

Antón, M., F. Ederer, M. Giné, and M. C. Schmalz (2018). Common ownership, competition, and top management incentives. *Ross School of Business Paper* (1328).

Azar, J., S. Raina, and M. C. Schmalz (2019). Ultimate ownership and bank competition. *Available at SSRN 2710252*.

Azar, J. and M. C. Schmalz (2017). Common ownership of competitors raises antitrust concerns. *Journal of European Competition Law & Practice 8*(5), 329–332.

Azar, J., M. C. Schmalz, and I. Tecu (2018). Anticompetitive effects of common ownership. *The Journal of Finance 73*(4), 1513–1565.

Bai, J., T. Philippon, and A. Savov (2016). Have financial markets become more informative? *Journal of Financial Economics 122*(3), 625–654.

Baker, S., D. Chapman, and M. Galleyer (2020). Activism and indexing in equilibrium. Technical report, working paper.

Banker, R. D., D. Byzalov, and J. M. Plehn-Dujowich (2014). Demand uncertainty and cost behavior. *The Accounting Review 89*(3), 839–865.

Bao, J., M. O'Hara, and X. A. Zhou (2018). The volcker rule and corporate bond market making in times of stress. *Journal of Financial Economics 130*(1), 95–113.

Bergemann, D. and S. Morris (2016). Information design, bayesian persuasion, and bayes correlated equilibrium. *American Economic Review 106*(5), 586–91.

Bond, P., A. Edmans, and I. Goldstein (2012). The real effects of financial markets. *Annu. Rev. Financ. Econ. 4*(1), 339–360.

Bond, P. and I. Goldstein (2015). Government intervention and information aggregation by prices. *The Journal of Finance 70*(6), 2777–2812.

Brav, A., A. Dasgupta, and R. D. Mathews (2016). Wolf pack activism.

Buss, A. and S. Sundaresan (2020). More risk, more information: How passive ownership can improve informational efficiency.

Corum, A. A., A. Malenko, N. Malenko, et al. (2020). Corporate governance in the presence of active and passive delegated investment. *OSF Preprints 17*.

Cvijanović, D., A. Dasgupta, and K. E. Zachariadis (2016). Ties that bind: How business connections affect mutual fund activism. *The Journal of Finance 71*(6), 2933–2966.

Dannhauser, C. D. (2017). The impact of innovation: Evidence from corporate bond exchange-traded funds (etfs). *Journal of Financial Economics 125*(3), 537–560.

Dick-Nielsen, J. and M. Rossi (2019). The cost of immediacy for corporate bonds. *The Review of Financial Studies 32*(1), 1–41.

Dow, J. and G. Gorton (1997). Stock market efficiency and economic efficiency: is there a connection? *The Journal of Finance 52*(3), 1087–1129.

Dugast, J. and T. Foucault (2018). Data abundance and asset price informativeness. *Journal of Financial Economics 130*(2), 367–391.

Dyck, A., K. V. Lins, L. Roth, and H. F. Wagner (2019). Do institutional investors drive corporate social responsibility? international evidence. *Journal of Financial Economics 131*(3), 693–714.

Edmans, A., V. W. Fang, and E. Zur (2013). The effect of liquidity on governance. *The Review of Financial Studies 26*(6), 1443–1482.

Edmans, A., I. Goldstein, and W. Jiang (2015). Feedback effects, asymmetric trading, and the limits to arbitrage. *American Economic Review 105*(12), 3766–97.

Edmans, A., D. Levit, and D. Reilly (2019). Governance under common ownership. *The Review of Financial Studies 32*(7), 2673–2719.

Edmans, A. and G. Manso (2011). Governance through trading and intervention: A theory of multiple blockholders. *The Review of Financial Studies 24*(7), 2395–2428.

Foucault, T. and L. Frésard (2012). Cross-listing, investment sensitivity to stock price, and the learning hypothesis. *The Review of Financial Studies 25*(11), 3305–3350.

Foucault, T. and L. Frésard (2014). Learning from peers' stock prices and corporate investment. *Journal of Financial Economics 111*(3), 554–577.

Gilje, E. P., T. A. Gormley, and D. Levit (2020). Who's paying attention? measuring common ownership and its impact on managerial incentives. *Journal of Financial Economics 137*(1), 152–178.

