When does overlapping ownership soften competition? The role of agency frictions and repeated interaction*

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Abstract

We document novel stylized facts about the effects of overlapping ownership on profits. We find that overlapping ownership is associated with *lower* profit margins when corporate governance is bad and in industries prone to softer competition due to tacit collusion. We build a simple dynamic model, where - due to agency frictions - firm managers derive a private benefit from deviating from tacit collusion. We find that overlapping ownership can increase, decrease, or have no effect on profits, depending on the extent of the agency friction and an industry's disposition towards softer competition. Our model is consistent with the stylized facts and can help reconcile theory with the mixed effects of overlapping ownership on profit found in the data.

Keywords: ownership, industry competition, repeated interaction, agency frictions
JEL Codes: D21, D22, G30, L13, L41

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1 Introduction

Overlapping ownership in competing firms has increased dramatically over the last decades (Schmalz, 2018; Backus et al., 2021b), leading to concerns that overlapping owners will soften competition among the firms in their portfolio. In particular, the manager of a firm whose owner also holds shares in the firm's competitors might take these cross-holdings into account when deciding about output, pricing, capacity, innovation, and expanding into new markets in ways that are detrimental to consumer welfare (Rotemberg, 1984; Hansen and Lott, 1996; Gordon, 2003; Azar, 2020; Antón et al., 2023).

While most models of overlapping ownership predict that increased overlapping ownership is detrimental to consumer welfare since it leads to softer product market competition, the empirical evidence of overlapping ownership on product market competition is mixed.[1] Backus et al. (2021a) find no effect of overlapping ownership on markups in the ready-to-eat cereal industry, and Koch et al. (2021) find no impact of overlapping ownership on markups across industries on average, but higher profits for some industries and even lower profits for other industries.[2] Thus, understanding what can account for the dispersion in the empirical results is important.

We study the factors driving the heterogeneous effect of overlapping ownership on firm profits finding that overlapping ownership is associated with lower profit margins when corporate governance is *bad*. Moreover, in industries with traditionally *softer* competition, for example, because of high entry barriers, we find that overlapping ownership is associated with lower profit margins. To understand these findings, we build a simple dynamic model of overlapping ownership with agency frictions between firm owners and managers. In this model, the impact of overlapping ownership on profits depends on the extent of the agency friction and, because of repeated interaction, an industry's "natural disposition" for soft competition due to tacit collusion. Depending on these factors, overlapping ownership can lead to higher, no change, or even lower profits. The predictions of our model are consistent with the stylized facts, and the model can account for some of the heterogeneous effects of

[1] Overlapping ownership can also have positive effects on consumers by increasing incentives for innovation (Anton et al., 2021; López and Vives, 2019), mitigating double marginalization through quasi-vertical integration (Crawford et al., 2018), or internalizing negative externalities due to their inter-industry (in addition to intra-industry) holdings (Azar and Vives, 2021a; Hart and Zingales, 2017).

[2] Azar et al. (2022, 2018) document that higher levels of overlapping ownership are associated with higher prices in the airline and banking industries.

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overlapping ownership on profit margins in the data.

Beyond the academic interest in understanding how overlapping ownership affects product market competition, our results can inform the policy debate about whether antitrust authorities should limit overlapping ownership (see Azar (2020) for an overview of the discussion). In particular, our results broadly support the view that overlapping ownership might soften competition only in a subset of industries characterized by relatively *good* corporate governance and a *low* "natural disposition" for soft competition.

Stylized Facts. We measure overlapping ownership using new, more complete data on ownership of S&P 500 firms collected by Amel-Zadeh et al. (2022). Since the incentives of overlapping owners might differ depending on the type of portfolio they hold (Lewellen and Lewellen, 2022; Appel et al., 2016), we distinguish between two types of overlapping owners: *universal* owners and *common* owners. Similar to Amel-Zadeh et al. (2022), we define universal owners as investors who hold part of at least 95% of S&P 500 firms. Common owners are all remaining investors who hold stakes in multiple firms but are not universal owners. We then explore whether two factors, *corporate governance* and an industry's *tendency for soft competition*, can account for some of the heterogeneous effects of overlapping ownership on firm profits.

To investigate the effect of corporate governance, we interact our measure of overlapping ownership with firms' managerial entrenchment index of Bebchuk et al. (2009). While we find no association between overlapping ownership and firm profitability on average, we find that common ownership is associated with *lower* profit margins for firms with *bad* corporate governance and *higher* profit margins when corporate governance is good. (*Stylized Fact 2a*). The effect of *universal* owners goes in the same direction but is much weaker. Importantly, the effect for common owners is only present for firms that are *close* competitors in the product space, as defined by the text-based product similarity measure by Hoberg and Phillips (2016). A strong disciplining device for owners and a critical part of the managerial entrenchment index of Bebchuk et al. (2009) is the cost for shareholders of firing incumbent managers (i.e., poison pills and golden parachute arrangements). Therefore we also investigate whether overlapping owners are more reluctant to fire CEOs. Using data by Peters and Wagner (2014) and Jenter and Kanaan (2015) on forced CEO turnover, we find that separate owners are more likely than common and universal owners to fire CEOs after a bad

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firm performance (*Stylized Fact 2b*).

The second set of factors we investigate relates to industry characteristics that facilitate *soft competition* (i.e., tacit collusion). For example, high entry barriers, homogeneous products, and symmetric cost structures (Ivaldi et al., 2003). Since there is no consensus in the literature on the best way to map theoretical factors facilitating soft competition to the data (Asker and Nocke, 2021), we use four different measures. First, an indicator for industries with a "natural disposition" towards softer competition (by Grout and Sonderegger (2005). Second, following Bindal and Nordlund (2022), we classify industries into high and low fixed assets to proxy for entry barriers. We also test whether industries with low advertisement expenditures and highly concentrated industries play a role. We find that in industries with a tendency towards soft competition, higher universal ownership is associated with *lower* profit margins (*Stylized Fact 3*). The effect for common owners is qualitatively similar but weaker.

As a next step, we provide a simple model to understand how the two factors, corporate governance and an industry's "natural disposition" towards soft competition, could interact with overlapping ownership.

Model. Our model in Section 3 combines the simplest competition setup from the industrial organization literature (*prisoner's dilemma*) with the simplest agency cost setup from the organizational literature (*self-dealing*) managers.[3] Two firms interact in the same market by playing a repeated prisoner's dilemma. The choice to cooperate or defect in each firm is made by its manager, who can divert a portion of the realized firm's profit. As a result, the interest of the firm's owner and its manager must be aligned by giving the manager appropriate incentives. In particular, the firm's owner can pay the manager to cooperate or to defect, and the owner can also fire the incumbent manager by incurring a fixed cost. All managers and owners agree that cooperation is optimal since it maximizes joint firm profits. Ex-post, however, each manager wants to defect and maximize his firm profit since this allows the manager to divert more. Thus, cooperation is costly for the owners since they must provide a "cooperation bonus" to the managers amounting to the foregone benefit of defection.

[3]We also consider other types of agency costs, such as *quite-life* managerial preferences (Bertrand and Mullainathan (2003)), which are very common in this line of research (Antón et al. (2023), and show that they cannot explain the stylized facts in Section 2 in the most parsimonious way.

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We are interested in understanding how three ownership arrangements affect firm profitability: *(i)* separate owners, *(ii)* active overlapping owners (common owners), and *(iii)* passive overlapping owners (universal owners). We follow the literature in treating universal owners as "passive" (Lewellen and Lewellen, 2018; Gilje et al., 2020) who hold formal but not real authority as in Aghion and Tirole (1997). In particular, the model assumes that such owners "inherit" and do not change the contractual arrangements already in place and are also less likely (or slower) to fire managers that do not act in the owners' best interest. The model then predicts that increasing universal ownership *lowers* firm profits in collusion-prone industries. The reason is that separate owners can coordinate on using threats of managerial termination to sustain cooperation in collusion-prone industries. In contrast, such an outcome is less likely to be sustained under universal owners because they are less likely to fire defecting managers.

We then investigate the effect of common owners (i.e., active overlapping owners) who choose managerial contracts and incur the same fixed cost as separate owners in replacing an incumbent manager. The effect of increasing common ownership on firm profitability is more complex, and we begin by studying a static version of the model to focus on the role of agency costs in isolation. In a static model, cooperation is never an equilibrium under separate ownership, regardless of agency cost. The reason is well-known: separate owners *do not* internalize the negative effect on the rival firms' profits. On the other hand, a common owner internalizes such negative effects and chooses to pay cooperation bonuses to the managers whenever the monetary gain from cooperation (in the form of soft competition among the firms) exceeds the cost of cooperation bonuses. Crucially, the magnitude of cooperation bonuses depends on the severity of agency costs: the larger the share of profits a manager can divert, the greater the cooperation bonus required to induce her to cooperate. Thus, agency costs are central to the common owners' willingness to induce cooperative behavior.

What is the effect of repeated interaction on our results? Following the literature on repeated games, we focus on subgame perfection: all players (managers and owners) *cannot* commit and instead always act to maximize their continuation payoff (Farrell and Maskin, 1989). Repetition allows the players to use *trigger strategies*: all managers start by cooperating. If ever one manager defects, all managers do not cooperate anymore. If the players are sufficiently patient, trigger strategies constitute a subgame perfect equilibrium of the

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game under separate ownership.[4] Further, trigger strategies reduce managerial rents making cooperation profitable for the separate owners. However, notice that separate owners can coordinate on trigger strategies such that after a managerial defection, the game reverts to the one-shot non-cooperative equilibrium unless the firm's owner replaces the defecting manager. In such an equilibrium, each separate owner would replace a defecting manager to avoid reversing to the punishment phase (i.e., he "fears" what the other owners would do otherwise), which in turn makes the threat of termination credible and deters managerial defection. A common owner, in contrast, has no other owners to "fear" since he controls the managerial incentives of all managers and prefers to avoid any Pareto-inefficient outcomes ex-post - such as those involving a dead-weight cost of firing managers.

Our results do not rely on exogenously reducing the severity of punishments available to common relative to separate owners. The key is that threats to fire defecting managers will be plagued by a lack of credibility under common ownership - as long as replacing an incumbent manager carries some cost for the owner.[5] The same agency cost and lack of commitment issues plague separate owners in our model. Still, the fact that separate owners do not internalize the profit of the competing firms gives them greater credibility under repeated interaction. This implication is supported by our finding in Section 2 that overlapping owners are *less* likely than separate owners to fire managers for bad performance (stylized fact 2b).

The baseline model treats the ownership arrangement as given, which raises the question of why common ownership would ever increase in high agency costs industries if this is expected to strengthen competition and reduce firm profitability. The answer is that managers in industries with high agency costs might prefer to coordinate on the tacitly collusive outcome since this allows them to earn high rents. The owners, however, prefer the managers to play uncooperatively since, even though joint firm profits decrease, joint managerial rents decrease by an even greater amount implying that joint profits for the owners would increase. We show in Section 4.1 that a free-rider problem plagues separate ownership in this situation since the increasing competition while reducing total managerial rents would

[4] Although in practice CEO have limited terms, (the average term for US public firms is around seven years, see Link) we think that terms are long enough to think of shareholder-manager interactions as a repeated game.

[5] Firing CEOs is likely to be costly. Taylor (2010), for example, estimates that to account for the low observed 2% forced CEO turnover rate, boards behave as if firing a CEO costs 5.9% of total firm value.

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reduce the profit of at least one separate owner, who would, as a result, refuse to go along with the plan unless compensated by the owners who gain. Common ownership is then a device to overcome this free-rider issue and induce all owners to participate in reducing managerial rents through increasing competition. The model implies that high agency costs predict increasing common ownership *and* decreasing firm profits. This outcome manifests the owners' desire to reduce managerial rents in high agency costs industries rents even at the cost of greater competition.

Contribution. First, we contribute to the empirical literature studying the effects of overlapping ownership on product market competition. We use state-of-the-art data on ownership by Amel-Zadeh et al. (2022) to show that the effect of overlapping ownership depends on firms' corporate governance and an industry's disposition towards soft competition. We also show important differences between active common and passive universal owners. To our knowledge, the negative relationship between common ownership and profit margins for firms with bad corporate governance and the lower willingness to fire CEOs upon bad performance has not been documented previously. We also show that overlapping ownership is associated with lower profitability in industries with a "natural" disposition towards soft competition.

He et al. (2019) and Charoenwong et al. (2022) find that mutual funds with overlapping ownership are more likely to vote against management proposals, which is consistent with our finding that overlapping owners seem to find it more difficult to increase profits when corporate governance is bad (for example, when shareholder voting power is restricted). Bindal and Nordlund (2022) show that overlapping ownership leads to higher profits in initially more competitive industries. Their results are consistent with our empirical results and the predictions of our model, where soft competition under overlapping ownership is easier to sustain in industries with a low "natural" disposition towards soft competition. Different from Bindal and Nordlund (2022), we also consider agency frictions between managers and shareholders, which allow us to account for the negative effect of overlapping ownership on profits in some industries. Consistent with our empirical findings and model predictions Koch et al. (2021) find mixed empirical evidence with higher levels of overlapping ownership

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leading to higher profitability in some industries but lower profitability in other industries.[6]

Second, we contribute to the theoretical literature on overlapping ownership by studying the effect of overlapping ownership on product market competition in a model featuring *both* agency cost and repeated interaction. This is important because the combination of the two ingredients drives the main prediction of our model: overlapping owners lead to higher profits in some industries but lower profits in others. The previous literature has focused on models that either include agency costs but no repeated interaction (Antón et al., 2023; Backus et al., 2021b) or repeated interaction but not agency cost (Malueg, 1992; Gilo et al., 2006). Adding an agency cost sharpens the model predictions relative to Malueg (1992) and Gilo et al. (2006) and allows us to better account for the patterns in the data where the effect of overlapping ownership interacts with managerial incentives.

Antón et al. (2023) investigate the effect of overlapping ownership in a model featuring agency costs. First, they explicitly rule out tacit collusion, whereas this channel plays a central role in our case. Second, our model assumes self-dealing managers whereas Antón et al. (2023) assumes managers prefer to enjoy the *quiet life* by exerting less effort (Bertrand and Mullainathan, 2003). This distinction is important: with quiet life agency costs, overlapping ownership always softens competition in our model. Empirically, overlapping ownership sometimes appears to increase competition, consistent with the agency cost we postulate. Finally, our model implies that overlapping owners are incentivized to strengthen corporate governance, whereas overlapping owners in Antón et al. (2023) lead to weaker corporate governance. In practice, overlapping owners might strengthen corporate governance in some dimensions (for example, to reduce managerial self-dealing) and weaken it in others (such as cutting costs and improving productivity). This is consistent with the mixed empirical evidence on the effect of overlapping ownership on corporate governance (i.e., Appel et al. (2016) and Heath et al. (2022)).

[6] Among other explanations for the mixed empirical evidence is the presence of identification problems (Lewellen and Lowry, 2021).

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2 Stylized Facts

2.1 Data

Ownership data and measure Our ownership data come from Amel-Zadeh et al. (2022) and include ownership information of all S&P 500 firms from 2003 until 2019, except for firms with dual-class shares. In addition to the information contained in 13-F blockholder filings, Amel-Zadeh et al. (2022) also scrape 13-D/G and Form 2/3/4 filings which include information about other types of blockholders, corporate insiders for example, to obtain a complete picture of S&P 500 firms' ownership structure.[7]

We measure overlapping ownership between two firms as the cosine similarity between two vectors β_f and β_g, where each vector contains the fraction of shares owned by investors in firm f and g respectively (Backus et al., 2021a). We also provide robustness checks using profit weights, κ_{gf}, as an alternative measure of how overlapping ownership might affect a firm's incentives.

Universal vs. common ownership In our empirical analysis, we distinguish between universal and common owners similar to Amel-Zadeh et al. (2022). As mentioned in the introduction, accounting for the heterogeneity in the type of overlapping owners is important since universal and common owners hold different portfolios and thus may face different trade-offs and incentives when interacting with the firms' managers. Specifically, we define universal owners as investors who own a fraction of equity of at least 95% of S&P 500 firms.[8] Common owners are all remaining investors who hold stakes in more than one firm but are not classified as universal owners.[9] Our sample includes ownership shares of around 29k different investors. The vast majority of these investors, around 20k, own a stake in only one firm. Of the remaining investors, 265 are classified as universal owners, and the other 9491 as common owners. Appendix Table B2 provides separate summary statistics for the three

[7] We would like to thank the authors for making this dataset available. For more details about the dataset, we refer the reader to Amel-Zadeh et al. (2022).

[8] When the average share of S&P firms held by an investor is below 75%, we classify an investor as a common owner even though that investor might satisfy the definition of a universal owner for some years in our sample.

[9] This definition differs from Amel-Zadeh et al. (2022) who define common owners as investors who own blocks in several firms of a given SIC4 industry, while we keep universal owners separate and do not define common owners by the type of firm they hold.

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investor types: more than 25% of universal owners are banks and insurances, and about 10% are retirement funds. Most of the remaining 65% are asset management companies, including the big four, i.e., State Street, Vanguard, Blackrock, and Fidelity. Common owners include smaller asset managers, but also hedge funds. In Appendix Section B.2 we provide the names of a subset of common and universal owners in our sample.

Figure 1 shows the average share of equity held by the three different types of investors. On average, single firm investors hold only a very small fraction, whereas universal and common owners hold the bulk of a firm's equity. Universal owners have increased their share at the expense of common owners over time, whereas the overall share of equity held by blockholders remained constant at around 80%. The average equity shares, however, hide the large variation in ownership shares: Appendix Figure B1 indicates that both common owners and single firm investors hold a large fraction of equity of some firms in our sample.

In our regressions, we distinguish between overlapping ownership coming from universal and common owners to total overlapping ownership by separating overlapping ownership into a part coming from universal owners and a second part coming from common owners as follows:

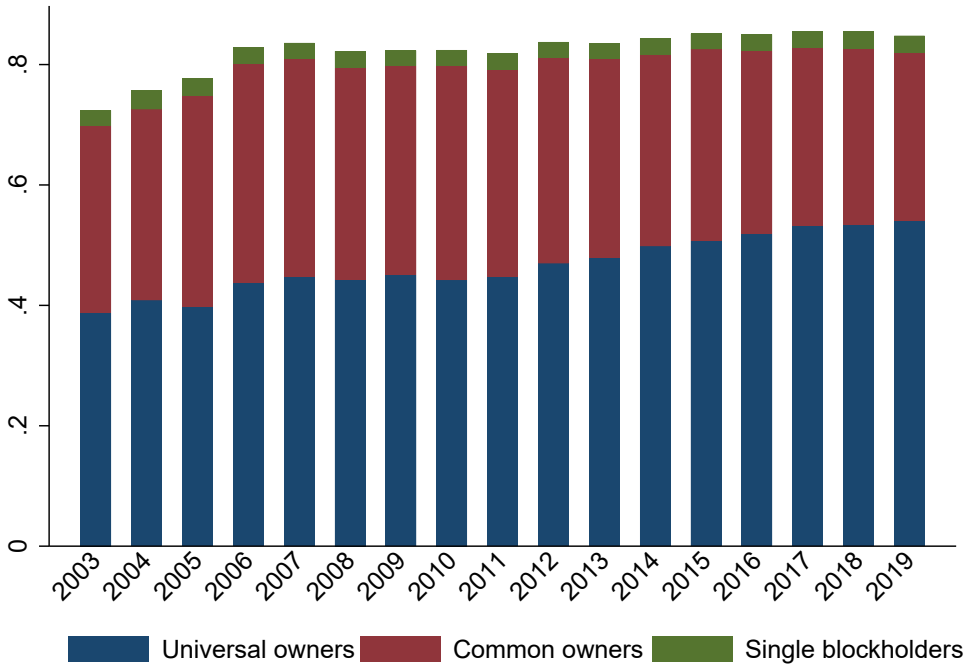
$$\cos(\beta_f, \beta_g) = \frac{\beta_f \cdot \beta_g}{\|\beta_f\|\|\beta_g\|} = \frac{\sum_{i \in \mathbf{I}} \beta_{fi}\beta_{gi}}{\sqrt{\sum_{i \in \mathbf{I}} \beta_{fi}^2}\sqrt{\sum_{i \in \mathbf{I}} \beta_{gi}^2}}$$
$$= \underbrace{\frac{\sum_{i \in \mathbf{UO}} \beta_{fi}\beta_{gi}}{\sqrt{\sum_{i \in \mathbf{I}} \beta_{fi}^2}\sqrt{\sum_{i \in \mathbf{I}} \beta_{gi}^2}}}_{\text{Universal owner } \cos(\beta_f,\beta_g)} + \underbrace{\frac{\sum_{i \in \mathbf{CO}} \beta_{fi}\beta_{gi}}{\sqrt{\sum_{i \in \mathbf{I}} \beta_{fi}^2}\sqrt{\sum_{i \in \mathbf{I}} \beta_{gi}^2}}}_{\text{Common owner } \cos(\beta_f,\beta_g)}$$

with I, UO, CO the set of all investors, universal owners, and common owners, respectively. Investors holding a stake in only one firm are not contributing to ownership overlap by definition, but they still affect the denominator of the cosine similarity measure, which accounts for ownership concentration. Appendix Section B.1 provides numerical examples to illustrate the importance of data on single-firm investors to measure overlapping own-

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ership correctly. Figure 7 shows the distribution of cosine similarity of firm-pairs in our sample across time. While overlapping ownership has increased overall (Panels a) and c)), the increase is driven by universal owners (Panels b) and d)). The contribution of common ownership, however, decreases towards the end of the sample.[10]

Figure 1: Average Share of Equity held by Type of Investor



Notes: This figure shows the average share of equity of S&P 500 firms held by universal owners, common owners, and single blockholders based on data by Amel-Zadeh et al. (2022). Universal owners are defined as investors owning shares in at least 95% of S&P 500 firms, single blockholders own only a fraction of one firm, common owners are all other investors

Additional data We use COMPUSTAT data to calculate firms' price-cost-margin, defined as $\frac{\text{SALES}-\text{COGS}+\Delta\text{INV}}{\text{SALES}+\Delta\text{INV}}$, as our measure for the profit margin and firm's size, age, book leverage, market to book ratio, return on assets, and cash holdings as control variables. Finally, we add the text-based product distance measures between firms in the product space by Hoberg

[10]The difference between Figure 7 and Figure 4 in Amel-Zadeh et al. (2022) is that we define common owners by investors' portfolio type and not by blockholdings in a given SIC4 industry.

