Common Ownership and Executive Compensation

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Abstract

This study examines the effect of institutional common ownership on the use of peer benchmarking for CEO pay. I find that CEO compensation tends to be positively related to the performance of industry peers that share common blockholders. The results remain robust after addressing the endogeneity of institutional common ownership using the merger between BlackRock Inc. and Barclays Global Investors as a quasi-natural experiment. I also find that firms sharing common blockholders tend to have more differentiated products, a higher combined market share, and greater geographical overlap subsequently. Overall, the results suggest that institutional common blockholders use CEO compensation contracts to mitigate competition and increase joint performance among rival portfolio firms.

Keywords: Common ownership, Blockholders, CEO compensation, Relative performance evaluation, Benchmarking

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1. Introduction

Institutional common ownership, where an investor owns large shares in multiple firms in the same industry, has become a prevalent phenomenon in the United States. As Figure 1 shows, the proportion of U.S. public firms that share common blockholders with industry peers increased from 35% in 1992 to 82% in 2013. Given the fast growth in assets under management (Gompers and Metrick, 2001), institutional investors inevitably become blockholders of many firms in the same industry. A natural question that arises is whether and how institutional common ownership impacts the firms' competitive landscape. The existing industrial organization theory suggests that common ownership of same-industry firms can reduce competition (Gordon, 1990; O'Brien and Salop, 2000; Gilo, Moshe, and Spiegel, 2006). Consistent with this idea, recent research shows that common block ownership is associated with increased product pricing (Azar, Schmalz, and Tecu, 2015) and higher market share (He and Huang, 2014).

In this paper, I investigate the mechanism through which common blockholders influence competition among rival portfolio firms. As Aggarwal and Samwick (1999) point out, a positive pay sensitivity to rival firms' performance can incentivize managers to soften product market competition. By compensating managers based on their co-owned peers' performance as well as their own performance, blockholders can incentivize managers to avoid head-to-head competition with their co-owned peers and maximize group performance. Therefore, I hypothesize that CEOs' compensation is positively sensitive to the performance of industry peers that share common blockholders.

I test this hypothesis using a sample of U.S. public firms with available data on executive compensation from 1992 to 2013, and I define firms as co-owned peers if they share common blockholders in the current and past four quarters. I find that a CEO's total compensation is positively sensitive to the stock performance of industry peers that share common blockholders. The positive weight on co-owned peers' stock returns amounts to 13%-26% of the

positive weight on the firms' own stock returns, suggesting that the award based on the co-owned peers' performance is economically significant. The positive pay-for-peer-performance sensitivity also holds for co-owned peers' operating performance in terms of return on assets (ROA). In addition, I examine the effect of compensation benchmarking on CEO pay and find that CEOs' compensations are also positively sensitive to co-owned peers' compensation. Importantly, the pay sensitivity to co-owned peer performance remains significantly positive after accounting for compensation benchmarking. Further analysis on the components of CEO compensation reveals that only long term incentives, such as stocks and options, have positive sensitivity to the performance of co-owned peers.

The above results are consistent with the prediction that blockholders incentivize managers to mitigate direct competition with their co-owned peers. However, as institutional common ownership is endogenously formed, these results are subject to other non-causal interpretations. For example, investors could choose to cross-hold firms in the same industries that are known to not compete against one another. Moreover, there could be unobservable characteristics among these firms that cause both a positive pay-performance sensitivity and institutional common ownership.

To address these endogeneity concerns, I exploit the largest asset management firms merger between BlackRock Inc. and Barclays Global Investors, which resulted in exogenous common ownership between firms that were previously owned separately by BlackRock and Barclays. Using a difference-in-differences (DiD) approach, I show that the BlackRock-Barclays merger led to positive pay-performance sensitivity among industry rivals that are co-owned by the newly merged asset management company. The effect is also economically significant: the increase in the positive weight to co-owned peer stock returns after the merger amounts to 48%-172% of the positive weight on the firms' own stock returns.