Gilo, D., Y. Moshe, and Y. Spiegel (2006). Partial cross ownership and tacit collusion. *The Rand Journal of Economics 37*(1), 81–99.

Goldstein, I. and A. Guembel (2008). Manipulation and the allocational role of prices. *The Review of Economic Studies 75*(1), 133–164.

Goldstein, I., Y. Li, and L. Yang (2014). Speculation and hedging in segmented markets. *The Review of Financial Studies 27*(3), 881–922.

Goldstein, I., E. Ozdenoren, and K. Yuan (2013). Trading frenzies and their impact on real investment. *Journal of Financial Economics 109*(2), 566–582.

Goldstein, I. and L. Yang (2019). Good disclosure, bad disclosure. *Journal of Financial Economics 131*(1), 118–138.

Hart, O. and L. Zingales (2017). Companies should maximize shareholder welfare not market value. *ECGI-Finance Working Paper* (521).

Hasbrouck, J. (2009). Trading costs and returns for us equities: Estimating effective costs from daily data. *The Journal of Finance 64*(3), 1445–1477.

He, J. J., J. Huang, and S. Zhao (2019). Internalizing governance externalities: The role of institutional cross-ownership. *Journal of Financial Economics 134*(2), 400–418.

Heinle, M. S., K. C. Smith, and R. E. Verrecchia (2018). Risk-factor disclosure and asset prices. *The Accounting Review 93*(2), 191–208.

Hombert, J. and A. Matray (2018). Can innovation help us manufacturing firms escape import competition from china? *The Journal of Finance 73*(5), 2003–2039.

Kyle, A. S. (1985). Continuous auctions and insider trading. *Econometrica: Journal of the Econometric Society 53*(6), 1315–1335.

Levit, D. and N. Malenko (2011). Nonbinding voting for shareholder proposals. *The Journal of Finance 66*(5), 1579–1614.

Levit, D., N. Malenko, and E. Maug (2020). Trading and shareholder democracy.

López, Á. L. and X. Vives (2019). Overlapping ownership, r&d spillovers, and antitrust policy. *Journal of Political Economy 127*(5), 2394–2437.

Posner, E. A., F. M. Scott Morton, and E. G. Weyl (2017). A proposal to limit the anti-competitive power of institutional investors. *Antitrust Law Journal, forthcoming*.

Schmalz, M. C. (2018). Common-ownership concentration and corporate conduct. *Annual Review of Financial Economics 10*, 413–448.

A Appendix

A.1 Proof of Lemma 1

If $x_d = 0$, $n_j^c = 0$ and equilibrium effort is determined by the first-order condition:

$$0 = \frac{\partial \Pi_j}{\partial e_j} = 1 - \kappa_j e_j \tag{A.1}$$

such that $e_j = \frac{1}{\kappa_j}$ for firm $j \in \{A, B\}$.

If $x_d = \Delta_\mu$, we conjecture that a mass χ of common owners trades in both firms and that a mass $1-\chi$ of undiversified owners only trades firm $j = \tau$. The first-order condition for this firm is equal to:

$$0 = \frac{\partial \Pi_\tau}{\partial e_\tau} + \frac{\chi}{1+\beta} \frac{\partial \Pi_{-\tau}}{\partial e_\tau} = 1 - \underline{\kappa} e_\tau - \frac{\chi\gamma}{1+\beta} \tag{A.2}$$

such that $e_j\left(\Delta_\mu, \underline{\kappa}\right) = \frac{1}{\underline{\kappa}}\left(1 - \gamma\chi(1+\beta)^{-1}\right)$.

For the non-targeted firm, we obtain the following first-order condition:

$$0 = \frac{\partial \Pi_{-\tau}}{\partial e_{-\tau}} + \frac{\chi}{\chi+\beta} \frac{\partial \Pi_\tau}{\partial e_{-\tau}} = 1 - \overline{\kappa} e_{-\tau} - \frac{\chi\gamma}{\chi+\beta} \tag{A.3}$$

such that $e_j\left(\Delta_\mu, \overline{\kappa}\right) = \frac{1}{\overline{\kappa}}\left(1 - \gamma\chi(\chi+\beta)^{-1}\right)$.