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and Phillips (2010, 2016) to identify firms that compete against each other in the product market.

As overlapping ownership is measured at the firm-pair level and additionally, product similarity is also measured at the firm-pair level, we conduct most of our empirical tests at that level. Table 2 presents summary statistics of our dataset. We trim our dependent variable by removing the top and bottom 1% of observations, and we restrict our sample to firm pairs that include at least three years of non-missing data.

2.2 Three Stylized Facts

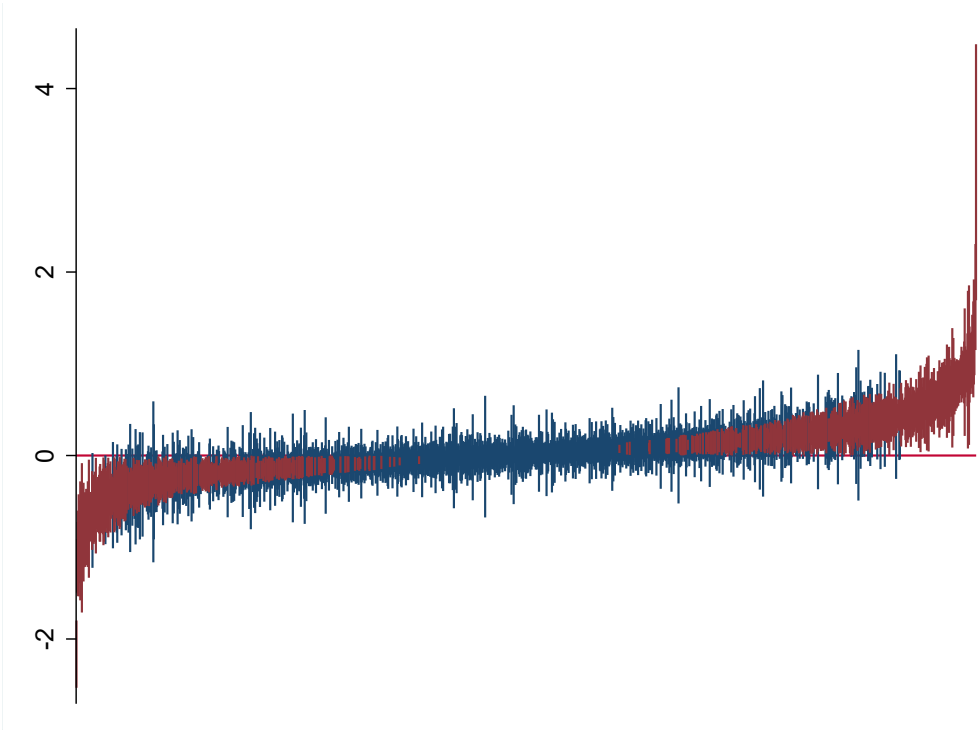
In this section, we document three stylized facts about overlapping ownership. First, the correlation between overlapping ownership and profit margins varies substantially in the cross-section of firms. Profit margins sometimes decrease, sometimes increase, and are sometimes not affected by changes in overlapping ownership. Second, we show that corporate governance can explain some of this variation. When *common* ownership increases, profit margins increase, but only when corporate governance is good. For *universal* owners, the effect is weaker and not statistically significant. Third, *universal* owners, but not common owners, appear to decrease profits when the industry of the firm is traditionally thought to be collusion-prone.

Stylized Fact 1: Large cross-sectional heterogeneity of the effect of common ownership on profitability We start by documenting that increasing overlapping ownership can be followed by increases, decreases, or no change in firm profitability. While overlapping ownership might not have an effect on firm profitability on average, the correlations in Figure 2 suggest that the average effect potentially masks large negative and positive effects of overlapping ownership in the cross-section. As a next step, we investigate whether the relationship between common ownership and profitability varies systemically with certain firm and industry characteristics. Our starting point is to test whether a firm's corporate governance matters.

Stylized Fact 2a: Overlapping ownership is associated with lower profitability when corporate governance is bad We measure corporate governance using the managerial entrenchment index by Bebchuk et al. (2009), which identifies six key corporate

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Figure 2: Marginal Effect of Common Ownership on Price-Cost-Margin



Notes: This figure shows the marginal effects of the cosine similarity measure, $cos(\beta_f, \beta_g)$, on price-cost margin for each S&P 500 firm-pair separately. Coefficients in red are statistically significant at the 5% level.

governance provisions: golden parachute, poison pill, and four different provisions limiting shareholders' voting power.[11] The entrenchment index is zero for firms without any of these provisions and can be six at most for firms where all the provisions apply. Notice that the provisions limiting shareholders' voting rights are especially relevant when studying the effects of overlapping ownership because these provisions directly limit shareholders' influence on management. For our main regression, we take a firm-pairs' E-Index value in 1995, which is measured well before the beginning of our sample in 2003, to address endogeneity concerns related to investors or managers trying to adjust corporate governance after a change in ownership. We then run the following regression using our firm-pair sample:

[11]Several issues with the governance data have been documented by Frankenreiter et al. (2021); Karthaus et al. (2021), especially when using the time-series dimension. We include year-fixed effects in all our specifications which should address systematic changes in governance data collection.

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$$pcm_{fgt+1} = \alpha_{f,g} + \gamma_t + \sum_{i \in \{\mathbf{UO},\mathbf{CO}\}} \rho_1^i cos(\beta_{ft}, \beta_{gt})^i + \sum_{i \in \{\mathbf{UO},\mathbf{CO}\}} \rho_2^i cos(\beta_{ft}, \beta_{gt})^i \cdot \text{E-Index}_{fg1995} + \rho_f X_{ft} + \rho_g X_{gt} + \epsilon_{fgt}$$

with $cos(\beta_{ft}, \beta_{gt})^i$ measuring the overlap in ownership between the two firms as the cosine similarity of universal and common ownership shares, and pcm_{fgt+1} the average price cost margin of the two firms. Time-varying firm-level controls are included in X_{ft} and X_{gt}. In our baseline regression, we restrict the sample to firm pairs of firms close in the product space as defined by (Hoberg and Phillips, 2016).

Table 3 shows the results for firm-pairs close in the product market. Column 1 of Table 3 shows that, on average, there is no statistically significant effect of higher common ownership on firm-pair profits. In columns 2 to 4, however, we find that when we include the entrenchment index as a measure for the quality of the firm pairs corporate governance *common* ownership increases profits for firm-pairs with good corporate governance. The negative sign of the interaction term indicates that common ownership does not increase profits for firms with bad corporate governance. When shareholders' voting power is limited in both firms, a higher level of common ownership is associated with lower profit margins. For *universal* owners, the sign of the coefficients are similar, but none of the coefficients is statistically significant. Appendix Figure B2 plots the marginal effect of an increase in common and universal ownership for different E-Index levels.

Robustness We find that the result holds when we use the time-varying entrenchment index as a measure of corporate governance in Appendix Table B3, and also when we use profit weights, κ_{fgt}, instead of cosine similarity in Table B4. We also find that the effect is indeed coming from firms competing against each other. In particular, when we use the full sample, i.e., not only close competitors, in Table B5, we find that effect is mainly driven by firm-pairs who are close competitors. In Table B6 we check that our results are not driven by spuriously high overlapping ownership of firms with a high share of retail ownership. Finally, our results are also similar when we run firm-level instead of firm-pair regressions and compute weighted cosine similarity and E-index values for a firm's close competitors (Table B7).

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The negative effect of overlapping ownership on profits for firm-pairs with bad corporate governance is at odds with the prediction of most models of overlapping ownership, namely that more overlapping ownership leads to (weakly) lower competition. Our results indicate that common owners can increase profitability compared to separate owners, but only when firms have good corporate governance. What prevents common owners from increasing profitability in firms with bad corporate governance? One possibility, which we explore below in the *Stylized Fact 2b*, is that common owners (and overlapping owners in general) might find it more difficult to discipline managers after a bad performance.

Stylized Fact 2b: Overlapping owners are less likely to fire CEOs for bad performance The threat of firing a CEO is an important disciplining device for investors. We now investigate whether investors differ in how likely they are to fire a CEO after a bad firm performance. We use the forced CEO turnover database by Peters and Wagner (2014) and Jenter and Kanaan (2015), which provides an indicator variable when a CEO's employment is terminated at a firm. Since CEO turnover is measured at the firm level, we aggregate our overlapping ownership measures to the firm level and run the following linear probability regression model:

$$\begin{aligned}\mathbb{1}_{\text{Forced Turnover},ft} =& \alpha_f + \alpha_j + \gamma_t + \rho_1 \overline{cos}_{ft} + \rho_2 \text{roa}_{ft} \\ &+ \rho_3 \overline{cos}_{ft} \cdot \text{roa}_{ft} + \rho_4 X_{ft} + \rho_5 X_{jt} + \epsilon_{it}\end{aligned}$$

where i denotes a firm, j a CEO, and $\overline{cos}$ is the weighted average cosine similarity between firm f and other S&P 500 firms, i.e., $\overline{cos}_{ft} = \frac{1}{N}\sum_g \omega_{fgt} cos(\beta_{ft}, \beta_{gt})$, with ω_{fgt} weights depending on the product similarity between the two firms. For firms that are not competing in the same product market as defined by Hoberg and Phillips (2016), the weight is zero. The CEO control variables X_{jt} include the salary, bonus, tenure, and an indicator variable for a CEO being new. The time-varying firm control variables are the same as before.

The predicted probability of forced turnover shown in Panel a) of Figure 3 shows that CEOs of firms with low overlapping ownership are more likely to be fired after a bad firm performance. At the same time, the probabilities of forced turnover after an intermediate

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and good performance are very similar regardless of the type of ownership. In Panel b) of Figure 3, we distinguish between common and universal owners. Although the difference between the predicted probabilities is not statistically significant, they suggest that *universal* owners are least likely to fire managers after a bad firm performance and separate owners most likely. The firing probability of CEOs with high *common* ownership is between the two other types of ownership. Results, reported in Appendix Figure B3, are similar when using a firm's Market to Book value as a performance measure.

Next, we investigate whether overlapping ownership affects profit margins in industries traditionally considered to be less competitive. Although we do not find an effect of overlapping ownership on profit margins on average, it is still possible that industries where softer competition is easier to achieve experience an increase in profit margins due to overlapping ownership.

Stylized Fact 3: Overlapping ownership is associated with lower profitability in industries traditionally prone to soft competition The theoretical industrial organization literature has identified different characteristics that should matter for an industry's natural disposition towards soft competition (Ivaldi et al., 2003), for example, high barriers to entry. However, the empirical industrial organization literature provides little guidance on mapping the factors facilitating soft competition to the data.[12] We use four different measures: first, we use a list of the 30 industries most prone to soft competition identified by Grout and Sonderegger (2005).[13] Appendix Section B.4 provides more information about the construction of the index. Second, following Bindal and Nordlund (2022), we sort industries into high and low capital intensity. Similarly, we sort industries into high and low advertisement intensity and finally also into industries with a high HHI index.

Table 4 reports the result for the firm-pair sample, which are close competitors in the product market. We find that higher *universal* ownership in industries prone to soft competition leads to lower profitability. The coefficients for *common* owners are similar but smaller and mostly not statistically significant.

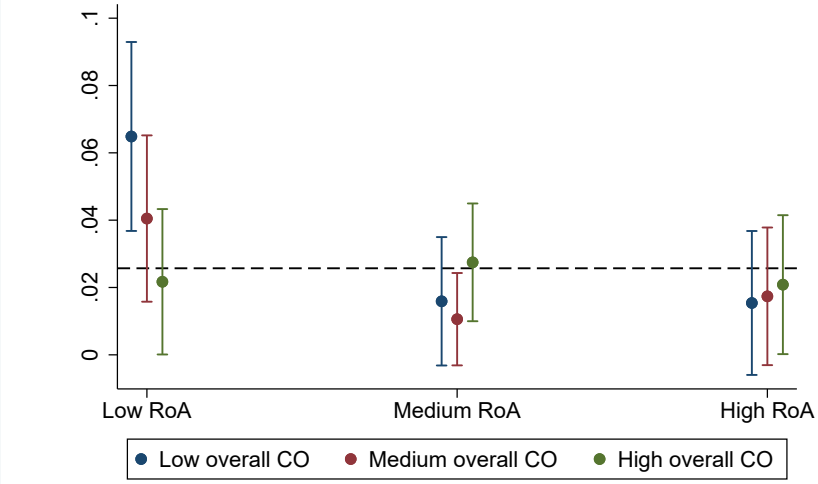
[12] Asker and Nocke (2021) write that "[...], while the theoretical literature on the factors that facilitate collusion continues to grow, the predictive power of the theoretical framework is poor and the mapping of theory to empirics not very well developed."

[13] See Table 3 in Grout and Sonderegger (2007).

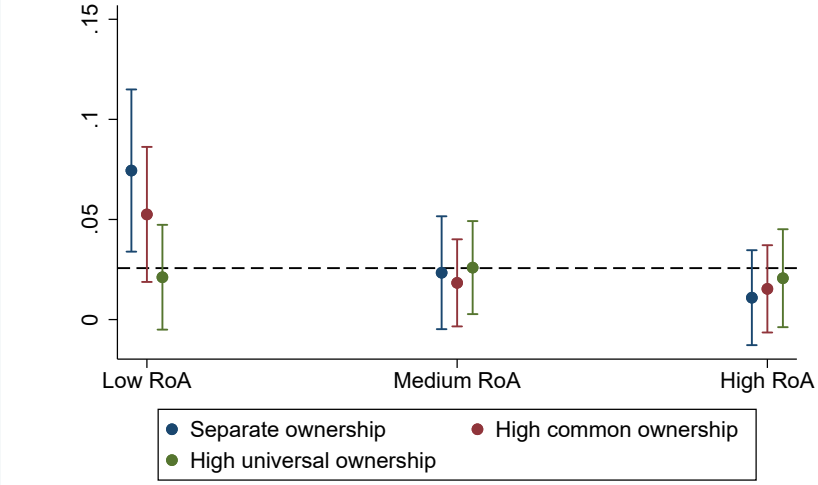
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Figure 3: Predicted probability of forced CEO turnover

(a) Overlapping ownership vs. separate ownership



(b) Universal vs. common owner



Notes: Predicted probability of a forced CEO Turnover depending on the firm's performance measured as return on assets (x-axis) and different levels of overlapping ownership as measured by the average profit weight a firm puts on other S&P 500 firms. Robust standard errors clustered by firm and CEO.

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Robustness The result is robust to measuring overlapping ownership by profit weights (Table B8), and the effect seems to be driven by firm-pairs which are competing in the product market (Table B9). We also find that excluding firm-pairs where one of the firms has a retail share of ownership above 40% does not change the result in Table B10 and we find similar results when running a firm-level instead of a firm-pair regression in Table B11.

To sum up, *common* ownership is associated with higher profitability, but not when corporate governance is bad. Corporate governance has a much weaker effect on firm pairs owned by *universal* owners. Related, common, and universal owners seem more reluctant to fire CEOs after a bad firm performance. Industry characteristics facilitating soft competition under separate ownership, such as high entry cost, do not seem to facilitate anti-competitive behavior under overlapping owners (common and universal). On the contrary, profit margins fall when *universal* ownership increases in a firm-pair of a collusion-prone industry. The effect for *common* owners goes in the same direction but is weaker. In the next section, we propose a simple model to explain these stylized facts.

3 The Model: Simplified Exposition

This section illustrates the main ideas through a simplified model. The main message from this section can be extended to a general model of oligopolistic competition, as we show in Appendix A.1.

There are two firms. Each firm has an owner (he) and a manager (she). The manager of each firm can divert a portion $\theta \in (0, 1)$ of the firm's profit. The form of the agency cost plays a critical role in the model and in matching the empirical findings. We will show how the results change under different types of agency costs, and in particular *quite-life* preferences, in Section 4.2. The managers of the firms play a repeated *prisoner's dilemma*: each manager chooses whether to play cooperatively by choosing C or defect by choosing N. Cooperation is an *anti-competitive* behavior increasing joint firm profits: producing low quantities, setting high prices, sharing information, avoiding costly litigation, and so on. The firm's profits are displayed below.

Ownership types. We begin by considering separate and common ownership and later add universal ownership to the model in Section 3.4. Under *separate ownership*, there are four

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Payoffs	Cooperate (C)	Defect (N)
Cooperate (C)	π^C, π^C	0, $\tilde{\pi}^N$
Defect (N)	$\tilde{\pi}^N$, 0	π^N, π^N

Table 1: Profits satisfy $\tilde{\pi}^N > \pi^C > \pi^N$. Each firm's profit is shared between its owner and manager. Each manager can divert a portion θ of the firm's profit.

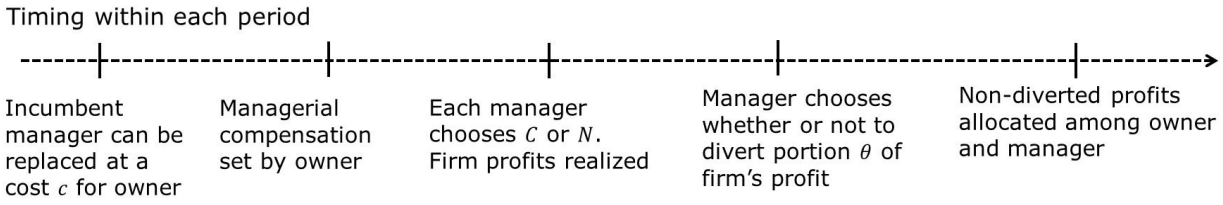


Figure 4

players: owner 1, owner 2, manager 1, and manager 2. Under *common ownership*, there are three players: the common owner, manager 1, and manager 2.[14]

Timing. The sequence of events is depicted in Figure 4. The owners offer compensation contracts to the managers on a take-it-or-leave-it basis. Each manager chooses to cooperate C or defect N, and profits are realized. Each manager then chooses whether or not to divert a portion θ of her firm's profit. The remaining profits are allocated among each firm's owner and manager according to their contract. Managerial actions are observable by the owners.[15]

Corporate governance. Bad corporate governance in this setup is captured through a high θ (the manager can divert a large amount) or through a high managerial replacement cost c. For the remainder of this section, we will fix $c > 0$ and vary the quality of corporate governance by changing θ since this is the more interesting comparative static to analyze. In particular, the model's main message carries through as long as c is positive. Section 5 discusses how the model is affected when managers and owners can influence θ.

[14]The baseline model treats the ownership structure as given. Section 4.1 extends the model to endogenous ownership. Also, the baseline model considers either fully separate or fully common ownership in the baseline model. The main results extend to mixed ownership (see Section 5).

[15]Appendix A.2 shows that the model's main message extends to a setup where actions are not observable, and the owners use noisy signals to compensate managers (i.e., firm performance).

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Disposition to tacit collusion. All players are risk-neutral with per-period discount factor $\delta\frac{1}{1+r}$ where r is the risk-free interest rate and $\delta \in [0,1]$ the probability that the game (i.e., same players and payoffs) moves to period $t+1$ given that it reached period t. Thus, $1-\delta \in [0,1]$ is the probability that the industry structure changes due to, for example, the entry of new competitors leading to a per period profit of each firm of at most $\pi^o \leq \pi^N$. We think of δ as an industry's disposition towards tacit collusion (i.e., soft competition) similar to the proxy variables we use to establish stylized fact 3 in Section 2.2. For example, new firms might find it more difficult to enter industries with high fixed assets, increasing the likelihood that the industry structure does not change (i.e., high δ).