Next, I examine the effect of institutional common ownership on future product market characteristics. I argue that the strategic incentive contracts offered by common blockholders can induce coordination among co-owned peers in the product market to reduce direct

competition and enhance group performance. Consistent with my prediction, I find that, after having the cross-holding relationship, firm pairs that share common blockholders tend to have more differentiated products, as reflected by the product descriptions in the annual reports. I also show that co-owned firm pairs tend to have a higher joint market share, and subsequently, a greater geographical overlap in business operations. The results are consistent with the idea that managers under the incentives to cooperate can avoid direct competition through product differentiation, and thus they can coexist in the same local market and enhance joint performance.

Next, I conduct subsample analysis to investigate cases in which common blockholders are more likely to adopt the positive pay sensitivity to co-owned peer performance for managers. I find that the positive peer pay-performance sensitivity is more likely to occur in more competitive industries and among firm pairs with lower joint market share and more similar products. This is consistent with the prediction in Aggarwal and Samwick (1999) that the use of positive peer pay-performance sensitivity is more likely when the need to soften competition is greater.

I have conducted additional tests to ensure the robustness of my findings. In the main analysis, I define industry peers based on the three-digit level of Standard Industry Classification (SIC). I show that the results on the positive pay-performance sensitivity to co-own peer performance still hold when I define industry peers using the four-digit SIC classification and the Text-Based Network Industry Classifications (TNIC) by Hoberg and Phillips (2010 and 2015). Thus, the results are robust to alternative industry classifications.

This paper contributes to two strands of the literature. First, it contributes to the growing literature on cross-holding and common ownership in the same industry. The existing industrial organization theory has shown that cross-holding of same-industry firms can reduce the incentives of firms to compete with one another (Gordon, 1990; Hansen and Lott, 1996; O'Brien and Salop, 2000; Gilo, Moshe, and Spiegel, 2006). Empirical studies suggest that cross-holding among industrial firms can reduce competition and offer strategic benefits

in product market relationships. For example, Allen and Phillips (2000) show that corporate acquisitions of block(s) in the firms that the acquirer has industrial ties with bring large and significant value gain due to the strategic benefits from product market relationships. Fee, Hadlock, and Thomas (2006) find that customer firms equity holding in supplier firms help to alleviate the friction along the supply chain relationships. Nain and Wang (2013) show that acquisitions of a minority stake in competing firms lead to higher output prices and profit margins. Some recent studies focus on cross-ownership by institutional investors.[1] For example, He and Huang (2014) show that firms with common blockholders enjoy larger market share growth. Azar, Schmalz, and Tecu (2015) and Azar, Raina, and Schmalz (2016) conduct focused studies on the airline industry and banking industry, respectively, and show that common ownership induces collusive pricing and reduces competition. This paper adds to the literature by documenting a new effect of institutional common ownership on executive compensation and shedding light to the mechanism through which common ownership reduces competition.

Second, this study adds to the large empirical and theoretical literature on the executive compensation setting. Principal-agent theory suggests that the market-wide component of firm performance should be removed from the compensation package because executives have no control over market factors, and it is costly for them to bear market-wide risks (Holmstrom, 1982; Holmstrom and Milgrom, 1987). Relative performance evaluation (RPE), in which agents are compensated based on their performance relative to that of industry rivals, insulates agents from common risk and also provides a more informative measure of the agents' performance. However, prior studies show mixed evidence on the use of RPE in CEO compensation (Antle and Smith, 1986; Gibbons and Murphy, 1990; Janakiraman et al., 1992; Aggarwal and Samwick, 1999; Bertrand and Mullainathan, 2001; Garvey and Milbourn, 2006; Jenter and Kanaan, 2015).[2] Some studies argue that outside employment

[1] Matvos and Ostrovsky (2008) investigate the influence of institutional cross-holders in merger and acquisition. However, Harford, Jenter, and Li (2011) find that the impact of cross-holdings by active investors may be too small to matter.

[2] See Albuquerque (2009) for a nice summary of empirical findings on implicit tests of RPE.

opportunities are a reason for not using RPE (Oyer, 2004; Rajgopal, Shevlin, and Zamora, 2006).[3] Others find strong evidence of RPE if appropriate peer groups are used (Albuquerque, 2009; Lewellen, 2015; Jayaraman, Milbourn, and Seo, 2015).[4] My study largely follows the argument by Joh (1999) and Aggarwal and Samwick (1999) that the use of RPE is limited by product market interaction and shows that the emergence of common ownership reinforces the role of product market considerations in a compensation setting.