A.2 Proof of Lemma 2

We take the composition of informed traders as given. Thus, the mass of common owners is equal to $n_j^c = \chi$ for both firms. The mass of undiversified owners is equal to $n_\tau^u = 1-\chi$ and $n_{-\tau}^u = 0$. we conjecture that informed traders only buy if $x_d = \Delta_\mu$. It follows that total order flow is equal to:

$$Y_\tau = \begin{cases} 1 + z_\tau & \text{if } x_d = \Delta_\mu \\ z_\tau & \text{if } x_d = 0, \end{cases} \quad \text{and } Y_{-\tau} = \begin{cases} \chi + z_{-\tau} & \text{if } x_d = \Delta_\mu \\ z_{-\tau} & \text{if } x_d = 0. \end{cases}$$

The market maker does not observe $\{x_d, x_\kappa\}$ and sets the equilibrium stock price equal to $\mathbb{E}[\Pi_j|Y_j]$, which leads to the following pricing function:

1. $Y_j \in (0, \chi)$: the market maker knows that $x_d = 0$. The stock price is equal to:

$$p_j = \frac{1}{2}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right)\right]$$

2. $\Upsilon_j \in (\chi, 1)$: the market maker knows that $x_d = 0$ with probability $\frac{1}{2}$. With probability $\frac{1}{2}$, demand is high and $\kappa_j = \overline{\kappa}$. The stock price is equal to:

$$p_j = \frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + 2\Pi\left(\Delta_\mu, \overline{\kappa}\right)\right]$$

3. $\Upsilon_j \in (1, L)$: the market maker knows that $x_d = \Delta_\mu$ with probability $\frac{1}{2}$. He does not learn additional information about κ_j. The stock price is equal to:

$$p_j = \frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right]$$

4. $\Upsilon_j \in (L, L + \chi)$: the market maker knows that $x_d = \Delta_\mu$ but does not learn additional information about κ_j. The stock price is equal to:

$$p_j = \frac{1}{2}\left[\Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right]$$

5. $\Upsilon_j \in (L + \chi, L + 1)$: the market maker knows that $x_d = \Delta_\mu$ and that $\kappa_j = \underline{\kappa}$. The stock price is equal to:

$$p_j = \Pi\left(\Delta_\mu, \underline{\kappa}\right).$$

Next, we compute trading profits for undiversified and common owners conditional on $x_d = \Delta_\mu$.

1. Undiversified owners.

$$U_u = \Pi\left(\Delta_\mu, \underline{\kappa}\right) - \mathbb{E}\left[p_j | x_d = \Delta_\mu, n_j^u = 1 - \chi\right] \tag{A.4}$$

2. Common owners.

$$U_c = \Pi\left(\Delta_\mu, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) - \mathbb{E}\left[p_j | x_d = \Delta_\mu, n_j^u = 1 - \chi\right] - \mathbb{E}\left[p_j | x_d = \Delta_\mu, n_j^u = 0\right] \tag{A.5}$$

The conditional expectations of p_j are given by:

$$\begin{aligned} \mathbb{E}\left[p_j | x_d = \Delta_\mu, n_j^u = 1 - \chi\right] &= \frac{(L-1)}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] \\ &+ \frac{\chi}{L}\frac{1}{2}\left[\Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] + \frac{(1-\chi)}{L}\Pi\left(\Delta_\mu, \underline{\kappa}\right) \end{aligned} \tag{A.6}$$

and

$$\mathbb{E}\left[p_j|x_d=\Delta_\mu, n_j^u=0\right] = \frac{(1-\chi)}{L}\frac{1}{4}\left[\Pi(0,\overline{\kappa})+\Pi\left(0,\underline{\kappa}\right)+2\Pi\left(\Delta_\mu,\overline{\kappa}\right)\right] + \frac{(L-1)}{L}\frac{1}{4}\left[\Pi(0,\overline{\kappa})+\Pi\left(0,\underline{\kappa}\right)+\Pi\left(\Delta_\mu,\overline{\kappa}\right)+\Pi\left(\Delta_\mu,\underline{\kappa}\right)\right] + \frac{\chi}{L}\frac{1}{2}\left[\Pi\left(\Delta_\mu,\overline{\kappa}\right)+\Pi\left(\Delta_\mu,\underline{\kappa}\right)\right] \tag{A.7}$$