Assumptions. We will normalize the interest rate to zero $r = 0$ and impose the following assumptions on the repeated game.

Assumption 1. ***No commitment***. *Each player cannot commit to future actions and would always act to maximize his continuation payoff. This assumption applies to each owner (separate or common) and each manager. As a result, we focus only on subgame perfect equilibria, as is common in repeated games.*

Assumption 2. ***Stationarity***. *The set of equilibria the players can attain does not depend on the period and the game history. That is, the past is sunk, and the players can always treat any future period as if it was the first.*[16]

We will show that soft competition is, under some circumstances, easier to sustain under common than under separate ownership (as the previous literature has argued) but that under a different set of circumstances, this flips. We will detail how common owners might find it more difficult to sustain soft competition than separate owners. For clarity, we start with the one-shot game.

[16] Assuming that the past is *sunk* and does not affect the set of possible equilibria, as we do in Assumption 2, is natural in setups where the stage game is infinitely repeated (Abreu and Pearce (1991)). Note that assumption 2 *does not* rule out equilibria where owners build a reputation for being tough by, for example, firing defecting managers or taking other actions that come at a cost for owners. Assumption 2 only states that the players can always behave as if the game started in the current period by agreeing to "forget" past digressions (Farrell and Maskin (1989)). Section 4.2 offers further discussion of the modeling assumptions.

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3.1 The One-Shot Game

The game lasts one period with two stages within the period (equivalently, $\delta = 0$). In the first stage, the owner(s) offer contracts to the managers. In the second stage, the managers play cooperatively C or uncooperatively N, given their contracts (see the timeline in Figure 4). The most general way of specifying managerial contracts in our setup is as a mapping from the realized profile of firm profits (π_1, π_2) to a payment for each manager. An equivalent way is to specify the payment for each manager as a function of her choice of action (C or N) and diversion. These two specifications are equivalent in our setup, and we use the second way since it is simpler. Throughout the discussion in this section, one should keep in mind that each manager is paid *only* conditional on not diverting her firm's profits.

3.1.1 Managerial incentives

We start by describing how different contracts provide incentives for the managers, irrespective of the type of ownership. Each manager can be induced to cooperate by the following contract: the manager is paid $\tau^C(\theta) = \theta\tilde{\pi}^N$ for choosing C and zero for choosing N. On the other hand, each manager can be induced to play uncooperatively by the following contract: the manager is paid $\tau^N(\theta) = \theta\pi^N$ for choosing N and zero for choosing C. We write $\tau^C(\theta)$ and $\tau^C(\theta)$ to stress that the managerial compensation depends on the portion of firm profits that the manager can divert, namely θ. Note that the non-collusive contract is equivalent to paying each manager a proportion θ of her firm's profit. The collusive contract is equivalent to paying each manager a proportion $\frac{\theta\tilde{\pi}^N}{2\pi^C}$ of joint firm profits.

Strategic rents. Soft competition in our setup has two opposing effects: it increases joint profit *and* allows the managers to extract strategic rents. The second effect stems from the separation of ownership and control and is critical. Specifically, by cooperating, each firm earns π^C, implying its manager can divert $\theta\pi^C$. However, each manager is paid $\tau^C(\theta) = \theta\tilde{\pi}^N > \theta\pi^C$ to cooperate since paying less is *not* incentive-compatible: the manager would choose N and then divert $\theta\tilde{\pi}^N$.

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3.1.2 Incentives of separate owners

Suppose each firm has a separate owner who enters into a private bilateral contract with the firm's manager. Let both managers be given the collusive contract $\tau^C(\theta) = \theta\tilde{\pi}^N$, implying that each owner's payoff is $\pi^C - \tau^C(\theta) = \pi^C - \theta\tilde{\pi}^N$, and each manager's payoff is $\tau^C(\theta) = \theta\tilde{\pi}^N$. However, this outcome is *not* an equilibrium of the game under separate ownership since the owner and manager of each firm prefer to defect to N and split the additional profit - not internalizing that such defection lowers the rival firm's profit. This conclusion results from Assumption 1 (no-commitment). If separate owners could commit to playing C, they could sustain soft competition even in the one-shot setup.

3.1.3 Incentives of common owner

Suppose the firms have the same owner who commits to a set of publicly observable bilateral contracts - one for each manager.[17] Due to agency costs, even a common owner would *not* necessarily coordinate the managers on the collusive equilibrium. To understand why, notice that the common owner's payoff from putting the managers on collusive contracts is $2(\pi^C - \tau^C(\theta)) = 2(\pi^C - \theta\tilde{\pi}^N)$ (i.e., $\pi^C - \theta\tilde{\pi}^N$ per firm), whereas his payoff from putting them on no-collusive contracts is $2(\pi^N - \tau^N(\theta)) = 2(\pi^N - \theta\pi^N)$. We have

$$(\pi^C - \theta\tilde{\pi}^N) \geq (\pi^N - \tau^N(\theta)) \qquad \Leftrightarrow \qquad \theta \leq \frac{\pi^C - \pi^N}{\tilde{\pi}^N - \pi^N} \equiv \hat{\theta}. \tag{1}$$

Thus, for $\theta < \hat{\theta}$, the common owner maximizes his payoff by putting the managers on the collusive contract τ^C, which leads them to cooperate (i.e., each selects C). On the other hand, for $\theta > \hat{\theta}$, the common owner maximizes his payoff by putting the managers on the non-collusive contract τ^N, which leads them to uncooperative play (i.e., each selects N). The reason is that for $\theta > \hat{\theta}$ the total collusion bonus that must be given to the managers to induce them to select (C, C), namely $2\theta(\tilde{\pi}^N - \pi^N)$, exceeds the total collusion gain of $2(\pi^C - \pi^N)$.[18]

[17] Suppose the common owner instead enters into private bilateral contracting with the manager. In that case, we assume that, after observing an out-of-equilibrium contract inducing cooperation, each manager believes the other firm is also steered to cooperate. This assumption is consistent with the common owner's eagerness to promote collusion and, in this particular example, implies the same outcome as public offers.

[18] If $\tilde{\pi}^N - \theta(\tilde{\pi}^N + \pi^N) > 2(\pi^C - \theta\tilde{\pi}^N)$ the common owner prefers to induce the asymmetric outcome where one manager selects C and the other N to the symmetric outcome where both managers select C. This

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3.1.4 Summary

The equilibrium of the one-shot game under separate ownership is characterized by low firm profits (i.e., π^N per firm) for any level of agency cost θ. On the other hand, the equilibrium under common ownership is characterized by high firm profits (i.e., π^C per firm) - as long as $\theta < \hat{\theta}$ is not too high, as shown in Figure 5 where $\tilde{\pi}^N = 30$, $\pi^C = 20$, $\pi^N = 15$ implying $\hat{\theta} = 1/3$. This conclusion aligns with the existing literature, which typically considers one-shot interactions and concludes that separate owners tend to be pro-competitive relative to common owners. At the same time, the common owner's cost of inducing high firm profits increases in θ, and for $\theta > 1/3$, he abandons the high-profit equilibrium since this leads to lower joint firm profits, but it decreases total managerial rents by an even greater amount. Finally, notice that improved corporate governance (i.e., lower θ) under common ownership can have an *anti-competitive* effect, consistent with the Stylized Fact 2a in Section 2.2, namely that common owners increase firm profitability but only if agency costs are low. For example, implementing better governance practices that reduce θ from 4/10 to 3/10 makes it profitable for the common owner to select the high firm profit equilibrium.

3.2 The Repeated Game

Next, suppose the game is infinitely repeated. Each player has a discount factor $\delta \in [0, 1)$, which is the probability that the game continues to stage $t+1$ given that it reached stage t. The repeated game under separate ownership always has an equilibrium where each manager plays uncooperatively, and each firm earns a per-period profit of π^N. At the same time, it is well-known that tacit collusion can be sustained through repeated interaction if the firms follow *trigger strategies*. That is, the firms start by cooperating. If any firm defects, the firms do not cooperate thereafter, and the game reverts to a repetition of the one-shot Nash equilibrium. Our setup differs from canonical repeated games in that there is a *separation* of ownership and control, which implies that we must jointly consider the incentives of the managers and the owners.

asymmetric outcome does not change the main message - the common owner induces at least one of the managers to cooperate as long as θ is below a cutoff. To streamline the analysis, we impose $2\pi^C + \pi^N > 2\tilde{\pi}^N$ implying that the asymmetric equilibrium is never optimal for the common owner.

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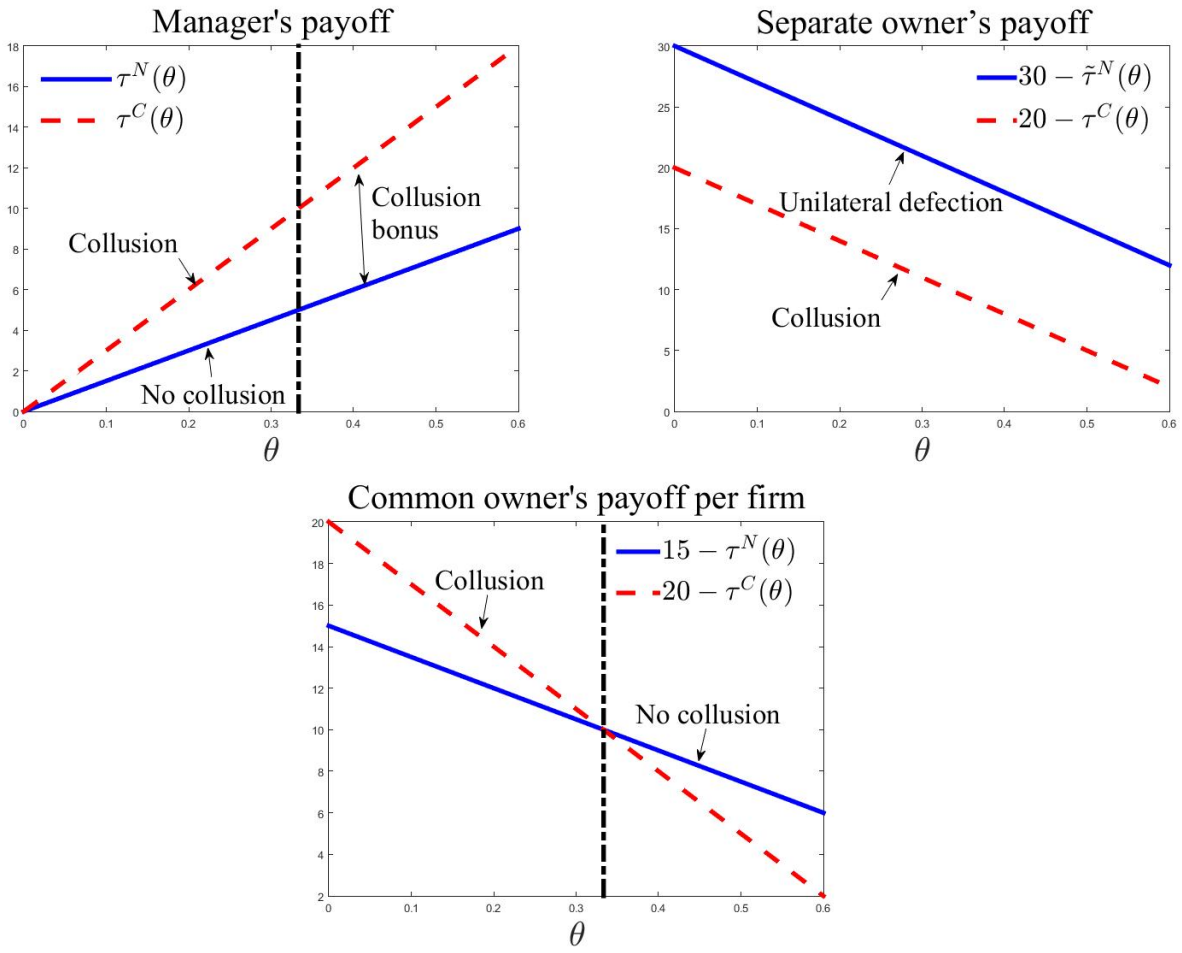


Figure 5: The managers do not cooperate in the one-shot game unless given collusion bonuses, which increase in θ (level of agency costs). The one-shot equilibrium under separate ownership features low firm profits for any θ. The one-shot equilibrium under common ownership features high firm profits only if θ is less than or equal to $\frac{1}{3}$.

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3.2.1 Managerial incentives

As in the one-shot case, we start with managerial incentives regardless of ownership type. There are two types of trigger strategies depending on whether the firm's owner replaces a defecting manager. We consider the simpler case first, where the trigger strategies do not rely on managerial termination since the model's main insights do not depend on whether or not the owners can fire the managers (see Section 3.2.3 for managerial termination).

Contracts without termination. The managers start by cooperating. If ever any manager defects, the managers do not cooperate anymore. Trigger strategies without termination constitute a subgame perfect equilibrium of the repeated game (SPNE) if the following no-defection conditions hold. *(i)* Managerial contracts are such that each manager best responds by cooperating (i.e., choosing C) when she expects the other firm to cooperate and by defecting (i.e., choosing N) when she expects the other firm to defect. *(ii)* Each owner best responds by inducing his firm's manager to cooperate when he expects the other firm to cooperate and to defect when he expects the other firm to defect.

The managers can be induced to follow such trigger strategies through appropriate contractual arrangements. Consider a contract consisting of two components $\{\tau^C, \tau^N\}$. The first component τ^C specifies the managerial compensation if the firms are cooperating, and the second component τ^N specifies the managerial compensation if the firms are not cooperating. Specifically, the *collusive* component of the contract is defined as paying the manager $\tau^C(\theta) = \theta\pi^C$ for choosing C and zero for choosing N. Second, the *non-collusive* component of the contract is defined as paying the manager $\tau^N(\theta) = \theta\pi^N$ for choosing N and zero for choosing C. Finally, the firm's owner initially puts each manager on $\tau^C(\theta)$. If a manager defects, each manager is put on the $\tau^N(\theta)$. Now, suppose both managers are put on such a trigger contract $\{\tau^C, \tau^N\}$. By cooperating each manager gets an overall payoff of $\frac{1}{1-\delta}\theta\pi^C$ (i.e., $\theta\pi^C$ per period). By defecting, each manager gets an overall payoff of $\theta\tilde{\pi}^N + \frac{\delta}{1-\delta}\theta\pi^N$ (i.e., she deviates and diverts $\theta\tilde{\pi}^N$ triggering non-cooperative play giving $r^N(\theta) = \theta\pi^N$ each subsequent period). If the discount factor is sufficiently large. That is, $\delta \geq \hat{\delta}_{NT}$, where

$$\hat{\delta}_{NT} \equiv \frac{\tilde{\pi}^N - \pi^C}{\tilde{\pi}^N - \pi^N}, \tag{2}$$

then each manager best responds by cooperating - provided the threat of reversion to non-

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cooperative play is credible. To determine whether the threat is credible, we next examine the incentives of different types of owners.[19]

3.2.2 Incentives of separate owners

We now show that each separate owner best responds by inducing the manager of his firm to follow a trigger strategy whenever the discount factor is at least $\hat{\delta}_{NT}$. First, suppose there is a managerial defection in period t. In that case, each separate owner puts his firm's manager on the non-collusive contract from period $t+1$ onward, expecting the other to do the same - since failure to do so would lead to lower firm profits given the behavior of the other manager. In other words, the punishment phase is *self-enforcing*. Similarly, in period 0, each separate owner prefers to put his firm's manager on the trigger contract - as long as he expects the same from the other owner. The reason is that the maximum a separate owner can get by inducing defection, which then triggers non-cooperative play, is $(1-\theta)\tilde{\pi}^N + \frac{\delta}{1-\delta}(1-\theta)\pi^N$, which for $\delta \geq \hat{\delta}_{NT}$ is less than his payoff on the collusive path $\frac{1}{1-\delta}(1-\theta)\pi^C$. Hence, for $\delta \geq \hat{\delta}_{NT}$, a subgame perfect equilibrium exists of the repeated game where each manager cooperates in each period. Thus, even in the presence of agency cost, repeated interaction expands the tools available to the separate owners to promote anti-competitive behavior.

Several remarks are in order. First, the owners and managers of different firms do not have to explicitly collude or even communicate with each other to attain soft competition. Second, the managers are induced to cooperate not through collusion bonuses, which, as we saw, are not used by separate owners and only sometimes used by common owners (i.e., when $\theta < \hat{\theta}$) but by credible threats of non-cooperative play. Third, even if the soft competition outcome exists, the separate owners will not necessarily coordinate the managers on anti-competitive conduct. The reason is that each owner induces the manager of his firm to cooperate only if he expects the other owner to do the same. This is the well-known situation of multiplicity in repeated games, which in our case, turns out to help to explain the stylized facts in Section 2, as will be explained in Section 3.3.

[19] Observe that (2) corresponds to the well-known cutoff from the repeated game literature, which obtains in our case as well because the amount each manager can divert is proportional to firm profit. More generally, if the amount a manager can divert is not necessarily proportional to firm profit, the cutoff will be a function of θ. Such a specification complicates the analysis but does not alter the main message except for Section 4.1, where we consider endogenous ownership.

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3.2.3 Incentives of common owners

The common owner cannot rely on trigger strategies to induce cooperation because he always benefits from restoring collusion after managerial defection. This effectively removes the threat for the managers not to defect, and thus cooperation unravels. To establish this claim, we proceed by deriving contradiction by first assuming that the common owner could induce the managers to cooperate through the same trigger contract as the separate owners $\{\tau^C, \tau^N\}$ and then showing that this is inconsistent with Assumptions 1 - 2. To see why, suppose the common owner could induce the managers to cooperate through the same trigger contract as the separate owners $\{\tau^C, \tau^N\}$. Thus, each manager is initially put on the collusive component of the contract $\tau^C(\theta) = \theta\pi^C$. If ever one manager defects, each manager is put on the non-collusive component $\tau^N(\theta) = \theta\pi^N$. The common owner's overall payoff on the collusive path is $V^C = \frac{1}{1-\delta}2(1-\theta)\pi^C$ (i.e., $(1-\theta)\pi^C$ per period per firm). If ever a manager defects, the game should enter the non-cooperative phase where both managers are induced not to cooperate, which gives an overall payoff for the common owner of $V^N = \frac{1}{1-\delta}2(1-\theta)\pi^N$ (i.e., $(1-\theta)\pi^C$ per firm per period).

However, the past is sunk and does not affect any payoff-relevant factors and the set of equilibria available to the players (Assumption 2). Stated differently, the players can always agree to "forget" past defections and resume whatever they were doing before the defection (Farrell and Maskin, 1989). Therefore, if a given managerial contract profile under common ownership induces the managers to cooperate in period t (as we assumed to be the case for $\{\tau^C, \tau^N\}$), the same contract profile should induce the managers to cooperate in period $t+1$ (Assumption 2). The common owner can thus induce the managers to resume cooperation by again putting each on the collusive component of the trigger contract τ^C, which gives the common owner a higher overall payoff of V^C. Moreover, since the common owner cannot commit not to do something which is ex-post optimal for him, he will restart the collusive agreement (Assumption 1: no commitment). But, if the game does not enter the punishment phase, each manager recognizes that defection will not be penalized and wants to defect. Specifically, she gets $\theta\pi^C + \frac{\delta}{1-\delta}\theta\pi^C$ by colluding and $\theta\tilde{\pi}^N + \frac{\delta}{1-\delta}\theta\pi^C$ by defecting, where the second term in each expression is the same since the game never reverts to non-cooperative play. Hence, our initial assumption that the common owner can use the trigger contract $\{\tau^C, \tau^N\}$ to induce the managers to cooperate cannot be true.

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Managerial Termination. So far, the managers have "job security." The worse that could happen to them is for the game to revert to non-cooperative play, thus raising the question of whether higher-powered incentives would alter the results. To investigate this possibility, we now allow the firm's owner to replace an incumbent manager by incurring a cost. The takeaway is that the threat of managerial termination can enhance the separate but *not* the common owner's capacity to soften competition through trigger strategies.

Assumption 3. ***Managerial termination****. Each owner incurs a cost $c > 0$ of replacing the incumbent manager of his firm. The outside option of each manager is normalized to zero.*[20]

Next, we consider trigger strategies that allow for managerial termination. Specifically, the managers start by cooperating. If a manager defects, the managers no longer cooperate unless the firm's owner fires the defecting manager. Trigger strategies with termination constitute a subgame perfect equilibrium if the following conditions jointly hold. *(i)* Managerial contracts are such that each manager best responds by cooperating (i.e., choosing C) when she expects the other firm to cooperate and by defecting (i.e., choosing N) when she expects the other firm to defect. *(ii)* Each owner best responds by inducing his firm's manager to cooperate when he expects the other firm to cooperate and to defect when he expects the other firm to defect. *(iii)* Each owner best responds by incurring the cost of replacing a defecting manager when he expects that failing to do so would lead the other firm to stop cooperating.