It follows that we can express trading profits more compactly as:

$$U_u = \frac{1}{4L}\left[(3(L-1)+2\chi)\Pi\left(\Delta_\mu,\underline{\kappa}\right)-(L-1+2\chi)\Pi\left(\Delta_\mu,\overline{\kappa}\right)+(L-1)\left(\Pi(0,\overline{\kappa})+\Pi\left(0,\underline{\kappa}\right)\right)\right]-\lambda \tag{A.8}$$

and

$$U_c = \frac{L-1}{2L}\left[\Pi\left(\Delta_\mu,\underline{\kappa}\right)+\Pi\left(\Delta_\mu,\overline{\kappa}\right)\right]-\frac{L+1-2\chi}{2L}\left[\Pi(0,\overline{\kappa})+\Pi\left(0,\underline{\kappa}\right)\right]-\frac{(1-\chi)}{L}\Pi\left(\Delta_\mu,\overline{\kappa}\right)-2\lambda \tag{A.9}$$

A.3 Proof of Proposition 1

Conjecture 1

Assumption 1 implies that the conjectured trading policy is optimal for traders. We formally show in Appendix A.11 that, for any value of β, traders optimally buy at least the target firm if $x_d = \Delta_\mu$, and do not trade if $x_d = 0$.

For ease of exposition, we denote the trading profit in the non-targeted firm as:

$$U_{-\tau}^{**} \equiv \lim_{\beta\to\infty}\left[\Pi\left(\Delta_\mu,\overline{\kappa}\right)-\mathbb{E}[p_j|x_d=\Delta_\mu, n_j^u=0]\right]. \tag{A.10}$$

Uniqueness of Equilibrium

Plugging in the expressions for the terminal firm value and the expected stock price derived above yields:

$$\frac{\partial U_{-\tau}^{**}}{\partial\chi} = \frac{2\gamma\underline{\kappa}+\underline{\kappa}-\bar{\kappa}\left(4\underline{\kappa}\Delta_\mu+2\gamma+1\right)}{8L\bar{\kappa}\underline{\kappa}} < 0. \tag{A.11}$$

Hence, the unique equilibrium is either equal to $\chi^{**}=0$ if $U_{-\tau}^{**}<\lambda$ at $\chi=0$, or equal to $\chi^{**}=1$ if $U_{-\tau}^{**}>\lambda$ at $\chi=1$, or equal to $\chi^{**}\in(0,1)$ otherwise (by the intermediate value theorem).

Limit $\Delta_\kappa \to 0$

We have:

$$\lim_{\Delta_\kappa \to 0} U^{**}_{-\tau} = \frac{L-\chi}{2L}\Delta_\mu \tag{A.12}$$

which is greater than $\overline{\lambda}$ for all $\chi \in [0,1]$ such that $\chi^{**} = 1$.

Comparative statics

1. With respect to the transaction cost λ: Note that $U^{**}_{-\tau}$ does not depend on λ. It follows directly that an increase in λ leads to a decrease in χ^{**} and thus to a decrease in the mass of common owners.

2. With respect to market liquidity L:

$$\frac{\partial U^{**}_{-\tau}}{\partial L} = \frac{\bar{\kappa}\left(4\chi\underline{\kappa}\Delta_\mu - (2\gamma+1)(1-\chi)\right) + (2\gamma+1)(1-\chi)\underline{\kappa}}{8L^2\bar{\kappa}\underline{\kappa}} \tag{A.13}$$

which is positive if and only if $\chi > \frac{(2\gamma+1)\left(\bar{\kappa}-\underline{\kappa}\right)}{\bar{\kappa}\left(4\underline{\kappa}\Delta_\mu+2\gamma+1\right)-(2\gamma+1)\underline{\kappa}}$.

3. With respect to the demand shock Δ_μ:

$$\frac{\partial U^{**}_{-\tau}}{\partial \Delta_\mu} = \frac{L-\chi}{2L} > 0. \tag{A.14}$$

4. With respect to the difference in the firms' cost of effort $\Delta_\kappa = \overline{\kappa} - \underline{\kappa}$:

$$\frac{\partial U^{**}_{-\tau}}{\partial \Delta_\kappa} = -\frac{(2\gamma+1)(2L+\chi-1)}{8\overline{\kappa}^2 L} < 0. \tag{A.15}$$

A.4 Proof of Proposition 2

Conjecture 1

Assumption 1 implies that the conjectured trading policy is optimal for traders. We formally show in Appendix A.11 that, for any value of β, traders optimally buy at least the target firm if $x_d = \Delta_\mu$, and do not trade if $x_d = 0$.