Next, suppose Assumptions 1 - 3 hold then separate owners can credibly employ threats to fire misbehaving managers (i.e., as part of SPNE) but not common owners. In particular, each separate owner incurs the cost of replacing a manager that defected because failing to do so would lead the other owners to induce their managers to play uncooperatively. On the other hand, the common owner cannot credibly rely on threats to fire managers since he does not have to worry about how other owners would respond to his actions. This is consistent with the Stylized fact 2b in Section 2: common owners are less likely than separate owners to fire CEOs after a bad performance. Thus, regardless of whether or not defecting managers are replaced, the common owner can restart the original equilibrium path of play. Otherwise,

[20] In practice, the managerial replacement cost can be significant (almost 6 percent of firm value according to estimates in Taylor (2010)), but the argument we make in this section only requires that there is *some* replacement cost.

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the game history affects the attainable equilibrium payoffs, and the past will no longer be sunk (violating Assumption 2: stationarity). Moreover, if replacing managers is costly, the common owner is not maximizing his continuation payoff unless all incumbent managers are retained, and therefore, he retains them (Assumption 1: no commitment). In other words, the threat to fire defecting managers is not credible as long as replacement carries some cost $c > 0$ for the owner.

Discussion. The previous arguments *do not* establish that the common owner will never induce the managers to cooperate but that he will *not* use trigger strategies to attain soft competition. The common owner can still use one-shot collusion bonuses to induce managerial cooperation, which, as we showed, is better for the common owner than letting the managers compete whenever agency costs are small enough $\theta < \hat{\theta}$. The reason is that one-shot collusion bonuses do not require the common owner to do something which he strictly prefers to avoid ex-post. More broadly, the common owner cannot credibly use managerial incentives that rely on reversion to non-cooperative play or contain other threats (such as firing defecting managers) that the common owner prefers not to carry out.

The only difference between separate and common owners is that there are no coordination issues under the common owner and hence, no multiplicity of equilibria. That is, Assumptions 1 - 3 hold for separate *and* common owners, but each separate owner faces another friction: he must *coordinate* with the other separate owner, whereas no such friction exists for the common owner. In particular, each separate owner best responds by inducing his manager to play uncooperatively when he expects the other owner to do the same. In other words, the punishment phase can be self-enforcing and hence *credible* under separate ownership. Notice that the separate owners would also prefer, as a group, to retain the incumbent managers (and thus avoid the replacement cost) and also return to the collusive path after a defection. However, it is individually rational for each separate owner to fire defecting managers or induce his manager to play uncooperatively when the others are doing the same.

3.3 Effect of common ownership

Proposition 1 summarizes this section's main results. First, common owners cannot induce the managers to follow trigger strategies since the threat of managerial termination or rever-

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sion to non-cooperative play is not credible, as we saw above. As a result, common owners can only rely on one-shot managerial collusion bonuses to induce the managers to cooperate as in the one-shot game. The common owner will provide such bonuses and thus attain soft competition if and only if $\theta < \hat{\theta}$ where the cutoff $\hat{\theta}$ is given in (1). Second, separate owners can potentially coordinate on using trigger strategies if δ is sufficiently large. Specifically, denote by $\hat{\delta}_{NT}$ the lowest value of the discount factor δ that allows cooperation without managerial termination and by $\hat{\delta}_T$ the lowest value of the discount factor that allows cooperation with managerial termination. We have $\hat{\delta}_{NT} > \delta_T$ if the managerial replacement cost c is sufficiently small and $\hat{\delta}_{NT} < \delta_T$ otherwise. Thus, if $\delta > \hat{\delta}$, where $\hat{\delta}$ is the smaller of the two cutoffs, soft competition is an SPNE of the game under separate ownership. Finally, we assume that the separate owners coordinate on the soft competition SPNE (when it exists, that is, $\delta > \hat{\delta}$) with some probability strictly greater than zero and less than one.

Proposition 1. ***Effect of common ownership on firm profitability****. Given an industry defined by* $(\tilde{\pi}^N, \pi^C, \pi^N, c, \theta, \delta)$ *there are corresponding cutoffs* $\hat{\theta}$ *and* $\hat{\delta} = \min\{\hat{\delta}_{NT}, \hat{\delta}_T\}$ *and such that common ownership has*

(i) an anti-competitive effect if $\theta < \hat{\theta}$

(ii) a pro-competitive effect $\theta > \hat{\theta}$ *and* $\delta > \hat{\delta}$*, and*

(iii) no effect if $\theta > \hat{\theta}$ *and* $\delta < \hat{\delta}$*.*

Proposition 1 follows as a special case of Proposition 3 in the Appendix, which considers a general model of oligopolistic competition. If $\theta < \hat{\theta}$ as in case *(i)*, then soft competition always emerges under common ownership (there are no multiple equilibria under common ownership) and only sometimes emerges under separate ownership. That is when $\delta > \hat{\delta}$ and the separate owners coordinate on the collusive SPNE. As a result, common ownership has an *anti-competitive* effect in this case. If $\theta > \hat{\theta}$ and $\delta > \hat{\delta}$ as in case *(ii)*, then soft competition does not emerge under common ownership but can emerge under separate ownership with positive probability. As a result, common ownership has a *pro-competitive* effect in this case. Finally, if $\theta > \hat{\theta}$ and $\delta < \hat{\delta}$ as in case *(iii)*, then soft competition does not emerge under either type of ownership, implying no effect of common owners. Notice that the magnitude of the effect in *(i)* - *(ii)* depends on how likely it is for the separate owners to coordinate on the collusive SNPE conditional on its existence. However, the specific probabilities will not affect the qualitative predictions of the model unless separate owners always coordinate

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on the soft-competition equilibrium when it exists. In this special case, common owners will have no effect if $\theta < \hat{\theta}$ and $\delta > \hat{\delta}$.

Model predictions. Figure 6 summarizes the model predictions concerning the effect of increasing common ownership on firm profitability. The model implies that common ownership has a heterogeneous impact on firm profits, as shown in Section 2.2 (Stylized Fact 1). This heterogeneous effect is explained in the model by the interaction of corporate governance *and* the industry's natural disposition to soft competition. Specifically, Proposition 1 implies that common ownership has an *anti-competitive* effect when corporate governance is good (i.e., θ small) and a *pro-competitive* effect when governance is bad (i.e., θ large), which is consistent with Stylized Fact 2a. The model also implies that common ownership has an ambiguous effect on profits in industries naturally prone to collusion (i.e., δ high). This model implication is consistent with Stylized Fact 3: increasing common ownership has no statistically significant effect on profit margins in collusion-prone industries (but universal ownership does; see the next subsection). The reason for the ambiguous effect, according to the model, is that there is a confounding factor, namely θ. If θ is high, common ownership will be pro-competitive - as long as δ is high enough to ensure the existence of the tacitly collusive SPNE under separate ownership. However, if θ is low, common ownership will be anti-competitive even for δ high since separate owners are not guaranteed to coordinate on the soft-competition equilibrium.

3.4 Universal owners

We now add a universal owner to the model who is assumed to be passive and to hold the "market portfolio." Recall that universal owners own part of at least 95% of S&P 500 firms. We found in Section 2.2 that these owners are more reluctant to fire CEOs for bad performance than separate owners (Stylized Fact 2b). We also found that increasing universal ownership leads to lower profit margins in collusion-prone industries (Stylized Fact 3). To investigate how universal owners affect firm profits relative to separate ownership, we consider a situation where the ownership changes from separate to universal in some period t.[21] As mentioned in the Introduction, we identify universal owners as investors that

[21] This thought experiment assumes that the change in ownership is exogenous and thus not driven by strategic considerations related to the industry, which is arguably a realistic description of this type of

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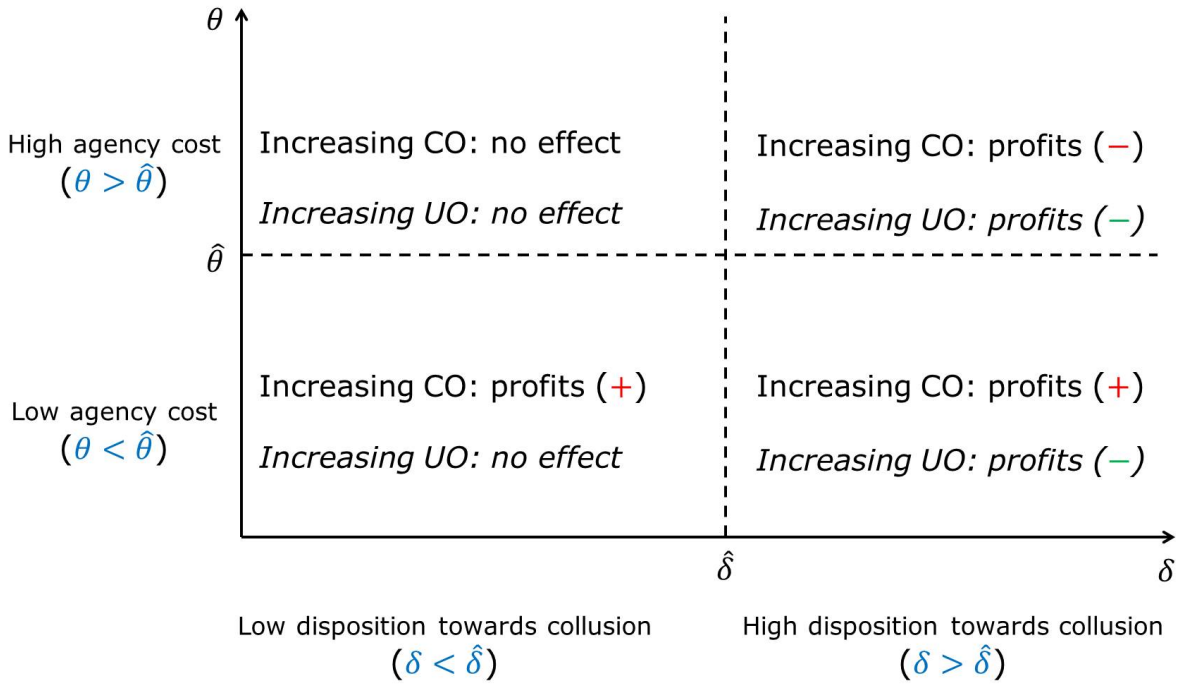


Figure 6: This figure summarizes the equilibrium effect of *increasing* common ownership (CO) or universal ownership (UO) on firm profitability as a function of the agency cost θ and the industry's natural disposition to soft competition δ. In each case, the increase in overlapping ownership (common or universal) relative to separate ownership is treated as exogenous (see Section 4.1 for endogenous ownership). The model implies that higher common ownership (see Section 3.3) tends to *increase* firm profitability for low agency costs (low θ) and *decrease* profitability for high agency costs (high θ). On the other hand, higher universal ownership (see Section 3.4) tends to *decrease* firm profitability for collusion-prone industries (high δ).

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"inherit" and do not change the managerial contracts chosen by the previous owners. In other words, we treat universal owners as "passive indexers" (Lewellen and Lewellen, 2018; Gilje et al., 2020) with formal but no real authority (Aghion and Tirole, 1997). For simplicity, we assume in this section that universal owners never fire managers that do not behave in the owners' best interest. Similar results obtain under weaker assumptions; for example, if universal owners are slower or less likely to fire managers (or incur a higher replacement cost) than separate owners.

Remark 1. ***Effect of universal ownership on firm profitability****. Universal owners have (i) no effect if* $\delta < \hat{\delta}_T$ *and (ii) an pro-competitive effect if* $\delta > \hat{\delta}_T$*.*

Figure 6 summarizes the model predictions concerning the effect of increasing universal ownership (relative to separate ownership). To understand the above, suppose ownership is changed from separate to universal. The universal owners would then use the same managerial contracts but would not fire the managers for defecting since they are passive. The managerial compensation thus becomes *lower-powered* since each manager has greater job security. Thus, firm profit would decrease *if* the separate owners had been coordinating on soft competition through threats of managerial termination - an event which is possible only if δ is not less than $\hat{\delta}_T$ (recall: $\hat{\delta}_T$ is the lowest discount factor such that the SPNE with termination is possible under separate ownership). The model thus implies that universal owners have a pro-competitive effect for high values of δ. This is consistent with Stylized Facts 3 in Section 2, namely that profit margins fall when universal ownership increases in collusion-prone (i.e., high δ) industries.[22]

investor.

[22]We assume that universal owners are "passive indexers." Another explanation with the same empirical implication is that high prices in one industry (say, oil) negatively affect firm profits in another industry (airlines). Universal owners consider such inter-industry portfolio effects and may choose *not* to pursue tacit collusion in one industry due to a negative impact on the other (Azar and Vives, 2021a,b). As a result, universal owners can be passive in promoting anti-competitive conduct in a given industry but active in different directions (i.e., ecological and social issues Hart and Zingales (2017)).

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4 Endogenous ownership and discussion of assumptions

4.1 Endogenous ownership

The baseline model in Section 3 treats the ownership arrangements as *given*. But why would separate owners buy a stake in their rivals (thus increasing common ownership) if this is expected to lead to a breakdown of soft competition and *lower* firm profitability? This section shows that, under certain conditions, separate owners in high agency costs industries would *choose* to acquire stakes in their rival firms even if they anticipate this to lead to lower firm profits (Proposition 2). Specifically, we investigate a situation where the managers prefer cooperative play since this allows them to earn high rents. In contrast, the separate owners prefer uncooperative play since this reduces managerial rents more than firm profits. This situation arises naturally in our setup due to the type of agency costs we have postulated. However, the only way separate owners can induce the managers to play uncooperatively is by *increasing* common ownership.

To explain how this happens, we first modify the baseline setup by assuming that the portion of firm profits that can be diverted is increasing in firm profits. Specifically, denote by θ^N and θ^C the portion of the firm profit that the manager can divert when firm profit equals π^N and π^C respectively ($\pi^C > \pi^N$). Also, assume that firing incumbent managers is prohibitively expensive for the owners ($c = \infty$).[23]

Proposition 2. ***Endogenous ownership***. *Consider an industry characterized by separate ownership and tacit collusion (i.e., δ is large enough). Assume that firing incumbent managers is prohibitively costly for the owners and the following parameter condition holds*

$$\frac{1 - 0.5\theta^C}{1 - 0.5\theta^N} < \frac{\pi^N}{\pi^C}. \tag{3}$$

Then increasing common ownership leads to lower firm profits since tacit collusion breaks down, but a higher joint payoff for the owners since the decline in managerial rents more

[23] The argument in this section applies as long as there are some industries where managerial self-dealing is both high and increasing in firm profits, and the owners find it difficult to fire incumbent managers. First, $\theta^C > \theta^N$ is realistic, given that that cutthroat competition is unlikely to yield many self-dealing opportunities for management. Second, a critical ingredient of the managerial entrenchment index of Bebchuk et al. (2009) we use as a proxy for agency cost is the cost for the shareholders of firing the incumbent manager (i.e., the presence of poison pills or golden parachutes).

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than offsets the decline in firm profits.

The condition in (3) holds whenever the portion of firm profits the manager can divert under cooperation is sufficiently large and also greater than the portion that can be diverted under non-cooperative play $\theta^C > \theta^N$. To understand why common ownership, in this case, would increase the payoff of the owners by having a pro-competitive effect, we start with the managers' incentives. Consider the following trigger strategies: each manager starts by cooperating and choosing C. However, if one manager defects, the managers no longer cooperate; instead, each chooses N. The no-defection condition for each manager is then

$$\theta^C \pi^C + \frac{\delta}{1-\delta}\theta^C \pi^C \geq \tilde{\theta}^N \tilde{\pi}^C + \frac{\delta}{1-\delta}\theta^N \pi^N. \tag{4}$$

If the managers cooperate, each gets $\theta^C \pi^C$ per period, i.e., the amount that can be diverted, and the owners cannot use the threat of termination to reduce diversion. If the manager defects, she gets $\tilde{\theta}^N \tilde{\pi}^C$ in the period of the defection leading to a reversion to non-cooperative play, giving her a per period payoff of $\theta^N \pi^N$. Since $\theta^C \pi^C > \theta^N \pi^N$ the no-defection condition in (4) holds whenever δ is close enough to one, and it implies that there exists an SPNE where the managers play cooperatively.[24] The per-period payoff for each separate owner on the collusive path is $(1-\theta^C)\pi^C$ whereas the per-period profit for each separate owner on the non-collusive path is $(1-\theta^N)\pi^N$. Note that (3) implies

$$(1-\theta^C)\pi^C < (1-\theta^N)\pi^N. \tag{5}$$

Each separate owner gets a strictly larger payoff on the non-collusive path. The reason is that the greater firm profit due to tacit collusion is more than offset by the greater diversion by the firm's manager.[25] Each manager can be induced to play uncooperatively as a dominant strategy by a contract that pays her $\theta^C \pi^C$ for choosing N and not diverting and zero for choosing either C or diverting. However, by putting the manager on such a contract, the separate owner's payoff will be *lower* than on the collusive path $\pi^N - \theta^C \pi^C < \pi^C - \theta^C \pi^C$ (recall $\pi^N < \pi^C$). Hence, inducing both managers to abandon cooperative play is too

[24] We assume the managers coordinate on this tacitly collusive SPNE whenever it exists. The same argument applies if the managers coordinate on this equilibrium with a positive probability.

[25] To see that (3) implies (5), first define $g(x) \equiv \frac{1-x\theta^C}{1-x\theta^N}$. From (3) we get $\theta^C > \theta^N$ which implies $g'(x) = \frac{\theta^N - \theta^C}{(1-x\theta^N)^2} < 0$. Hence, $\frac{\pi^N}{\pi^C} > \frac{1-0.5\theta^C}{1-0.5\theta^N} > \frac{1-\theta^C}{1-\theta^N}$ as desired.

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expensive for the owners, and they must find other ways to reduce managerial rents.

Notice that inducing the managers to play uncooperatively requires only one of them to be put on the above contract (i.e., the owners can use asymmetric compensation plans). Suppose firm 1's manager is put on the above contract, which induces her to play uncooperatively. Firm 2's manager can then earn at most $\theta^N\pi^N$. The total payoff for the owners is now $2\pi^N - (\theta^C\pi^C + \theta^N\pi^N)$ which is greater than their total payoff on the collusive path $2(\pi^C - \theta^C\pi^C)$ whenever the parameter condition in 3 is satisfied.[26]

$$\frac{1-0.5\theta^C}{1-0.5\theta^N} < \frac{\pi^N}{\pi^C} \qquad \Leftrightarrow \qquad 2\pi^N - (\theta^C\pi^C + \theta^N\pi^N) > 2(\pi^C - \theta^C\pi^C).$$

The reason is that total firm profit falls from $2\pi^C$ to $2\pi^N$, but the total managerial compensation falls by a greater amount from $2\theta^C\pi^C$ to $\theta^C\pi^C + \theta^N\pi^N$ implying that the joint payoff of the owners goes up. The decrease in the total managerial compensation is entirely due to the reduction in the payment given to firm 2's manager since the manager of firm 1 is paid the same amount under each scenario. However, there is a problem: firm 1's owner strictly prefers *not* to implement this asymmetric managerial compensation scheme since his payoff will be less than on the collusive path $\pi^N - \theta^C\pi^C < \pi^C - \theta^C\pi^C$. Instead, the beneficiary of this scheme is Firm 2's owner, who gets a transfer from Firm 1's owner and Firm 2's manager. Thus, each separate owner prefers not to be the one inducing the manager to stop cooperating since the other owner reaps the benefits (there is a *free-riding problem*). As a result, the separate owners might be stuck in a soft competition equilibrium which benefits the managers but hurts the owners.

Common ownership can then be used to overcome this free-rider issue: each separate owner exchanges 50 percent of his stake with the other. Each owner now receives 50 percent of joint firm profit and strictly prefers to implement the asymmetric managerial compensation scheme - provided the parameter condition in (3) holds. Thus, common ownership in this setup reduces managerial rents since it ensures that the owners' incentives are better aligned, i.e., it overcomes a free-rider problem plaguing separate owners. The model implies that high agency costs predict increasing common ownership *and* decreasing firm profits. This outcome manifests the owners' desire to reduce managerial rents, which comes at the cost of greater

[26] Indeed, $2\pi^N - (\theta^C\pi^C - \theta^N\pi^N) > 2(\pi^C - \theta^C\pi^C)$ can be rewritten as $2\pi^N - (\theta^C\pi^C + \theta^N\pi^N) - 2(\pi^C - \theta^C\pi^C) = (1-0.5\theta^N)\pi^N - (1-0.5\theta^C)\pi^C > 0$ which is equivalent to (3).

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product market competition.