For ease of exposition, we denote the trading profit in the non-targeted firm as:

$$U^{*}_{-\tau} \equiv \Pi\left(\Delta_\mu, \overline{\kappa}\right) - \mathbb{E}[p_j | x_d = \Delta_\mu, n^u_j = 0]. \tag{A.16}$$

A.4.1 Equilibrium Existence and Number of Equilibria

An equilibrium value χ^* satisfies the following conditions:

$$\chi^* = \begin{cases} 0 & \text{if } U^*_{-\tau} \mid_{\chi=0} \leq \lambda \\ \in (0,1) & \text{if } U^*_{-\tau} \mid_{\chi=\chi^*} = \lambda \\ 1 & \text{if } U^*_{-\tau} \mid_{\chi=1} \geq \lambda. \end{cases} \tag{A.17}$$

In what follows, we show that there always exists at least one value of χ that satisfies condition (A.17). If $U^*_{-\tau} \mid_{\chi=0} \leq \lambda$, then $\chi^* = 0$ is an equilibrium. Similarly, if $U^*_{-\tau} \mid_{\chi=1} \geq \lambda$, then $\chi^* = 1$ is an equilibrium. Notice that the expression $U^*_{-\tau}$ is continuous in χ. As a consequence, if $U^*_{-\tau} \mid_{\chi=0} \geq \lambda$ and $U^*_{-\tau} \mid_{\chi=1} \leq \lambda$, then by the intermediate value theorem there exists a value $\chi' \in (0,1)$ such that $U^*_{-\tau} \mid_{\chi=\chi'} = \lambda$. In this case, χ' is an equilibrium of the game. Therefore, at least one equilibrium of the game always exists. The numerical examples given in the main text show that there might be multiple stable equilibria.

Limit $\Delta_\kappa \to 0$

One numerical example that yields an interior solution is $\overline{\kappa} = \underline{\kappa} = \gamma = \Delta = 1$ with $L = 10$, $\lambda = \frac{9}{20}$, and $\beta = \frac{1}{10}$, which generates a stable interior equilibrium at $\chi^* \approx 0.028$.

Comparative Statics

1. Comparative statics with respect to the transaction cost λ: Note that $U^*_{-\tau}$ does not depend on λ. It follows directly that an increase in λ leads to a decrease in χ^* and thus to a decrease in the mass of common owners.

2. Comparative statics with respect to market liquidity L: we obtain

$$\frac{\partial U^*_{-\tau}}{\partial L} \mid_{\chi=0} < 0 \quad \text{and} \quad \frac{\partial U^*_{-\tau}}{\partial L} \mid_{\chi=1} > 0 \tag{A.18}$$

   hence there must exist a cutoff $\overline{\chi} \in (0,1)$ such that $U^*_{-\tau}$ is decreasing in L for all $\chi \in [0, \overline{\chi}]$, by the intermediate value theorem.

3. Comparative statics with respect to the demand shock Δ_μ and the difference in the firms' cost of effort $\Delta_\kappa = \overline{\kappa} - \underline{\kappa}$ can be verified given the parametric restrictions in Assumption 1.

A.5 Proof of Lemma 3

For the target firm we obtain the following first-order condition:

$$\frac{\partial U_\tau}{\partial q_\tau} = 0 \Leftrightarrow q_\tau = \frac{1}{2}\left(\frac{\Delta_\mu - \underline{\kappa}}{\gamma} - \frac{(\beta + \chi + 1)q_{-\tau}}{\beta + 1}\right) \tag{A.19}$$

and for the non-targeted firm:

$$\frac{\partial U_{-\tau}}{\partial q_{-\tau}} = 0 \Leftrightarrow q_{-\tau} = \frac{1}{2}\left(\frac{\Delta_\mu - \bar{\kappa}}{\gamma} + \left(\frac{\beta}{\beta + \chi} - 2\right) q_\tau\right). \tag{A.20}$$