4.2 Discussion of assumptions

To better understand what drives the heterogeneous effect in the model, we show that the effect of common ownership on firm profitability is *always* (weakly) positive and thus inconsistent with the stylized facts in Section 2.2, if either (1) there is commitment, (2) there are no agency costs, or (3) there is no repeated interaction. First, suppose Assumption 1 does not hold, and the common owner can commit to behaving in a way that is not optimal for him ex-post. The threat of punishing defecting managers is then credible, implying the common owner can rely on trigger strategies to induce the managers to cooperate. As a result, the effect of common ownership on firm profitability will be weakly positive.

Remark 2. ***Commitment***. *Increasing common ownership has a (weakly) positive effect on firm profitability if the owners have commitment power.*

Second, the model has two additional ingredients: agency costs and repeated interaction. A natural question is whether we can dispense with one of those and generate the same empirical predictions but with a simpler model. The answer is no: *both* ingredients are necessary to explain the patterns we find in the data.

Remark 3. ***No agency costs or repetition***. *Increasing common ownership has a (weakly) positive effect on firm profitability if there are no agency costs or the game is static.*

The implication in Remarks 2 - 3 contradicts stylized fact 1 in Section 2.2. We thus focused on the simplest form of agency costs (i.e., managers can divert firm profit), implying managerial incentives are misaligned with the objectives of common owners (as in Azar and Ribeiro (2021)). Not all types of agency costs lead to misaligned objectives. For example, *quiet-life* preference (Bertrand and Mullainathan (2003)) would align the incentives of managers and common owners. We turn to those in the next section.

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5 Extensions

5.1 Quiet-life preferences

We now modify the baseline setup to capture *quiet-life* preferences. In particular, each manager incurs a private cost of γ^C from choosing C (playing cooperatively) and a private cost of γ^N from choosing N (playing uncooperatively) where $0 \leq \gamma^C < \gamma^N$ implying the managers dislike competing and prefer the *quiet-life*. To focus on the effect of *quiet-life* preferences, suppose the managers cannot divert $\theta = 0$. Since the objectives of the managers and the common owner are not misaligned, the model predicts that firm profits under common ownership cannot be less than firm profits under separate ownership.

Remark 4. ***Quiet-life preferences****. Suppose the managers have quiet-life preferences and no self-dealing opportunities. Then common ownership has no effect, or it increases firm profitability.*

This implication contradicts the stylized fact 1 in Section 2.2. One can proceed by analyzing a different type of agency costs as we do or by keeping the *quiet-life* preference but adding additional frictions as in Antón et al. (2023). It is important to recognize that the type of agency costs one postulates would shape the effect of common owners on the quality of corporate governance. For example, the model of Antón et al. (2023) implies that common ownership leads to higher cost and lower productivity and thus weakens corporate governance, at least in these dimensions. In practice, common owners may strengthen corporate governance in some dimensions, such as managerial rent-seeking, and weaken it in others, such as productivity enhancement which is consistent with the mixed empirical evidence on the effect of common owners on corporate governance (i.e., Appel et al. (2016) and Heath et al. (2022)).[27]

[27]The model in Antón et al. (2023) implies that increasing overlapping ownership leads to higher costs, higher prices, lower output, and higher profits. At the same time, the effect on markups is ambiguous due to frictions within the firm (in addition to a separation of ownership and control). As a result, not finding an effect on firm markups does not imply that common owners do not soften competition. Our model does not make this distinction since the only friction within a firm is between its manager and owner.

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5.2 Type of competition

Our model relies on a specific type of competition (prisoner's dilemma) and a specific type of agency cost (self-dealing managers). Therefore, it is important to understand whether the type of competition or agency costs drive the model implications. We address this question in Appendix A.1, which considers a general model of oligopolistic competition. We show that our results depend critically on the nature of agency costs but *not* on the type of competition.

5.3 Unobservable managerial actions

The baseline model assumes, for tractability, that the owners observe managerial actions (i.e., defection and diversion). Appendix A.2 investigates an extension where managerial actions are *not* observable to the owners who must, instead, rely on noisy signals, such as firm profit, to compensate managers. The basic idea is to reward the managers for outcomes, such as high industry profits that are more likely when the managers play cooperatively and do not divert. The model, in this case, will be more complicated since the owners must solve an inference problem about managerial actions based on firm profits. However, we show that the central message of the model remains: the common owner induces cooperation and higher firm profits, but only if the agency cost is sufficiently low.

5.4 Mixed ownership

The baseline model considers either fully separately owned firms or fully commonly owned firms. This assumption is for simplicity since it allows us to reach our main point faster, and relaxing it will not change the model's main message. To sketch how one could relax this assumption, suppose the common owner owns a fraction α of the shares in each firm, with the remaining shares in each firm owned by a separate owner. We must specify which owner chooses the managerial compensation within each firm since common and separate owners have different objectives. Following, Azar and Ribeiro (2021) and others suppose that the common owner gets to choose the managerial compensation in each firm with a probability proportional to his ownership stake in that firm α. Thus, higher common ownership implies that the managerial compensation in each firm is more likely to be selected by common rather than separate owners, but the main message of the model remains unchanged.

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5.5 Endogenous agency cost θ

The baseline model assumes that θ is an exogenous parameter. However, the main results would go through if owners partly control θ. In particular, suppose each firm's owner can reduce θ at a private cost (i.e., monitoring management more closely). The owners then appropriate a larger share of firm profits since they can reduce agency costs. Still, the model's main predictions on the effect of common ownership remain as in Proposition 1. What will change is the cutoff value of θ, which is now weakly higher since the common owner can now incur a cost to reduce managerial self-dealing opportunities. For example, suppose this cost is close to zero. In that case, managerial self-dealing is no longer a problem implying that common ownership can only increase firm profitability. Finally, suppose each manager can take actions leading to greater managerial entrenchment in the form of higher θ. While each manager would always like to be more entrenched under separate ownership, this is not necessarily true under common ownership, as can be seen in Figure 5 where going from $\theta = \frac{3}{10}$ to $\theta = \frac{4}{10}$ leads the common owners to abandon the collusive outcome leaving both managers worse off. Thus, common ownership can *discipline* managers by inducing them not to increase θ beyond the level where the common owner gives up inducing soft competition. In contrast, no such incentive exists under separate ownership.

6 Conclusion

The increase in overlapping ownership in recent years has sparked an intense debate on its impact on product market competition, particularly the most likely corporate governance channels through which overlapping owners can soften competition. In this paper, we document that the effect of overlapping ownership on profit margins varies strongly in the cross-section of firms that are close competitors (Stylized Fact 1). We also find that the effect of overlapping ownership on profits varies systematically with the type of overlapping owners (active or passive), the quality of corporate governance, and the industry's natural disposition towards soft competition (Stylized Fact 2a and 3). We finally find that overlapping owners are less likely than separate owners to fire managers after a bad performance (Stylized Fact 2b), which sheds light on the possible governance channels likely to shape the effect of overlapping owners on firm profits. We then showed how these stylized

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facts could be explained by a model combining the simplest competition setup, a repeated prisoner's dilemma, with the simplest principal-agent setup: managers that can divert firm profit. Depending on the severity of the agency conflict and an industry's natural disposition towards soft competition, an increase in overlapping ownership can lead to higher profits, lower profits, or no change at all. Our model highlights that the interplay of agency costs and repeated interaction is critical for understanding the patterns we document in data.

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Tables

Table 2: Summary Statistics

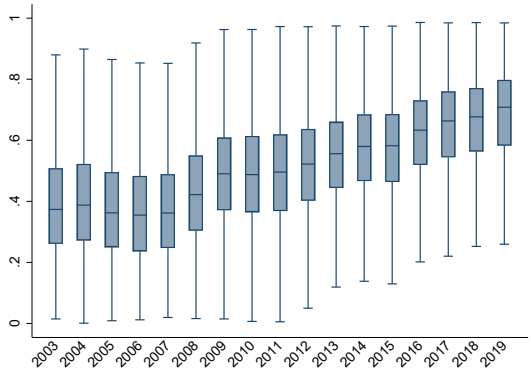
	Mean	P25	Median	P75	N
Price-Cost-Margin$_{fgt}$	45.93	27.54	38.05	65.44	11671
Overlapping ownership measures					
$\cos(\beta_{ft}, \beta_{gt})$	0.59	0.45	0.61	0.74	11671
Common owner $\cos(\beta_{ft}, \beta_{gt})$	0.10	0.02	0.05	0.13	11671
Universal owner $\cos(\beta_{ft}, \beta_{gt})$	0.49	0.35	0.49	0.63	11671
κ_{fgt}	0.62	0.48	0.64	0.77	11671
Corporate governance					
E-Index 1995$_{fg}$	1.95	1.00	2.00	2.50	11671
Tendency to collusion					
Grout (2005)	0.09	0.00	0.00	0.00	11525
High inv	0.54	0.00	1.00	1.00	11525
High ad	0.44	0.00	0.00	1.00	11525
High HHI	0.02	0.00	0.00	0.00	11525
Controls					
Size	10.61	9.75	10.58	11.30	11671
Age	3.44	3.33	3.47	3.56	11671
Leverage	0.21	0.09	0.19	0.31	11671
Market/book	1.01	0.49	0.78	1.25	11671
Return on assets	0.10	0.04	0.09	0.14	11671
Cash	0.11	0.02	0.05	0.15	11671

Summary statistics of the firm-pair dataset including only close competitors. Price-cost margin is the average between firm f and g. Overlapping ownership measures are based on data by Amel-Zadeh et al. (2022). The E-Index is the average entrenchment index by Bebchuk et al. (2009) between firm f and g measured in 1995 and constant across time. The tendency to collusion variables are indicator variables when: Grout and Sonderegger (2005) classify an industry as collusion-prone, an industry has above median investment (High inv), an industry has an above median advertisement expense to sales ratio (High ad), and an industry's HHI based on sales is above the median (High HHI).

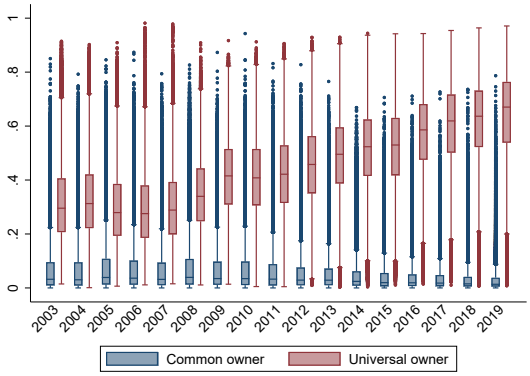
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Figure 7: Overlapping ownership among S&P 500 firms

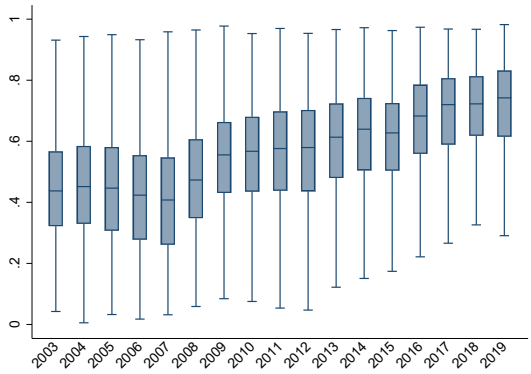
(a) Full sample



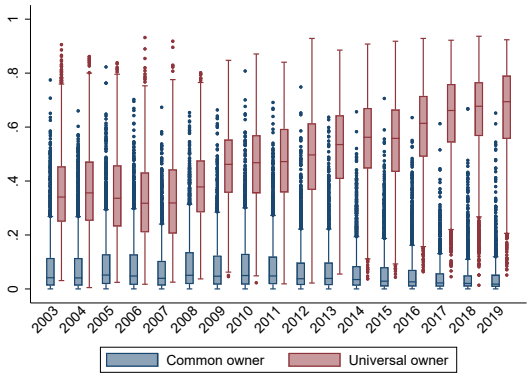
(b) Full sample



(c) Close competitors



(d) Close competitors



Notes: These figures show cosine similarity measures of overlapping ownership based on data by Amel-Zadeh et al. (2022) at the firm-pair level. Panels a) and b) use the full sample, whereas panels c) and d) only include firm pairs of close competitors identified using the Hoberg and Phillips (2016) product similarity data. Panels b) and d) show separate cosine similarity measures for common and universal owners.

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Table 3: Cross-Ownership and Corporate Governance

	(1)	(2)	(3)	(4)
Common owner $\cos(\beta_{ft}, \beta_{gt})$	2.01	8.47**	9.34**	11.02**
	(2.26)	(3.67)	(3.63)	(4.44)
Universal owner $\cos(\beta_{ft}, \beta_{gt})$	2.79	3.79	5.79	6.01
	(3.18)	(3.83)	(4.13)	(4.73)
E-Index 1995_{fg}		0.98	0.00	0.00
		(0.83)	(0.00)	(0.00)
Common owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}		−0.90	−3.94***	−4.74**
		(1.49)	(1.49)	(1.85)
Universal owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}		−1.48	−1.34	−1.69
		(1.32)	(1.38)	(1.76)
R^2	0.91	0.86	0.90	0.91
Observations	11520	11523	11523	11520
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair, Year	Industry, Year	Firm, Year	Firm-Pair, Year

Firm-pair regressions with next year's average price-cost-margin as dependent variable. The sample includes S&P 500 firms who are close competitors in the product market space (Hoberg and Phillips, 2016) from 2003 until 2018. Common ownership is measured as the cosine similarity of a firm-pair's ownership structure using data by Amel-Zadeh et al. (2022). The E-Index is the average managerial entrenchment index by Bebchuk et al. (2009) in 1995. Time varying firm-level control variables are: firm age, log total assets, book leverage, market to book value, return on assets, and cash to assets. Robust standard errors are clustered at the firm f and firm g level.

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Table 4: Cross- Ownership and Tendency to Collusion

	X=Grout(2005)	X=High inv	X=High HHI	X=High ad
Common owner $\cos(\beta_{ft}, \beta_{gt})$	0.10	2.18	−0.92	−4.22*
	(2.24)	(2.57)	(2.09)	(2.38)
Universal owner $\cos(\beta_{ft}, \beta_{gt})$	3.54	5.77*	2.76	−1.28
	(2.37)	(3.16)	(2.28)	(3.00)
X=1 · Common owner $\cos(\beta_{ft}, \beta_{gt})$	−8.34	−6.51*	−0.45	6.85*
	(5.19)	(3.39)	(3.67)	(3.57)
X=1 · Universal owner $\cos(\beta_{ft}, \beta_{gt})$	−12.28***	−7.52*	−9.85***	7.68*
	(3.18)	(4.42)	(2.65)	(4.03)
R^2	0.90	0.90	0.90	0.90
Observations	22041	22011	22011	22011
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair	Firm-Pair	Firm-Pair	Firm-Pair
	Year	Year	Year	Year

Firm-pair regressions with next year's average price-cost-margin as dependent variable. The sample includes S&P 500 firms who are close competitors in the product market space (Hoberg and Phillips, 2016) from 2003 until 2018. Common ownership is measured as the cosine similarity of a firm-pair's ownership structure using data by Amel-Zadeh et al. (2022). X are indicator variables for industries with a high propensity to collusion, above median capital intensity, above median concentration, and above median advertising intensity. Time varying control variables are: firm age, log total assets, book leverage, market to book value, return on assets, and cash to assets. Robust standard errors are clustered at the firm f and firm g level.

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A Appendix

A.1 General Model

This section considers a general model of oligopolistic competition under the same type of agency costs as in the simplified model in Section 3. The main result of this section is stated in Proposition 3, which is a generalization of Proposition 1. We will focus on the effect of common instead of universal owners since this is the more interesting case and abstract from managerial replacement (by setting $c = \infty$). The main message holds when managers can be fired but at the cost of greater complexity.

A.1.1 The environment

There are $n \geq 2$ firms in a given market in periods $t = 0, 1, 2.., T$ (where $T = \infty$) with firm i's action in period t denoted $a_{it} \in A_i \subseteq \mathbb{R}_+$. Denote by $\pi_{it} \equiv \pi_i(a_t)$ firm i's period-t profit where $a_t \equiv (a_{1t}, ..., a_{nt}) \in A_1 \times \cdots \times A_n \equiv A$ is the vector of actions played in period t. We focus on pure strategies only. Under separate ownership, there are $2n$ players: each firm's owner (he) and manager (she). Under common ownership, there are $n+1$ players: the owner of all firms and the n managers.

Agency cost. At the start of period 0 firm i's owner hires a manager to select its action sequence $\{a_{it}\}_{t=0}^{T}$. Firm i's manager can divert fraction $\theta \in (0, 1)$ of the period-t profit generated by her firm. Thus, if the firm gets π_{it} its manager can divert $\theta\pi_{it}$. Let $d_t \equiv (d_{1t}, d_{2t}, ..., d_{nt})$ where $d_{it} = 1$ if firm i's manager diverts in period t and $d_{it} = 0$ otherwise. The sequence of events in each period is the same as in the simplified model in Section 3 and summarized in Figure 4.

Payment plans. The history of the game up to, and including period-t, is denoted $h^t \equiv (a^t, d^t)$ and consist of action sequence $a^t \equiv (a_0, a_1, ..., a_t)$ and diversion sequence $d^t \equiv (d_0, d_1, ..., d_t)$. We assume h^t is observed at the end of period t by all players. The owner of firm i puts its manager on a payment plan $\tau_i \equiv \{\tau_{it}\}_{t=0}^{\infty}$ where $\tau_{it} \equiv \tau_i(h^t)$ is the manager's period-t salary as a function of the game's history. Thus, a payment plan $\{\tau_{1t}, ..., \tau_{nt}\}_{t=0}^{\infty}$ specifies a (non-negative) salary for each manager in every period and after every history. A given payment plan $\{\tau_{1t}, ..., \tau_{nt}\}_{t=0}^{\infty}$ induces a subgame perfect equilibrium (SPNE) of

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the managerial game, consisting of an action and diversion sequence for each manager $\{a_{1t}, ..., a_{nt}, d_{1t}, ..., d_{nt}\}_{t=0}^{\infty}$.

Payoffs. All players are risk-neutral with per-period discount factor $\beta \in (0, 1)$. One can think of $\beta \in (0, 1)$ as equal to $\beta = \beta'\delta$ where β' is a pure discount and δ is the probability that the game continues to period $t + 1$ given that it reached period t. Manager i's period-t payoff is the sum of her salary τ_{it} and the amount diverted $d_{it}\theta\pi_{it}$ giving a flow payoff $\tau_{it} + d_{it}\theta\pi_{it}$ and an overall payoff

$$\sum_{t=0}^{\infty} \beta^t(\tau_{it} + d_{it}\theta\pi_{it}).$$

The period-t payoff of the firm i's owner is $\pi_{it} - \tau_{it} - d_{it}\theta\pi_{it}$ giving an overall payoff

$$\sum_{t=0}^{\infty} \beta^t(\pi_{it} - \tau_{it} - d_{it}\theta\pi_{it}).$$

Finally, the period-t payoff of the common owner is $\sum_{i=1}^{n}(\pi_{it} - \tau_{it} - d_{it}\theta\pi_{it})$ giving an overall payoff

$$\sum_{t=0}^{\infty} \beta^t \left[\sum_{i=1}^{n}(\pi_{it} - \tau_{it} - d_{it}\theta\pi_{it})\right].$$

The common owner takes joint firm profit into account, whereas separate owners consider only their firm profit.

Assumptions. We impose *Assumptions 1* - *3* as in Section 3. We also impose a fourth technical assumption:

Assumption 4. *Suppose the common owner is indifferent between two paths of play, A and B since he gets the same payoff from each, but A is also associated with a strictly higher joint payoff for the managers. Then B is never played.*[28]

[28]If *Assumption 4* does not hold, then the common owner might be able to reduce managerial collusion rents through strategies that involve mini-maxing a defecting manager for a certain number of periods. However, suppose we restrict attention to those punishments featuring permanent or temporary reversion to the Nash equilibrium of the one-shot game, then *Assumption 4* can be weakened as follows: if two paths of play, A and B, deliver the same overall payoff for the common owner, but A also delivers a strictly higher overall payoff for *each* manager, then B is never played.

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This last assumption is unnecessary if one restricts attention to (admittedly realistic) equilibria where the common owner's payoff is always reduced if not all managers play cooperatively.

A.1.2 Effect of common ownership

We begin by defining several useful objects. The non-collusive plan $a^N \equiv (a_1^N, ..., a_n^N)$ constitutes Nash equilibrium of the one-shot game. That is, for each i

$$a_i^N = \underset{a_i \in A_i}{\text{argmax}} \pi_i \left(a_i,\, a_{-i}^N\right). \tag{6}$$

Let $\pi_i^N \equiv \pi_i(a^N)$. The collusive plan $a^C \equiv (a_1^C, ..., a_n^C)$ is obtained by maximizing joint per-period firm profit. That is, for each i

$$a^C = \underset{a \in A}{\text{argmax}} \sum_i \pi_i(a_i,\, a_{-i}). \tag{7}$$

Let $\pi_i^C \equiv \pi_i(a^C)$ and assume a_i^C is not a best response to a_{-i}^C for all i.[29] The collusive plan is thus not a Nash equilibrium of the one-shot game. Next, define for each i

$$\tilde{a}_i^N = \underset{a_i \in A_i}{\text{argmax}} \pi_i \left(a_i,\, a_{-i}^C\right) \qquad \text{and} \qquad \tilde{\pi}_i^N \equiv \pi_i \left(\tilde{a}_i^N,\, a_{-i}^C\right). \tag{8}$$

Thus, the maximum any given manager i can divert by *unilaterally* defecting from the collusive plan is $\theta\tilde{\pi}_i^N$. Since a^C is not Nash equilibrium $\theta\tilde{\pi}_i^N > \theta\pi_i^C$ for all i. That is, each manager can divert a greater amount by unilaterally defecting from the collusive plan. Finally, define

$$\theta^* \equiv \frac{\sum_i(\pi_i^C - \pi_i^N)}{\sum_i(\tilde{\pi}_i^N - \pi_i^N)} \qquad \text{and} \qquad \beta^* \equiv \max_{i=1,n} \left\{ \frac{\tilde{\pi}_i^N - \pi_i^C}{\tilde{\pi}_i^N - \pi_i^N} \right\}. \tag{9}$$

Notice that $\theta^* \in (0, 1)$ and $\beta^* \in (0, 1)$.

Proposition 3. *Increasing common ownership has*

[29] Depending on the application, a^C might correspond to producing low quantity, setting high prices, maximum product differentiation. We assume for simplicity that the collusive and non-collusive action plans are both unique.

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(i) an anti-competitive effect if $\theta < \theta^*$ *and* $\beta < \beta^*$
(ii) a pro-competitive effect $\theta > \theta^*$ *and* $\beta > \beta^*$*, and*
(iii) no effect if either $\theta > \theta^*$ *and* $\beta < \beta^*$ *or* $\theta < \theta^*$ *and* $\beta > \beta^*$*.*

By increasing common ownership, we mean moving from having n separate owners to having a single common owner. The rest of this section explains why we get Proposition 3. We begin with the incentives of the managers irrespective of ownership arrangement. Then we move to the incentives of separate and common owners. Without loss of generality, each manager is paid only conditional on not diverting.[30]

Managerial incentives. Consider the following behavior for the managers: each manager i starts by cooperating and choosing a_i^C. If ever one manager defects, all managers play the one-shot Nash equilibrium thereafter. The managers will be induced to follow such trigger strategies if promised a portion θ of their firm's profit, and there is sufficiently little discounting. Specifically, the no-defection condition for manager i is

$$\frac{\theta\pi_i^C}{1-\beta} \geq \theta\tilde{\pi}_i^N + \beta\frac{\theta\pi_i^N}{1-\beta}. \tag{10}$$

The left-hand side is the manager's overall payoff from colluding. The right-hand side is her payoff from the optimal deviation: she diverts $\theta_i\tilde{\pi}_i^N$ in the period of the defection triggering reversion to non-cooperative play giving a per-period payoff of $\tau_i^N = \theta_i\pi_i^N$. The manager's no defection condition in (10) holds if $\beta \geq (\tilde{\pi}_i^N - \pi_i^C)/(\tilde{\pi}_i^N - \pi_i^N)$. However, for trigger strategies to work, the punishment must be credible. We turn to the owners' incentives to determine whether this is the case.

Incentives of separate owners. After a defection by any manager, each separate owner best responds by putting the manager of his firm on a non-collusive contract expecting the other owners to do the same. In period 0, each separate owner best responds by placing the manager of his firm on the collusive contract as long as he expects the other owners to

[30]To see why, suppose the equilibrium path of play is $\{a_{1t}, ..., a_{nt}, d_{1t}, ..., d_{nt}\}_{t=0}^{\infty}$ giving an overall payoff to manager i of $\sum_{t=0}^{\infty}\beta^t(\tau_{it} + \theta d_{it}\pi_{it})$. Define a new contract $\hat{\tau}_{it} \equiv \tau_{it} + \theta d_{it}\pi_{it}$ such that manager i gets paid $\hat{\tau}_{it}$ but only if there is no diversion in period t. The new contract pays a given manager the amount she would divert (if any) under the old contract.

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cooperate and there is sufficiently little discounting. In particular, the no defection condition for the owner of firm i is

$$\frac{(1-\theta)\pi_i^C}{1-\beta} \geq (1-\theta)\tilde{\pi}_i^N + \beta\frac{(1-\theta)\pi_i^N}{1-\beta}. \tag{11}$$

The left-hand side is the owner's payoff on the collusive path, and the right-hand side is his maximum feasible payoff from inducing the manager to defect, leading to non-cooperative play in the subsequent periods. The manager recognizes that a defection triggers reversion to non-cooperative play and diverts $\theta\tilde{\pi}_i^N$ in the period of defection. Once the game is in the non-cooperative phase, the manager will be paid at least $\theta\pi_i^N$ (the amount she can divert). The condition in (11) holds if $\beta \geq (\tilde{\pi}_i^N - \pi_i^C)/(\tilde{\pi}_i^N - \pi_i^N)$. In summary, tacit collusion is a subgame perfect equilibrium of the game under separate ownership if $\beta \geq \beta^*$ where β^* is given in (9).

Incentives of common owners. First, suppose the managers play the one-shot Nash equilibrium a^N in (6) every period and after every history. Each manager gets at least $\theta\pi_i^N$ per period. Hence, the common owner gets an overall payoff of at most

$$V^N \equiv \tfrac{1}{1-\beta}\sum_i(\pi_i^N - \theta\pi_i^N).$$

Second, suppose the managers play the collusive outcome a^C in (7) in every period and after every history. In this case, manager i will not play her component of a^C unless paid at least $\theta\tilde{\pi}_i^N$ where $\tilde{\pi}_i^N$ is the one-shot collusion bonus given in (8). Hence, the common owner gets an overall payoff of at most

$$V^{\text{One-shot}} \equiv \tfrac{1}{1-\beta}\sum_i(\pi_i^C - \theta\tilde{\pi}_i^N),$$

where superscript indicates that the common owner uses one-shot collusion bonuses that do not rely on repetition. Notice that $V^{\text{One-shot}} \geq V^N$ if and only if agency cost is below the cutoff θ^* defined in (8). The question is whether the common owner can credibly use some payment plan that induces the managers to play a^C while also reducing their rents on the path of tacit collusion below the sum of one-shot collusion bonuses $\sum_i \theta\tilde{\pi}_i^N$. Proposition 3

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shows that the answer is no.[31]

To understand why this is the case, assume the common owner maximizes his overall payoff in period 0 by inducing tacit collusion through some payment plan ς^C. Whatever happens in period 0, the common owner can induce tacit collusion among the managers starting from period 1 through the same payment plan (i.e., by treating period 1 as the initial period and "forgetting" the past). Then, if ς^C maximizes the common owner's overall payoff in period 0, it must also maximize the common owner's continuation payoff in period 1 (by Assumption 2). The common owner would then induce tacit collusion among the managers in every period and after every history (by Assumption 1). Since the outcome a^C always repeats, the managers can be induced to select a^C only through one-shot collusion bonuses. In other words, the game becomes static since the common owner cannot commit to using punishments to deter defections.

To sum up: the common owner can always rely on one-shot collusion bonuses to induce anti-competitive managerial behavior. However, one-shot collusion bonuses become too expensive for the common owner if agency cost is high $\theta > \theta^*$, in which case he prefers to let the managers compete - unless managerial rents can be reduced in some way. The common owner could reduce managerial rents through threats of abandoning tacit collusion after defections, but *cannot* credibly commit to doing so. As a result, the managers must be paid at least their one-shot collusion bonus to behave anti-competitively, implying that the common owner continues to abandon tacit collision when agency cost is severe enough $\theta > \theta^*$.

A.2 Unobservable actions

In the baseline model, the owners observe managerial actions (diversion and collusion) and can contract on these choices. Here we assume managers' actions are not observed, and the owners must rely on noisy signals such as firm profits. For simplicity, we focus on the one-shot interaction of the prisoner's dilemma in Section 3, with payoffs shown in Table A1 where $\tilde{\pi}^N > \pi^C > \pi^N > \tilde{\pi}^C$. Specifically, if both managers play C, firm 1's profit is $y_1 = \pi^C + \epsilon_1$ and firm 2's profit is $y_2 = \pi^C + \epsilon_2$ where ϵ_i is a random mean zero shock to firm i's profit. If manager 1 plays N and manager 2 plays C firm 1's profit is $y_1 = \tilde{\pi}^N + \epsilon_1$

[31] We do not restrict attention to trigger strategies only. The common owner can use temporary or permanent reversion to non-cooperative play or any tit-for-tat strategy involving mini-maxing a defecting manager for several periods.

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and firm 2's profit is $y_2 = \tilde{\pi}^C + \epsilon_2$, and so on.

Payoffs	Cooperate (C)	Defect (N)
Cooperate (C)	$\pi^C + \epsilon_1$, $\pi^C + \epsilon_2$	$\tilde{\pi}^C + \epsilon_1$, $\tilde{\pi}^N + \epsilon_2$
Defect (N)	$\tilde{\pi}^N + \epsilon_1$, $\tilde{\pi}^C + \epsilon_2$	$\pi^N + \epsilon_1$, $\pi^N + \epsilon_2$

Table A1

Both collusion and profit diversion are unobservable: the owners only observe final firm profit $x_i = (1 - d_i\theta)y_i$ where $d_i = 1$ if manager i diverted and $d_i = 0$ otherwise. Hence, managerial contracts cannot be contingent on $a_i \in \{N, C\}$ and $d_i \in \{0, 1\}$ but only on (x_1, x_2). The support of (ϵ_1, ϵ_2) is sufficiently large to make perfect inference of managerial actions infeasible.

Write $r_i(x_1, x_2)$ for manager i's payment if firm 1's profit is x_1 and firm 2's profit us x_2. First, the owners cannot pursue legal actions against the managers for diverting since each manager can always claim that her firm's profit was low. Thus, the manager's payment cannot be negative $r_i \geq 0$. Second, giving the manager a fixed portion of the firm profit, say $\gamma > 0$, generates an expected profit for the manager of at least $[\theta + \gamma(1 - \theta)]E[y_i]$. To see why, assume the firm's profit is y_i. The manager would then divert θy_i leaving the firm with $(1 - \theta)y_i$ in profit and thus get $\gamma(1 - \theta)y_i$ in addition to what was diverted. Thus, for each y_i the manager gets at least $[\theta + \gamma(1 - \theta)]y_i$. It is, therefore, cheaper for the owner to set $\gamma = 0$ and let the manager divert θy_i.

Thus, unobservable diversion leads to low-powered managerial incentives consisting of a fixed payment and a bonus based on joint firm profits, as described below. In particular, to induce non-cooperative play (N, N), each manager is given a fixed wage $r_i^N = w$ to satisfy her participation constraint. (In the baseline model, $w = 0$ since the managers have zero outside options.) The unique equilibrium of the one-shot game is for each manager to play non-cooperatively and get an expected payoff $\theta\pi^N$ by diverting a portion θ of her firm's profit. Each firm owner gets $\pi^N - \theta\pi^N$ in expectation, and a common owner gets twice this amount. As in the baseline model, the one-shot equilibrium under separate ownership will be non-cooperative for any θ, giving expected industry profit $2\pi^N$.

On the other hand, to induce cooperative play (C, C), each manager is given a fixed wage w plus potentially a bonus b_S. The bonus b_S is paid only if an event S takes place, where S is more likely to occur under cooperative play (i.e., high industry profits). Denote

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by p_S^C the probability of S if both managers cooperate and by $\tilde{p}_S^N$ the probability of S if one manager defects. Define $\triangle_S \equiv p_S^C - \tilde{p}_S^N$. Each manager gets an expected payoff of $w + \theta\pi^C + p_S^C b_S$ from playing C. That is, a fixed salary w, an expected diversion of $\theta\pi^C$, and a bonus b_S with probability p_S^C. On the other hand, a defecting manager gets an expected payoff of $w + \theta\tilde{\pi}^N + \tilde{p}_S^N b_S$. A fixed salary w, an expected diversion $\theta\tilde{\pi}^N$, and a bonus b_S with probability $\tilde{p}_S^N$ (where $\tilde{p}_S^N = p_S^C - \triangle_S$). For given S, the lowest value of the bonus b_S necessary to induce the managers to cooperate is then

$$\underline{b}_S \equiv \frac{\theta(\tilde{\pi}^N - \pi^N)}{\triangle_S}.$$

The common owner prefers to induce cooperation while minimizing $\underline{b}_S$, which requires choosing S to maximize $\triangle_S$. Let $S = \{(y_1, y_2) : y_1 + y_2 \geq y_T\}$ where y_T is fixed in the managerial contract. Given that high industry, profit is more likely under cooperative play $\triangle_S > 0$, and y_T can be selected to maximize $\triangle_S$. Finally, the common owner induces cooperation leading to high industry profit $2\pi^C$ if agency cost is sufficiently small $\theta \leq \theta^*$ where

$$\theta^*(\triangle_S) \equiv \frac{\pi^C - \pi^N}{\pi^C - \pi^N + \frac{1}{\triangle_S}(\tilde{\pi}^N - \pi^C)}.$$

The cutoff decreases in $\triangle_S$: if S is more informative of cooperative play, the common owner is more eager to promote anti-competitive behavior. As the variance in the noise term, ϵ_i goes to zero $\theta^*(\triangle_S)$ goes to $\theta^*(1)$, which corresponds to the cutoff in the baseline model in Section 3.

A.3 Proof of Proposition 3

Here we establish Proposition 3. Proposition 1 then follows as a special case where the competitive structure corresponds to a prisoner's dilemma. The text established that tacit collusion (the managers playing a^C in every period) is sustainable as a perfect equilibrium of the repeated game under separate ownership as long as $\beta \geq \beta^*$ with β^* given (9). That is,

$$\beta^* \equiv \max_{i=1,n} \left\{ \frac{\tilde{\pi}_i^N - \pi_i^C}{\tilde{\pi}_i^N - \pi_i^N} \right\}.$$

The text also established that the common owner induces the managers to select a^C in

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every period whenever $V^N \leq V^{\text{One-shot}}$. That is,

$$\tfrac{1}{1-\beta}\sum_i(\pi_i^N - \theta\pi_i^N) \leq \tfrac{1}{1-\beta}\sum_i(\pi_i^C - \theta\tilde{\pi}_i^N).$$

The above is equivalent to $\theta \leq \theta^*$ with θ^* given in (9). That is,

$$\theta^* \equiv \frac{\sum_i(\pi_i^C - \pi_i^N)}{\sum_i(\tilde{\pi}_i^N - \pi_i^N)}.$$

Thus, common ownership has an anti-competitive effect on firm profits if $\theta \leq \theta^*$ and $\beta < \beta^*$ and no effect if $\theta \leq \theta^*$ and $\beta \geq \beta^*$. To finish the proof, we must show that common owners have a pro-competitive effect if $\theta > \theta^*$ and $\beta \geq \beta^*$ and no effect if $\theta > \theta^*$ and $\beta < \beta^*$.

For this, it is sufficient to show the common owner will *not* induce the managers to select a^C whenever $\theta > \theta^*$ (since tacit collusion is an SPNE of the game under separate ownership for $\beta > \beta^*$). First, assume all managers other than i play their components of the collusive plan a_{-i}^C in every period and after every history. Manager i will be induced to select a_i^C if and only if her payoff from doing is no less than the one-shot collusion bonus in (8). That is,

$$\theta\tilde{\pi}_i^N \equiv \max_{a_i \in A_i} \theta\pi_i(a_i, a_{-i}^C).$$

The common owner's overall payoff from inducing a^C through one-shot collusion bonuses is then

$$V^{\text{One-shot}} \equiv \frac{1}{1-\beta}\sum_i(\pi_i^C - \theta\tilde{\pi}_i^N).$$

When the managers play cooperatively, the common owner can always guarantee a payoff of at *least* $V^{\text{One-shot}}$. The question is whether the common owner *can* do better than that through some non-stationary payment plan ς^C. So, suppose the common owner can induce the managers to select a^C in each period through ς^C. The overall payoff for the common owner on the collusive path will be

$$V^C \equiv \frac{1}{1-\beta}\sum_i(\pi_i^C - \tau_i^C),$$

where τ_i^C is the salary for manager i on the collusive path associated with the payment plan

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ς^C. We must show $V^C \leq V^N$ whenever $\theta > \theta^*$. For that, it suffices to show that for any θ we have $V^C \leq V^{\text{One-shot}}$ which is equivalent to

$$\sum_i \tau_i^C \geq \sum_i \theta \tilde{\pi}_i^N.$$

The common owner cannot induce a^C *and* and also get an overall payoff higher than what can be attained through one-shot collusion bonuses. The proof is by contradiction: suppose $V^C > V^{\text{One-shot}}$ implying

$$\sum_i \tau_i^C < \sum_i \theta \tilde{\pi}_i^N.$$

Hence $\tau_i^C < \theta \tilde{\pi}_i^N$ for at least one manager i. The no-defection condition for this particular manager is

$$\tau_i^C + \beta \frac{\tau_i^C}{1-\beta} \geq \theta \tilde{\pi}_i^N + \beta U_i^P,$$

where U_i^P is manager i's continuation payoff after defection. Specifically, we denote by

$$\{a_{1t}^p ..., a_{nt}^P, d_{1t}^p, ..., d_{nt}^p\}_{t=1}^{\infty},$$

the action and divergence sequences in the punishment path of play for manager i. Let $\pi_{it}^p \equiv \pi_i(a_{it}^p)$ and $\tau_{it}^p \equiv \tau_i^p(a^{tP}, d^{tP})$. As before, there is no loss of generality in restricting attention to paths of play that do not feature diversion (i.e., $d_{it}^P = 0$ for all i and t) since each manager can always be paid the amount she would have diverted. We have

$$U_i^P = \sum_{t=1}^{\infty} \beta^{t-1} \tau_{it}^p$$

Note that the punishment path of play can be a permanent or a temporary reversion to the one-stage Nash equilibrium. The punishment can also feature tit-for-tat strategies, such as when the other managers are induced to mini-max the defecting manager for several periods. Note that $\tau_i^C < \theta \tilde{\pi}_i^N$ implies

$$\frac{\tau_i^C}{1-\beta} > U_i^P.$$

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A defection by manager i triggers retaliation from the common owner who induces the other managers to play in a way lowering manager i continuation payoff below $\tau_i^C/(1-\beta)$. Suppose manager i defects in period 0, triggering the punishment phase associated with his manager's defection. The common owner continuation payoff after manager i has defected in period 0 is

$$V^{\text{Def},i} \equiv \sum_{t=1}^{\infty} \beta^{t-1} \sum_{i=1}^{n} (\pi_{it}^p - \tau_{it}^p).$$

Recall *Assumption 2*: if the common owner can select the collusive equilibrium in period 0 through the payment plan ς^C, then he can do the same in period 1 by treating period 1 as the start of the game (i.e., the past is sunk). As a result, the common owner's continuation payoff in the punishment path for manager i must equal V^C. That is, $V^{\text{Def},i} = V^C$ yielding

$$\sum_{t=1}^{\infty} \beta^{t-1} \sum_{i=1}^{n} (\pi_{it}^p - \tau_{it}^p) = \sum_{t=1}^{\infty} \beta^{t-1} \sum_{i=1}^{n} (\pi_i^C - \tau_i^C).$$

If the above does not hold (i.e., $V^{\text{Def},i} < V^C$) the common owner threat is not credible: manager i recognizes that after defection, the common owner restarts the collusive play from period $t = 1$ onward since otherwise, the common owner is not maximizing his continuation payoff (violating *Assumption 1*). Rewriting the above

$$\sum_{t=1}^{\infty} \beta^{t-1} \left[\sum_{i=1}^{n} \tau_i^C - \sum_{i=1}^{n} \tau_{it}^P \right] = \sum_{t=1}^{\infty} \beta^{t-1} \left[\sum_{i=1}^{n} \pi_i^C - \sum_{i=1}^{n} \pi_{it}^P \right] \geq 0.$$

The weak inequality above holds because a^C is the action profile maximizing joint per-period firm profit. Notice that if $a_{it}^P = a_i^C$ for all i and all $t \geq 1$ then each manager must be paid at least the one-shot collusion bonus to implement a^C. That is, $\tau_i^C \geq \theta \tilde{\pi}_i^N$ implying $\sum_i \tau_i^C \geq \sum_i \theta \tilde{\pi}_i^N$ and $V^C \leq V^{\text{One-shot}}$. Therefore, if $V^C > V^{\text{One-shot}}$ as we assumed initially, then some managers must not always play their component of a^C, implying that overall firm profit on the punishment path will be lower than on the collusive path

$$\sum_{t=0}^{\infty} \beta^{t-1} \sum_{i=1}^{n} \pi_i^C > \sum_{t=0}^{\infty} \beta^{t-1} \sum_{i=1}^{n} \pi_{it}^P.$$

The above implies that the managers derive greater joint payoff on the collusive path,

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whereas the common owner is indifferent between the collusive and the punishment path (since his overall payoff is the same $V^{\text{Def},i} = V^C$). That is,

$$\sum_{t=0}^{\infty} \beta^{t-1} \sum_{i=1}^{n} \tau_i^C > \sum_{t=0}^{\infty} \beta^{t-1} \sum_{i=1}^{n} \tau_{it}^P .$$

But then by *Assumption 4*, the game never enters the punishment path of play for manager i. Therefore, manager i must be paid at least the one-shot collusion bonus, namely $\theta\tilde{\pi}_i^N$, to play cooperatively. Thus, for each i we have $\tau_i^C \geq \theta\tilde{\pi}_i^N$ which, in turn, implies $\sum_i \tau_i^C \geq \sum_i \theta\tilde{\pi}_i^N$ as desired. Finally, assume managers can also be fired at some cost for the common owner (*Assumption 3*). Essentially the same argument as above can be used to conclude that a common owner will not fire defecting managers and, thus, cannot credibly rely on trigger strategies that feature managerial termination.