Solving these two equations for q_τ and $q_{-\tau}$ leads to:

$$q_\tau = \frac{(\beta + \chi)\left((\beta + 1)\left(\bar{\kappa} - 2\underline{\kappa} + \Delta_\mu\right) + \chi\left(\bar{\kappa} - \Delta_\mu\right)\right)}{\gamma\left((\beta + 2)\chi + 3\beta(\beta + 1) - 2\chi^2\right)} \tag{A.21}$$

and

$$q_{-\tau} = \frac{(\beta + 1)\left(\beta\left(-2\bar{\kappa} + \underline{\kappa} + \Delta_\mu\right) + 2\chi\left(\underline{\kappa} - \bar{\kappa}\right)\right)}{\gamma\left((\beta + 2)\chi + 3\beta(\beta + 1) - 2\chi^2\right)}. \tag{A.22}$$

To ensure that both quantities are positive, we impose the sufficient condition:

$$\Delta_\mu > 2\left(1 + \frac{1}{\beta}\right)\overline{\kappa} \equiv \overline{\Delta}_\mu^c. \tag{A.23}$$

If $x_d = 0$, both firms optimally choose $q_j = 0$.

A.6 Proof of Proposition 3

In the model with Cournot competition, we require the following condition the ensure the existence of an equilibrium given $x_d = \Delta_\mu$:

$$\Pi\left(\Delta_\mu, \underline{\kappa}\right) - \mathbb{E}[p_j | Y_j = 1 + z_j] > \lambda, \tag{A.24}$$

such that informed traders are willing to trade in the target firm in equilibrium. We can plug in the equilibrium price derived above and use that $\Pi\left(0, \kappa_j\right) = 0$ to get:

$$\begin{aligned} \lambda &< \frac{L + \chi - 1}{L}\Pi\left(\Delta_\mu, \underline{\kappa}\right) - \frac{\frac{1}{2}L + \chi - \frac{1}{2}}{L}\frac{1}{2}\left[\Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] \\ &= \frac{3L - 3 + 2\chi}{4L}\Pi\left(\Delta_\mu, \underline{\kappa}\right) - \frac{\frac{1}{2}L + \chi - \frac{1}{2}}{2L}\Pi\left(\Delta_\mu, \overline{\kappa}\right) \end{aligned} \tag{A.25}$$

such that we obtain $\overline{\lambda}^c = \min_\chi \frac{3(L-1)}{4L}\Pi\left(\Delta_\mu, \underline{\kappa}\right) - \frac{(L-1)}{4L}\Pi\left(\Delta_\mu, \overline{\kappa}\right)$.

The equilibrium stock prices in Lemma 2 only depend on Π and are thus unchanged.

1. Comparative statics with respect to the transaction cost λ: Note that trading profits do not depend on λ. It follows directly that an increase in λ leads to a decrease in χ^* and thus to a decrease in the mass of common owners.

2. Comparative statics with respect to market liquidity L: we find that at $\chi = 0$ trading profits are decreasing in L, while at $\chi = 1$ they are increasing in L. Hence there must exist a cutoff $\overline{\chi} \in (0, 1)$ such that trading profits are decreasing in L for all $\chi \in [0, \overline{\chi}]$, by the intermediate value theorem.

3. Comparative statics with respect to Δ_κ and with respect to Δ_μ, assuming $\Delta_\kappa \to 0$ and $\beta > 1$: these results follow directly from the functional form of trading profits and the parametric restrictions in Assumption 2.

A.7 Proof of Lemma 4

1. Product market prices: we plug in the equilibrium quantities into $\rho = x_d + \gamma\left(q_A + q_B\right)$ and obtain that $\frac{\partial\rho^*}{\partial\chi}$ is given by:

$$\frac{\beta\left(\bar{\kappa}\left(-\left((\beta+\chi)^2+2\chi-1\right)\right)-(\beta+1)\underline{\kappa}(\beta-4\chi+2)+\left(2\beta^2-2(\beta+1)\chi+3\beta+\chi^2+1\right)\Delta_\mu\right)}{\left((\beta+2)\chi+3\beta(\beta+1)-2\chi^2\right)^2}.$$

   Since ρ^* depends on λ and L only through χ, it inherits these two comparative statics from χ.

2. Total surplus. Note that we can write S as follows:

$$S = \frac{1}{2}\left(\Pi_\tau + \Pi_{-\tau} + \left(q_\tau + q_{-\tau}\right)^2\right) - \frac{\lambda}{2}\left(L + \chi + 1\right) \tag{A.26}$$

   An example of the ambiguous dependence of S on λ is given in Figure 7. To show the ambiguous dependence of S on L, we can consider the case $\lambda \to 0$ and use the ambiguous effect of L on χ, which increases the first component above.

A.8 Proof of Lemma 5

Solving the firms' first-order conditions for ρ_τ and $\rho_{-\tau}$, given $x_d = \Delta_\mu$ yields:

$$\rho_\tau = \frac{\underline{\kappa}\left(-(\beta+\chi+1)\left(2\beta-\gamma^2\chi\right)-2\chi\right)-\gamma\bar{\kappa}(\beta-\chi+1)(\beta+\chi)-(\beta+\chi)\Delta_\mu((\beta+1)(\gamma+2)+\gamma\chi)}{(\beta+\chi+1)\left(\beta\left(\gamma^2-4\right)+2\gamma^2\chi\right)-4\chi}$$

and

$$\rho_{-\tau} = \frac{\bar{\kappa}\left(\chi\left(\beta\left(\gamma^2-2\right)-2\right)-2\beta(\beta+1)+2\gamma^2\chi^2\right)+(\beta+1)\left(\Delta_\mu(-(\beta(\gamma+2)+2(\gamma+1)\chi))-\beta\gamma\underline{\kappa}\right)}{(\beta+\chi+1)\left(\beta\left(\gamma^2-4\right)+2\gamma^2\chi\right)-4\chi}.$$

The previous condition $\Delta_\mu < \overline{\Delta}_\mu^c$ ensures that these prices are positive. If $x_d = 0$, both firms set $\rho_j = 0$.

A.9 Proof of Proposition 4

As in the model with Cournot competition, we require that:

$$\lambda < \frac{3L-3+2\chi}{4L}\Pi\left(\Delta_\mu,\underline{\kappa}\right)-\frac{\frac{1}{2}L+\chi-\frac{1}{2}}{2L}\Pi\left(\Delta_\mu,\overline{\kappa}\right) \tag{A.27}$$

such that we can again use the threshold $\overline{\lambda}^c = \min_\chi \frac{3(L-1)}{4L}\Pi\left(\Delta_\mu,\underline{\kappa}\right)-\frac{(L-1)}{4L}\Pi\left(\Delta_\mu,\overline{\kappa}\right)$.

The equilibrium stock prices in Lemma 2 only depend on Π and are thus unchanged.

1. Comparative statics with respect to the transaction cost λ: Note that trading profits do not depend on λ. It follows directly that an increase in λ leads to a decrease in χ^* and thus to a decrease in the mass of common owners.

2. Comparative statics with respect to market liquidity L: we find that at $\chi = 0$ trading profits are decreasing in L, while at $\chi = 1$ they are increasing in L. Hence there must exist a cutoff $\overline{\chi} \in (0,1)$ such that trading profits are decreasing in L for all $\chi \in [0,\overline{\chi}]$, by the intermediate value theorem.

3. Comparative statics with respect to Δ_μ, assuming $\Delta_\kappa \to 0$ and $\beta > 1$: this result follows directly from the functional form of trading profits and the parametric restrictions on Δ_μ.

A.10 Proof of Lemma 6

1. The average price only depends on λ and L through χ. Moreover, we can verify that it is strictly increasing in χ. Hence, we can use the results in Proposition 4 to show that the average price decreases with λ and increases with L (if χ^* is large enough).

2. If $\lambda = 0$, S may decrease in L, as shown in Figure 8.

A.11 Derivations for Assumption 1

In this section, we derive the cutoff values for Δ_μ and λ. These two parametric assumptions ensure that it is optimal for informed traders not to trade if $x_d = 0$ and to buy at least one of the assets (the target firm) if $x_d = \Delta_\mu$. Formally, we can write these two conditions as follows:

$$\widetilde{U}_0 \equiv \Pi\left(0, \underline{\kappa}\right) - \mathbb{E}\left[p_j | Y_j = z_j\right] < \lambda \tag{A.28}$$

and

$$\widetilde{U}_1 \equiv \Pi\left(\Delta_\mu, \underline{\kappa}\right) - \mathbb{E}\left[p_j | Y_j = 1 + z_j\right] > \lambda \tag{A.29}$$