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B Internet Appendix

B.1 Numerical examples cosine similarity

A high retail share is problematic As illustrated by Backus et al. (2021a) in Example 1, profit weights κ, and the cosine similarity might indicate a high degree of overlapping ownership even though the actual share of a firm-pair's equity owned is rather low. In Example 1 of Table B1, the cosine similarity between the blockholders of firms A and B, C and D, and E and F is the same (0.8) even though the ownership structure of the firm is completely different and only for firms A and B the high level of overlapping ownership indicated by the cosine similarity seems appropriate. Fortunately, in our sample, the retail share of most firms is quite low, less than 2% at the tenth percentile and still lower than 40% at the 90th percentile of the distribution, as can be seen in Figure B1.

Example 1: Retail share

	Investor 1	Investor 2	Retail share	Cosine similarity
Firm A	25%	50%	25%	$cos(\beta_A, \beta_B) = 0.8$
Firm B	50%	25%	25%	
Firm C	0.25%	0.5%	99.25%	$cos(\beta_C, \beta_D) = 0.8$
Firm D	0.5%	0.25%	99.25%	
Firm E	25%	50%	25%	$cos(\beta_E, \beta_F) = 0.8$
Firm F	0.5%	0.25%	99.25%	

Example 2: Single firm investor

	Investor 1	Investor 2	Investor 3	Cosine similarity
Firm A	10%	25%	0%	$cos(\beta_A, \beta_B) = 1$ (Without Investor 3)
Firm B	10%	25%	50%	$cos(\beta_A, \beta_B) = 0.47$ (With Investor 3)
Firm C	0.1%	0.25%	0%	$cos(\beta_A, \beta_B) = 1$ (Without Investor 3)
Firm D	0.1%	0.25%	50%	$cos(\beta_A, \beta_B) = 0.05$ (With Investor 3)

Table B1: Overlapping ownership examples

Data on single firm investors are crucial Thanks to the extensive data collection effort by Amel-Zadeh et al. (2022), we have data on investors available who are only blockholders

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of one firm. This is important to measure overlapping ownership correctly. The cosine similarity measure between Firm A and B in Example 2 of Table B1 equals one when ignoring investor 3. The cosine similarity drops to 0.47 once we take into account Investor 3. The difference is even larger when considering firms C and D: while the cosine similarity is still one when ignoring Investor 3, the measure drops to 0.05, correctly indicating a very low level of overlapping ownership once Investor 3 is taken into account.

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B.2 List of most important common and universal owners

Universal owners Below we provide the names of the 65 universal owners that hold at least a 5% stake in a firm at some point during our sample.

Big four Blackrock Inc, Fmr Llc, State Street Corp, Vanguard Group Inc

Banks and insurance companies Axa, Bank Of America Corp De, Bank Of New York Mellon Corp, Citigroup Inc, Credit Suisse First Boston Inc, Deutsche Bank Ag, Goldman Sachs Group Inc, J P Morgan Chase & Co, Keybank National AssociationOh, Lehman Brothers Holdings Inc, Manufactureres Life Insurance Co, Mellon Bank N A, Merrill Lynch & Co Inc, Merrill Lynch Asset Management Inc, Metropolitan Life Insurance CoNy, Morgan Stanley, National City Corp, Norges Bank, Regions Financial Corp, Ubs Ag, Ubs Global Asset Management Americas Inc, Ubs Group Ag, Us Bancorp, Wachovia Corp New, Wells Fargo & Company Mn

Pension fund Canada Pension Plan Investment Board

Other asset managers Asset Management PlcUk, Alliancebernstein Lp, Allianz Asset Management Ag, American International Group Inc, Ameriprise Financial Inc, Aqr Capital Management Llc, Barclays Global Investors Uk Holdings Ltd, Caisse De Depot Et Placement Du Quebec, Caterpillar Investment Management Ltd, Citadel Advisors Llc, Dimensional Fund Advisors Lp, Eaton Vance Management, F&C Asset Management Plc, Fund Asset Management Inc, Gartmore Global Asset Management Ltd, Henderson Group Plc, Invesco Institutional Na Inc, Invesco Ltd, Janus Capital Management Llc, Mellon Financial Corp, Neuberger Berman Group Llc, Northern Trust Corp, Oppenheimer Funds Inc, Pictet Asset Management Ltd, Pnc Financial Services Group Inc, Price T Rowe Associates Inc Md, Principal Financial Group Inc, Putnam Investment Management Llc, Putnam Investments Llc, Susquehanna International Group Llp, Tiaa Cref Investment Management Llc, U S Trust Corp Ny.

Common owners Below we provide a list of a subset of common owners in our sample.

Banks and insurance companies

Allied Irish Banks Plc,Axa Financial Inc,Banco Santander Sa,Bancorpsouth Inc,Cincinnati Insurance Co,Country Trust Bank,Fukoku Mutual Life Insurance Co,Lloyds Tsb Bank Plc,Nippon

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Life Insurance Co,Northwestern Mutual Life Insurance Co,Softbank Group Corp.,State Farm Mutual Automobile Insurance Co

Activist investors

Appaloosa Investment Lp I,Appaloosa Management Lp,Appaloosa Partners Inc,Atlantic Investment Management Inc,Atticus Capital Lp,Atticus Management Llc,Basswood Capital Management Llc,Baupost Group Llcma,Canyon Capital Advisors Llc,Castle Point Capital Management Llc,Chieftain Capital Management Inc,Corvex Management Lp,Citadel Enterprise Americas Llc ,Deccan Value Investors Lp,Elliott Management Corp,Eminence Capital Lp,Esl Investments, Inc.,Esl Investors Llc,Esl Partners, L.P.,Fairholme Capital Management Llc,Farallon Capital Management Llc,Firefly Value Partners Lp,Gendell Jeffrey L Et Al,Glenview Capital Management Llc,Greenlight Capital Inc,Gscp Nj L P,Harbinger Capital Partners Master Fund I Ltd,Hassenfeld Alan G,Highfields Capital Management Lp,Horizon Kinetics Llc,Hotchkis & Wiley Capital Management Llc,Icahn Capital Lp,Icahn Carl C,Integrated Core Strategies (Us) Llc,Jana Partners Llc,Kkr Group Partnership L.P. ,Orbis Allan Gray Ltd,Paulson & Co Inc,Pennant Capital Management Llc,Perry Corp,Pershing Square Capital Management Lp,Relational Investors Llc,Sailingstone Capital Partners Llc,Scopia Capital Management Lp,Scout Capital Management Llc,Sessa Capital Im Lp,Silver Point Capital Lp,Soroban Capital Partners Llc,Southeastern Asset Management Inctn,Starboard Value Lp,Steel Partners Ii Lp,Stonebrook Fund Management Llc,Tci Fund Management Ltd,Third Point Llc,Tpg Group Holdings (Sbs) Advisors Inc,Tpg-Axon Capital Management Lp,Trian Fund Management Lp,Trian Partners General Partner Llc,Tudor Investment Corp Et Al,Ulysses Management Llc,Valueact Capital Management Lp,Valueact Holdings Lp,Viking Global Investors Lp,Viking Global Performance Llc ,Whitebox Advisors Llc,Zimmer Partners Lp

Others

1832 Asset Management Lp,A I M Management Group Inc De,Acadian Asset Management Llc,Adage Capital Partners Gp Llc,Aim Funds Management Inc,Albert D Mason Inc,Aletheia Research & Management Inc,Alex Brown Investment Management Llc,Allen Holding Inc Ny,Allen Investment Management Llc,Allianz Global Investors Of America L P,American Century Companies Inc,American Century Investment Management Inc,Apollo Investment Fund Iv Lp,Appleton Partners Incma,Archeus Capital Management Llc,Ariel Capital Management Inc Et Al,Ariel Capital Management Llc,Aronson & Partnerspa,Arrowstreet

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Capital Limited Partnership,Artisan Partners Limited Partnership,Artisan Partners Ltd Partnership,Atlanta Capital Management Co L L C,Allianz Global Investors Managed Accounts Llc,Allianz Global Investors U.S. Holdings Llc ,Allianz Global Investors U.S. Llc,Baillie Gifford & Co,Baker Bros Advisors Llc,Bamco Inc Ny,Barrett John F,Barrow Hanley Mewhinney & Strauss Llc,Berkshire Hathaway Inc,Bill & Melinda Gates Foundation Trust,Birck Michael J ,Blackstone Group Lp,Blair William & Coil,Blue Ridge Capital Holdings Llcblue Ridge Capital Offshore Holdings Llc,Boston Partners Asset Management Llc,Brandes Investment Partners Lp,Brave Warrior Capital Inc,Brookside Capital Management Llc,Brown Advisory Inc,Brown Brothers Harriman & Co,Brown John W ,Buffett Warren E ,Burgundy Asset Management Ltd,Benioff Marc,Blackstone Holdings Iii L.P. ,Capital Group Companies Inc,Capital Growth Management Lp,Capital Guardian Trust Co,Cascade Investment Llc,Channing Capital Management Llc,China Investment Corp,Cincinnati Financial Corp,Clearbridge Advisors Llc,Coca Cola Co (Ko),Colony Group Llc,Columbia Wanger Asset Management Llc,Cook Scott D,Cooke & Bieler Lp,Cramer Rosenthal Mcglynn Llc,Curian Capital Llc,D E Shaw & Co Inc,D E Shaw & Co Lp,Davis Selected Advisers,Delaware Management Co Incde,Diamond Hill Capital Management Inc,Dnb Nor Asset Management Us Inc,Dodge & Cox,Donald Smith & Co Inc,Dow Chemical Co De,Dreman Value Management L L C,Diller Barry,Eagle Capital Management Llc,Earnest Partners Llc,Eastbourne Capital Management Llcca,Edgepoint Investment Group Inc,Edgewood Management Llc,Edinburgh Partners Ltd,Empire Capital Management Llc,Eton Park Capital Management Lp,Evercore Trust Company Na,Fairfax Financial Holdings Ltd Can,Farmer Richard T,Farr Miller & Washington Llcdc,Fiduciary Management Inc Wi,First Eagle Investment Management Llc,First Pacific Advisors Inc,First Pacific Advisors Llc,Fisher Donald G,Fisher Robert J,Fishman Jay A Ltdmi,Fl Group Hf,Fort Washington Investment Advisors Inc Oh,Franklin Resources Inc,Frontier Capital Management Co Inc,Fundsmith Llp,Gamco Investors Inc Et Al,Gates William H Iii,Gendell Jeffrey L,General Electric Co,Generation Investment Management Llp,Geneva Investment Management Of Chicago Llc,Gic Private Ltd,Gilder Gagnon Howe & Co Llc,Great West Life Assurance Co Can,Greenhaven Associates Inc,Greenleaf Trust,Growth Fund Of America,Gund Gordon,Harbert Management Corp,Harris Associates L P,Hbk Investments L P,Heartland Advisors Inc,Helu Carlos Slim,Henkel Kgaa New,Highbridge Capital Management Llc,Highland Capital Management Lp,Icc Capital Management Inc,Independent Franchise Partners Llp,Invesco Asset Management Ltd,Investor Ab,Ionic Capital Manage-

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ment Llc,Iridian Asset Management Llcct,Isp Investco Llc,Jefferson Pilot Corp,Jennison Associates Llc,Jgd Management Corp Ny,Jobs Steven P,Jupiter Asset Management Ltd,K Capital Partners Llc,Kayne Anderson Rudnick Investment Management Llc,Kiltearn Partners Llp,Kinetics Asset Management Inc,Kirr Marbach & Co Llc In,Kohlberg Kravis Roberts & Co Lp,Lateef Investment Management Lp,Lazard Asset Management Llc,Legg Mason Capital Management Inc,Legg Mason Funds Management Inc Md,Legg Mason Inc,Leonard Green Partners Lp,Lmm Llc,Loews Corp,London Co Of Virginia,Lone Pine Capital Llc,Longview Asset Management Llc,Longview Partners (Guernsey) Ltd,Loomis Sayles & Co L P,Lord Abbett & Co Llc,Lsv Asset Management,Mac Per Wolf Co,Mackenzie Financial Corp,Macquarie Group Ltd,Macquarie Management Holdings, Inc. ,Magellan Asset Management Ltd,Mairs & Power Inc,Managed Account Advisors Llc,Manning & Napier Advisors Inc,Manulife Financial Corp (Mfc),Maori European Holding, S.L. ,Marathon Asset Management Llp,Marsico Capital Management Llc,Massachusetts Financial Services Co Ma,Maverick Capital Ltd,Mclean Budden Ltd,Md Sass Investors Services Inc,Meeder Asset Management Inc,Michas Alexis P,Morton Holdings, Inc.,Natixis Asset Management,Neuberger Berman Inc,Neuberger Berman Llc,Nordstrom Bruce J,Northern Cross Llc,Northwestern Investment Management Co Llc,Nwq Investment Management Company Llc,Newport Trust Co,Oak Associates Ltd Oh,Old Republic International Corp,Omidyar Pierre M,Onyx Capital Management Llc,Oppenheimer Capital,Oracle Corp De,Orbis Holdings Ltd,Orbis Investment Management Ltd,Osterweis Capital Management Inc,Pacific Financial Research Inc,Packard David & Lucile Foundation,Par Capital Management Inc,Parnassus Investments Ca,Peak6 Investments Lp,Perkins Investment Management Llc,Polen Capital Management Llc,Primecap Management Coca,Private Capital Management,Prudential Plc,Putnam Llc,Pzena Investment Management Llc,Rales Mitchell P,Rales Steven M,Rcm Capital Management Llc,Reed Conner & Birdwell Llc,Reinhart Partners Inc,Renaissance Technologies Llc,Robeco Investment Management Inc,Royce & Associates Llc,Rs Investment Management Co Llc,Ruane Cunniff & Goldfarb Inc,Ruane, Cunniff & Goldfarb L.P.,Salus Capital Management Inc,Samana Capital, L.P. ,Sanders Capital Llc,Sands Capital Management Llc,Sarasin & Partners Llp,Sasco Capital Inc Ct,Schneider Capital Management Corp,Scott & Stringfellow Llc,Select Equity Group Inc,Select Equity Group Lp,Select Offshore Advisors Llc,Seligman J & W & Co Inc Ny,Sentinel Asset Management Inc,Sf Holding Corp,Shapiro Capital Management Co Inc,Snow Capital Management Lp,Spo Advisory Corp,Starr International Co Inc,State Farm Investment Management

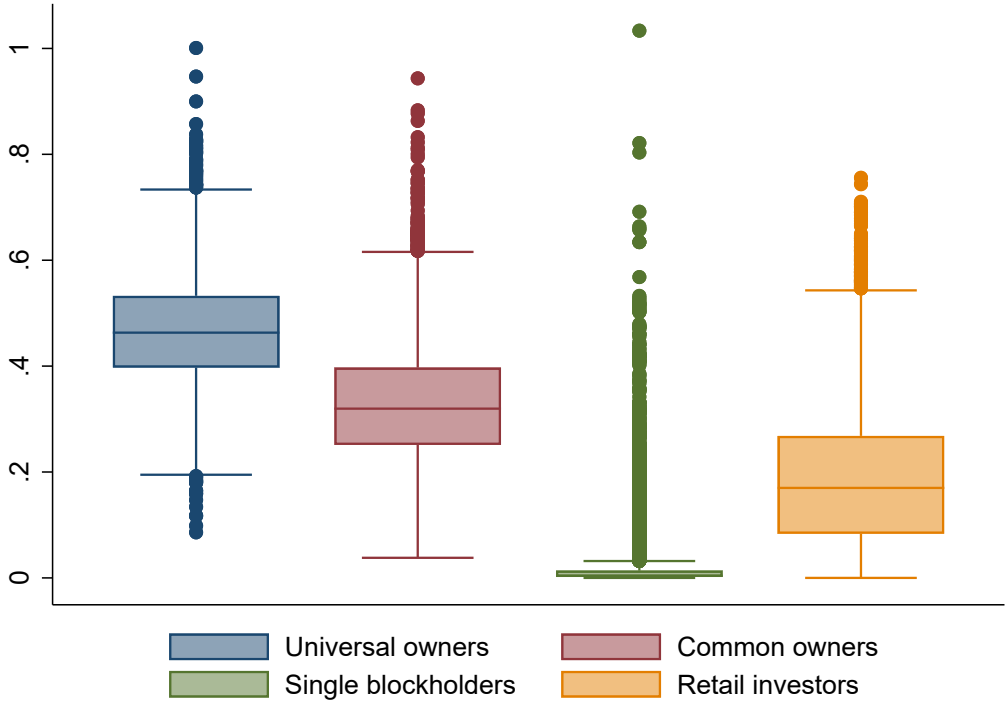
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Corp,State Street Research & Management Co Ma,Stifel Nicolaus & Co Inc Mo,Stralem & Co Inc,Strategic Fixed Income Llc,Synovus Financial Corp,Systematic Financial Management Lp,Schwab Charles R. ,Taconic Capital Advisors Lp,Taube Hodson Stonex Partners Llp,Tctc Holdings Llc,Tcw Group Inc,Temasek Holdings (Private) Ltd,Texas Yale Capital Corp,Third Avenue Management Llc,Thornburg Investment Management Inc,Timessquare Capital Management Llc,Tisch James S,Tokio Marine Asset Management Usa Ltd,Tradewinds Global Investors Llc,Transamerica Investment Management Llc,Turner Investment Partners Inc,United Management Co Llcva,United States Trust Company Na,Va Partners Llc,Va Partners I, Llc,Van Eck Associates Corp,Vanguard Chester Funds,Vanguard Fiduciary Trust Co,Vanguard Specialized Funds,Vanguard Windsor Funds,Veritas Asset Management (Uk) Ltd,Vulcan Value Partners Llc,Waddell & Reed Financial Inc,Warburg Pincus Llc,Wcm Investment Managementca,Wellington Management Group Llp,Wesley Capital Management Llc,Westchester Capital Management Llc,Westfield Capital Management Co Lp,Westwood Management Corp Tx,William Blair Investment Management Llc,Winslow Capital Management Inc Mn,Wood George F,Wynn Elaine P,Yacktman Asset Management Coil,Carlson Capital L P,Fisher Asset Management Llc,Sachem Head Capital Management Lp

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B.3 Additional figures and tables

Figure B1: Ownership shares by types of investor



Notes: This figure shows the average share of equity of S&P 500 firms held by universal owners, common owners and single blockholders based on data by Amel-Zadeh et al. (2022).