It follows from the proof of Lemma 2 that we can write the expected prices as:

$$\begin{aligned}\mathbb{E}\left[p_j | Y_j = z_j\right] &= \frac{\chi}{L}\frac{1}{2}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right)\right] + \frac{1-\chi}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + 2\Pi\left(\Delta_\mu, \overline{\kappa}\right)\right] \\ &+ \frac{L-1}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right]\end{aligned} \tag{A.30}$$

and

$$\begin{aligned}\mathbb{E}[p_j | Y_j = 1 + z_j] = &= \frac{L-1}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] \\ &+ \frac{\chi}{L}\frac{1}{2}\left[\Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] + \frac{1-\chi}{L}\Pi\left(\Delta_\mu, \underline{\kappa}\right)\end{aligned} \tag{A.31}$$

As a first step, we ensure that inequality (A.28) holds at $\lambda = 0$, such that:

$$\begin{aligned}\Pi\left(0, \underline{\kappa}\right) &< \frac{\chi}{L}\frac{1}{2}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right)\right] + \frac{1-\chi}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + 2\Pi\left(\Delta_\mu, \overline{\kappa}\right)\right] \\ &+ \frac{L-1}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right].\end{aligned} \tag{A.32}$$

To simplify this inequality, we define $\widetilde{\Pi}\left(\kappa_j\right) = \Pi\left(\Delta_\mu, \kappa_j\right) - \Delta_\mu$, which does not depend on Δ_μ. It follows that we require:

$$\begin{aligned}
\Pi\left(0, \underline{\kappa}\right) \quad &< \quad \frac{\chi}{L}\frac{1}{2}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right)\right] + \frac{1-\chi}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + 2\widetilde{\Pi}\left(\overline{\kappa}\right)\right] \\
&+ \quad \frac{L-1}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + \widetilde{\Pi}\left(\overline{\kappa}\right) + \widetilde{\Pi}\left(\underline{\kappa}\right)\right] + \frac{L+1-2\chi}{4L}\Delta_\mu.
\end{aligned} \tag{A.33}$$

Furthermore, it follows from Lemma 1 that:

$$\widetilde{\Pi}\left(\overline{\kappa}\right) + \widetilde{\Pi}\left(\underline{\kappa}\right) > \Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) \tag{A.34}$$

and that

$$\widetilde{\Pi}\left(\overline{\kappa}\right) < \widetilde{\Pi}\left(\underline{\kappa}\right) \tag{A.35}$$

such that we can obtain the sufficient condition for inequality (A.28), $\Delta_\mu > \overline{\Delta}_\mu$ with:

$$\overline{\Delta}_\mu \equiv \frac{L(1+2\gamma)\left(\overline{\kappa} - \underline{\kappa}\right)}{(L-1)\overline{\kappa}\underline{\kappa}} > 0. \tag{A.36}$$

Next, we assume that $\Delta_\mu > \overline{\Delta}_\mu$ and ensure that inequality (A.29) holds for all $\chi \in [0, 1]$:

$$\begin{aligned}
\lambda \quad &< \quad \Pi\left(\Delta_\mu, \underline{\kappa}\right) - \frac{L-1}{L}\frac{1}{4}\left[\Pi\left(0, \overline{\kappa}\right) + \Pi\left(0, \underline{\kappa}\right) + \Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] \\
&- \quad \frac{\chi}{L}\frac{1}{2}\left[\Pi\left(\Delta_\mu, \overline{\kappa}\right) + \Pi\left(\Delta_\mu, \underline{\kappa}\right)\right] - \frac{1-\chi}{L}\Pi\left(\Delta_\mu, \underline{\kappa}\right)
\end{aligned} \tag{A.37}$$

which holds if $\lambda < \overline{\lambda}$ with:

$$\overline{\lambda} \equiv \frac{L-1}{2L}\left[\Delta_\mu + \frac{\left(\bar{\kappa} - \underline{\kappa}\right)(\beta - \gamma + 1)(2\beta\gamma + \beta + 3\gamma + 1)}{2(\beta+1)^2\overline{\kappa}\underline{\kappa}}\right] > 0. \tag{A.38}$$