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Table B2: Characteristics by Investor Type

	Single firm investor	Common owner	Universal owner
Share of S&P 500 firms owned			
Max	0.00	0.15	0.99
Avg	0.00	0.11	0.94
Share of equity owned per firm, in %			
Max	0.26	0.78	3.90
Avg	0.19	0.11	0.23
Type of investor			
Bank & insurance	0.00	0.03	0.26
Pension	0.00	0.00	0.10
Type of SEC form filed			
13-F	0.02	0.77	0.99
Form-3/4/5 (Insider)	0.97	0.22	0.00
13-D	0.00	0.00	0.01
13-G	0.01	0.01	0.10
N	19412	9491	265

Summary statistics for the different types of investors. The numbers are averages across investors for each group. The share of S&P 500 firms owned is number of investments divided by the total number of firms. We manually classify investors into bank and insurances and identify pension funds when their name includes the word "pension" or "retirement". The data are from Amel-Zadeh et al. (2022)

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Table B3: Cross-Ownership and Corporate Governance: Time-Varying E-index

	(1)	(2)	(3)	(4)
Common owner $\cos(\beta_{ft}, \beta_{gt})$	−1.12	45.04***	16.13*	23.38**
	(2.98)	(10.90)	(9.22)	(11.83)
Universal owner $\cos(\beta_{ft}, \beta_{gt})$	3.48*	0.71	−0.02	0.28
	(2.01)	(7.25)	(7.70)	(9.50)
E-Index$_{fgt}$		0.56	−0.56	−0.22
		(1.45)	(1.50)	(1.73)
Common owner $\cos(\beta_{ft}, \beta_{gt})$ · E-Index$_{fgt}$		−10.28***	−4.71**	−6.67**
		(2.90)	(2.34)	(2.95)
Universal owner $\cos(\beta_{ft}, \beta_{gt})$ · E-Index$_{fgt}$		0.63	0.86	0.79
		(1.88)	(1.86)	(2.32)
R^2	0.92	0.84	0.91	0.92
Observations	14043	14043	14043	14043
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair, Year	Industry, Year	Firm, Year	Firm-Pair, Year

The same regression as in Table 3, but with a time-varying measure of the average managerial entrenchment index.

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Table B4: Cross-Ownership and Corporate Governance: Profit Weights

	(1)	(2)	(3)	(4)
Universal owner κ_{fgt}	1.95	2.91	4.78	5.26
	(2.90)	(3.56)	(3.64)	(4.21)
Common owner κ_{fgt}	1.74	8.20**	8.45**	9.93**
	(2.12)	(3.37)	(3.32)	(4.00)
E-Index 1995_{fg}		1.03	0.00	0.00
		(0.81)	(0.00)	(0.00)
Universal owner κ_{fgt} · E-Index 1995_{fg}		−1.46	−1.37	−1.79
		(1.23)	(1.31)	(1.65)
Common owner κ_{fgt} · E-Index 1995_{fg}		−0.95	−3.70***	−4.42**
		(1.38)	(1.42)	(1.72)
R^2	0.91	0.86	0.90	0.91
Observations	11520	11523	11523	11520
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair, Year	Industry, Year	Firm, Year	Firm-Pair, Year

The same regression as in Table 3, but with profit weights κ as an alternative measure of overlapping ownership.

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Table B5: Cross-Ownership and Corporate Governance: Full Sample

	Full Sample	Only Close
Common owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}	−1.72**	−4.59***
	(0.79)	(1.66)
Universal owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}	0.15	−1.59
	(0.68)	(1.27)
Competitors=1	−2.38**	
	(1.03)	
Competitors=1 $\cdot$ Common owner $\cos(\beta_{ft}, \beta_{gt})$	2.82	
	(2.15)	
Competitors=1 $\cdot$ Universal owner $\cos(\beta_{ft}, \beta_{gt})$	4.42***	
	(1.64)	
Competitors=1 $\cdot$ E-Index 1995_{fg}	0.22	
	(0.57)	
Competitors=1 $\cdot$ Common owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}	−2.55*	
	(1.34)	
Competitors=1 $\cdot$ Universal owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}	−0.11	
	(0.86)	
R^2	0.90	0.90
Observations	555915	11495
Controls	✓	✓
Fixed Effects	Firm-Pair, Year	Firm-Pair, Year

The same regression as in Table 3, but including the full sample of firm-pairs and not only close competitors in the product market space.

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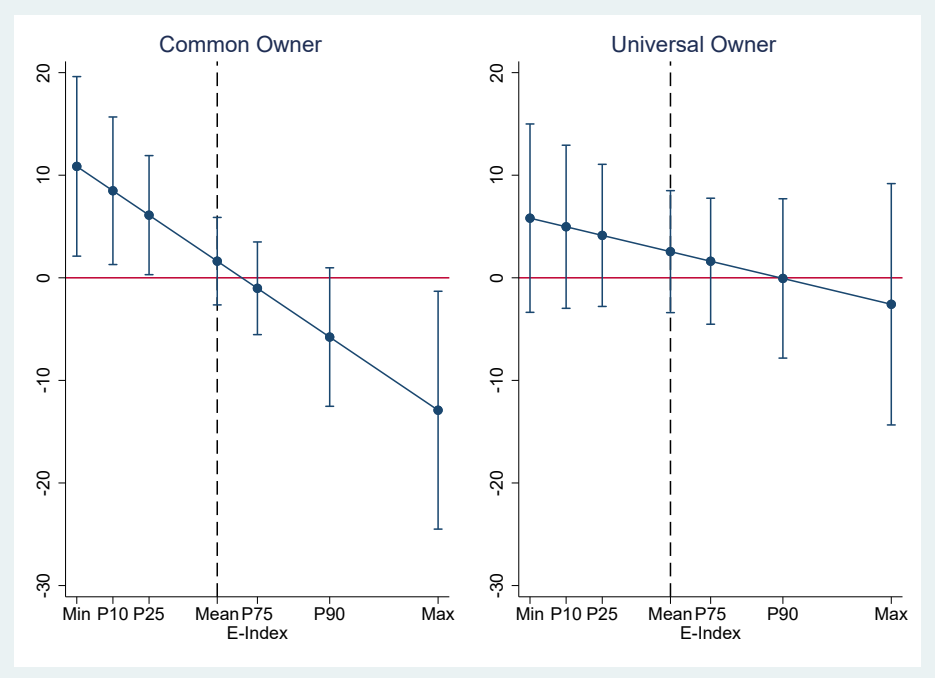
Table B6: Cross- Ownership and Corporate Governance: Excluding Firms with High Retail Share

	(1)	(2)	(3)	(4)
Common owner $\cos(\beta_{ft}, \beta_{gt})$	1.10	6.43	9.19**	9.69**
	(2.27)	(4.56)	(4.15)	(4.66)
Universal owner $\cos(\beta_{ft}, \beta_{gt})$	2.99	4.51	10.44**	7.40
	(2.91)	(4.00)	(4.75)	(5.49)
E-Index 1995_{fg}		2.23**	0.00	0.00
		(0.87)	(0.00)	(0.00)
Common owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}		−2.11	−4.54**	−4.44**
		(2.01)	(1.95)	(2.01)
Universal owner $\cos(\beta_{ft}, \beta_{gt}) \cdot$ E-Index 1995_{fg}		−2.49*	−3.07**	−2.26
		(1.37)	(1.55)	(2.06)
R^2	0.92	0.83	0.88	0.92
Observations	8044	8044	8044	8044
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair Year	Industry Year	Firm Year	Firm-Pair Year

The same regression as in Table 3, but excluding firm-pairs where at least one firm has a retail share of ownership above 40%.

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Figure B2: Marginal Effect of Common and Universal Ownership on Price-Cost-Margin for different Corporate Governance



Notes: This figure shows the marginal effects of the cosine similarity measure, $cos(\beta_f, \beta_g)$, on price-cost margin for firm-pairs with different average corporate governance quality.

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Table B7: Cross-Ownership and Corporate Governance: Firm-level

	(1)	(2)
Common owner	3.63	8.84**
	(2.52)	(3.50)
Universal owner	4.82***	−0.89
	(1.44)	(2.56)
E-index		−1.06**
		(0.50)
Common owner · E-index		−2.38*
		(1.32)
Universal owner · E-index		2.38**
		(1.05)
R^2	0.91	0.91
Observations	5631	5631
Controls	✓	✓
Fixed Effects	Firm, Year	Firm, Year

Firm-level regressions with next year's price-cost-margin as dependent variable. The sample includes S&P 500 firms from 2003 until 2019. Common ownership is measured as the average cosine similarity of a firm and its close competitors in the product market space (Hoberg and Phillips, 2016) among S&P 500 firms. The E-Index is the average managerial entrenchment index of firm's close competitors. Time-varying control variables are: firm age, log total assets, book leverage, market to book value, return on assets, and cash to assets. Robust standard errors are clustered at the firm level.

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Table B8: Cross-Ownership and Tendency to Collusion: Profit Weights

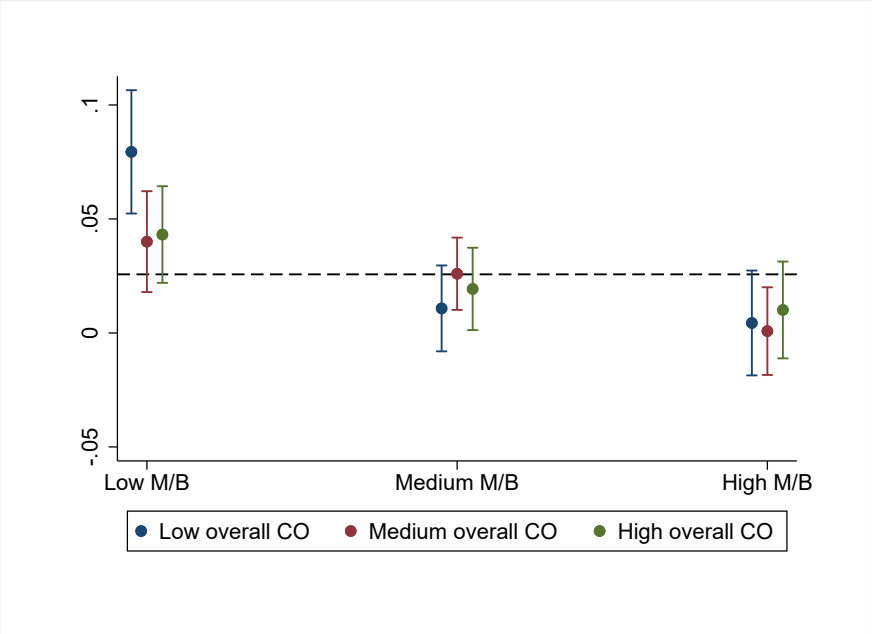
	Grout(2005)	High inv	High HHI	High ad
Universal owner κ_{fgt}	2.53	4.71	1.77	−2.03
	(2.26)	(3.07)	(2.17)	(2.97)
Common owner κ_{fgt}	−0.44	1.31	−1.26	−3.95
	(2.19)	(2.50)	(2.02)	(2.47)
X=1 · Universal owner κ_{fgt}	−10.86***	−7.14	−8.58***	7.21*
	(3.22)	(4.47)	(2.66)	(3.99)
X=1 · Common owner κ_{fgt}	−6.19	−5.52	3.16	5.65
	(5.13)	(3.44)	(4.68)	(3.54)
R^2	0.90	0.90	0.90	0.90
Observations	21522	21492	21492	21492
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair	Firm-Pair	Firm-Pair	Firm-Pair
	Year	Year	Year	Year

The same regression as in Table 4, but with profit weights κ as an alternative measure of overlapping ownership.

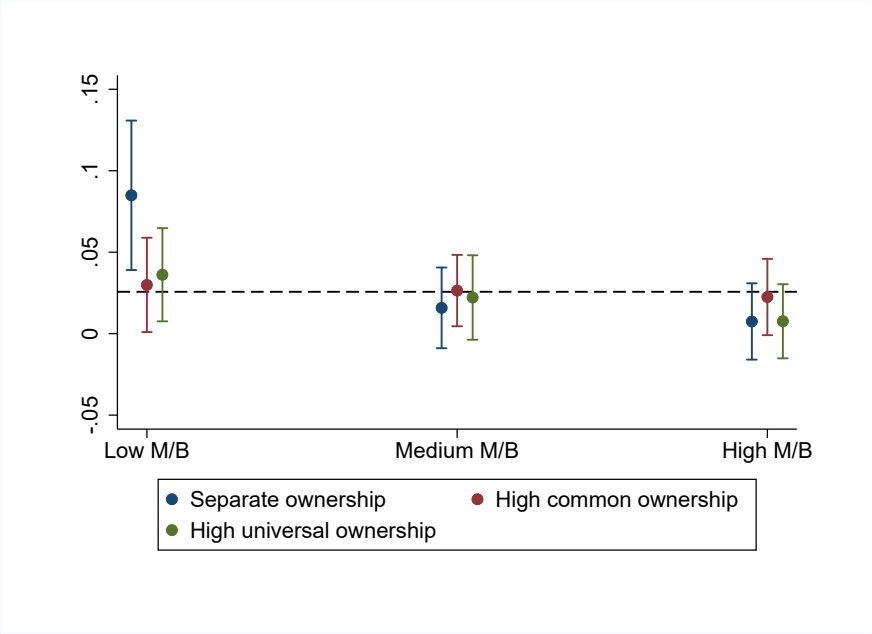
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Figure B3: Predicted probability of forced CEO turnover

(a) Overlapping ownership vs. separate ownership



(b) Universal vs. common owner



Notes: Predicted probability of a forced CEO Turnover depending on the firm's performance measured as market to book ratio (x-axis) and different levels of overlapping ownership as measured by the average profit weight a firm puts on other S&P 500 firms. Robust standard errors clustered by firm and CEO.

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Table B9: Cross-Ownership and Tendency to Collusion: Full Sample

	Grout(2005)	High inv	High HHI	High ad
X=1 · CO $\cos(\beta_{ft}, \beta_{gt})$	0.85	−0.09	−0.53	2.02**
	(1.28)	(0.96)	(1.12)	(0.99)
X=1 · UO $\cos(\beta_{ft}, \beta_{gt})$	−2.52*	−0.76	−6.70***	0.98
	(1.40)	(1.02)	(1.31)	(0.94)
Competitors=1	−1.61***	−1.04	−1.46***	−1.68**
	(0.51)	(0.68)	(0.49)	(0.71)
Competitors=1 · CO $\cos(\beta_{ft}, \beta_{gt})$	−2.67*	−0.14	−2.16	−3.74**
	(1.43)	(1.83)	(1.31)	(1.72)
Competitors=1 · UO $\cos(\beta_{ft}, \beta_{gt})$	3.83***	3.30*	3.47***	3.60***
	(1.04)	(1.72)	(1.00)	(1.24)
X=1 · Competitors=1	3.01***	−1.20	2.04***	0.62
	(0.84)	(1.06)	(0.70)	(0.93)
X=1 · Competitors=1 · CO $\cos(\beta_{ft}, \beta_{gt})$	2.39	−2.41	0.09	4.00*
	(2.19)	(2.51)	(2.62)	(2.16)
X=1 · Competitors=1 · UO $\cos(\beta_{ft}, \beta_{gt})$	−5.99***	0.70	−2.90**	−0.42
	(1.51)	(2.20)	(1.41)	(2.12)
R^2	0.90	0.90	0.90	0.90
Observations	1074502	1068826	1068826	1068826
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair Year	Firm-Pair Year	Firm-Pair Year	Firm-Pair Year

The same regression as in Table 4, but including the full sample of firm-pairs and not only close competitors in the product market space.

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Table B10: Cross-Ownership and Tendency to Collusion: Excluding Firms with High Retail Share

	Grout(2005)	High inv	High HHI	High ad
Common owner $\cos(\beta_{ft}, \beta_{gt})$	−1.21	1.92	−2.46	−5.91**
	(2.34)	(2.44)	(2.27)	(2.74)
Universal owner $\cos(\beta_{ft}, \beta_{gt})$	4.47**	5.79*	3.61*	−0.20
	(2.08)	(2.99)	(1.95)	(2.59)
X=1 · Common owner $\cos(\beta_{ft}, \beta_{gt})$	−8.41	−8.32**	0.77	7.35*
	(5.18)	(3.71)	(3.14)	(4.09)
X=1 · Universal owner $\cos(\beta_{ft}, \beta_{gt})$	−11.33***	−5.99	−10.43***	7.42*
	(3.24)	(4.55)	(2.58)	(4.05)
R^2	0.91	0.91	0.91	0.91
Observations	17095	17067	17067	17067
Controls	✓	✓	✓	✓
Fixed Effects	Firm-Pair	Firm-Pair	Firm-Pair	Firm-Pair

The same regression as in Table 4, but excluding firm-pairs where at least one firm has a retail share of ownership above 40%.

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Table B11: Cross-Ownership and Tendency to Collusion: Firm-Level

	Baseline	Grout(2005)	High inv	High HHI	High ad
Common owner	3.23	3.44	9.64***	3.62	−2.95
	(2.42)	(3.22)	(3.24)	(2.79)	(5.03)
Universal owner	5.12***	8.28***	5.85**	6.72***	7.75***
	(1.46)	(1.73)	(2.36)	(1.69)	(2.60)
X		6.57***	1.04	4.63***	−0.19
		(1.57)	(1.78)	(1.47)	(1.85)
Common owner · X		−2.19	−10.31**	−0.66	10.78*
		(4.29)	(4.59)	(4.87)	(5.67)
Universal owner · X		−13.76***	−1.55	−9.15***	−4.59
		(2.86)	(3.36)	(3.05)	(3.15)
R^2	0.91	0.91	0.91	0.91	0.91
Observations	5689	5689	5686	5686	5686
Controls	✓	✓	✓	✓	✓
Fixed Effects	Firm	Firm	Firm	Firm	Firm
	Year	Year	Year	Year	Year

Firm-level regressions with next year's price-cost-margin as dependent variable. The sample includes S&P 500 firms from 2003 until 2019. Common ownership is measured as the average cosine similarity of a firm and its close competitors in the product market space (Hoberg and Phillips, 2016) among S&P 500 firms. X are average indicator variables of a firm's close competitors for industries with a high propensity to collusion, above median capital intensity, above median concentration, and above median advertising intensity. Time-varying control variables are: firm age, log total assets, book leverage, market to book value, return on assets, and cash to assets. Robust standard errors are clustered at the firm level.

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B.4 Construction of collusion-prone index

Grout and Sonderegger (2005) fit a predictive model using cartels detected by the European Commission between 1990 and 2005 and by the US Department of Justice between 1994 and 2005 with industry-specific variables from the United Kingdom as predictors. These explanatory variables include industry turnover, demand volatility, entry barriers, and concentration indices, among others. Based on the obtained coefficients, Grout and Sonderegger (2005) compute the cartel likelihood for all industries in their sample, i.e., industries with and without detected cartel cases. Their top 30 list includes 16 industries where no cartel has been detected at the time of the study. Because their SIC classification differs from ours, we provide a cross-walk in Table B12.

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Table B12: Translation of Industries from Grout and Sonderegger (2005) Table

Grout and Sonderegger (2005) Description	Cartel probability	SIC3	Description
Building of complete constructions or parts thereof; civil engineering	0.89	150	GENERAL BUILDING CONTRACTORS
Telecommunications	0.84	480	COMMUNICATIONS
Activities of other transport agencies	0.80	478	Miscellaneous Transportation Services
Manufacture of cement, lime and plaster	0.77	324 327	Cement, Hydraulic Concrete, Gypsum, and Plaster Products
Scheduled air transport	0.73	451	Air Transportation, Scheduled
Manufacture of basic chemicals	0.72	281	Industrial Inorganic Chemicals
Manufacture of pharmaceuticals, medicinal chemicals and botanical products	0.71	283	Drugs
Manufacture of motor vehicles	0.68	371	Motor Vehicles and Equipment
Software consultancy and supply	0.68	737	Computer and Data Processing Services
Manufacture of aircraft and spacecraft	0.65	376 372	Guided Missiles, Space Vehicles, Parts Aircraft and Parts
Manufacture of grain mill products, starches and starch products	0.61	204	Grain Mill Products
Legal, accounting, bookkeeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy	0.55	872	Accounting, Auditing and Bookkeeping
Manufacture of other food products	0.52	209	Miscellaneous Food and Kindred Products
Cargo handling and storage	0.50	422	Public Warehousing and Storage
Activities of travel agencies and tour operators; tourist assistance activities	0.46	472	Arrangement of Passenger Transportation
Publishing	0.44	270	PRINTING AND PUBLISHING
Manufacture of railway and tramway locomotives and rolling stock	0.44	374	Railroad Equipment
Other land transport	0.43		
Manufacture of tubes	0.41	301	Tires and Inner Tubes
Recycling of metal waste and scrap	0.40		
Manufacture of articles of paper and paperboard	0.40	260	PAPER AND ALLIED PRODUCTS
Manufacture of basic iron and steel and of ferroalloys	0.39	330	PRIMARY METAL INDUSTRIES
Manufacture of weapons and ammunition	0.39	348	Ordnance and Accessories, NEC
Manufacture of beverages	0.39	208	Beverages
Processing and preserving of fruit and vegetables	0.38	203	Preserved Fruits and Vegetables
Manufacture of motorcycles and bicycles	0.38	375	Motorcycles, Bicycles and Parts
Quarrying of sand and clay	0.37	145 144	Clay, Ceramic and Refractory Minerals Sand and Gravel
Building installation	0.36	170	SPECIAL TRADE CONTRACTORS
Sea and coastal water transport	0.35	440	WATER TRANSPORTATION
Non-scheduled air transport	0.34	452	Air Transportation, Nonscheduled

Translation of the Top 30 collusion-prone industries identified by Grout and Sonderegger (2005) to SIC three-digit industries. Blue shaded cells indicate collusion-prone industries where at the time of the study no cartel have been found yet.

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