The remainder of this paper is organized as follows: Section 2 discusses hypotheses development. Section 3 describes the data and variable construction and reports summary statistics. Section 4 describes the empirical strategy and presents the results. Section 5 concludes.

2. Hypotheses development

Shareholders can link executive compensation to the peer firms' performance either positively or negatively. A negative pay sensitivity to peer performance is consistent with the practice of relative performance evaluation (RPE). RPE provides a cost-effective way to incentivize risk-averse managers by filtering out the common shock to the industry. For this purpose, CEOs' compensation may be negatively linked to commonly owned peer-firm performance because common ownership may increase the stock price correlation between firms (Antón and Polk, 2014), and that RPE is more useful when firm performance is more correlated with that of the peers' (Holmstrom and Milgrom, 1987).

However, RPE can also incentivize managers to behave aggressively in the product market to lower industry returns, which may not be in the interest of shareholders. As Aggarwal and Samwick (1999) argue, a positive pay sensitivity to peer performance can incentivize

[3]Oyer (2004) develops a model where pay can appear to respond to luck when the outside opportunities of the manager are correlated with industry performance. Rajgopal, Shevlin, and Zamora (2006) directly test Oyer's (2004) theory and find that the CEO's outside employment opportunities increase with his managerial talent, as proxied by the CEO's prior media mentions and his firm's industry-adjusted ROA.

[4]Albuquerque (2009) uses industry-size portfolio; Lewellen (2015) uses firm-specific industry portfolio; and Jayaraman, Milbourn, and Seo (2015) use Hoberg-Phillips Text-Based Network Industry Classification (TNIC).

managers to soften product market competition. Consistent with their argument, they find that the pay sensitivity to peer performance is positive in competitive industries. I argue that the prevalence of common ownership structure in the market reinforces this anti-competitive mechanism. The objective of institutional investors is to maximize portfolio performance. Thus, an increase in the value of one firm at the cost of another portfolio firm is not a desirable outcome for these investors. Furthermore, common blockholders can provide anti-competitive incentive contracts simultaneously among the portfolio firms to ensure effective coordination between industry peers. Hence, I predict that the use of incentive contracts for softening competition is stronger with the presence of common ownership among industry rivals. I formally hypothesize the following:

Hypothesis 1: CEO compensation is positively sensitive to the performance of peers with common blockholders.

Following *Hypothesis 1*, if blockholders can provide anti-competitive incentives to firm managers with positive pay sensitivity to peer performance, then firms with common block ownership can internalize externalities and enhance group performance (Hansen and Lott, 1996). For example, firms with common block ownership can differentiate their products to avoid direct competition with each other. As a result, these firms should enjoy higher growth in joint market share. Moreover, by preventing head-to-head competition in the product market, firms with common block ownership are also more likely to coexist in the same geographical area. Hence, my second hypothesis is the following:

Hypothesis 2: Firm pairs with common blockholders have more differentiated products, greater joint market share, and greater geographic overlap in business operations.

Similar to the argument by Aggarwal and Samwick (1999), common blockholders should have stronger incentives to curtail competition when the competition is already intense. Further, to set a positive pay sensitivity to the performance of co-owned peers, one has to exclude these peers from the list of rivals for RPE (Albuquerque, 2009; Lewellen, 2015;

Jayaraman, Milbourn, and Seo, 2015). In a concentrated industry where only a handful of major players are present, it might be hard to neglect any competitor in the RPE.[5] Also, considering that firms in concentrated industries are under great scrutiny by the Federal Trade Commission (FTC) and Department of Justice (DoJ), any attempt to collude or coordinate among market players could trigger antitrust-related investigations. Hence, the positive pay sensitivity to commonly owned peer performance is also more feasible in competitive industries, where neither of the co-owned firms is a major player in the market. When firms' products are similar, they are more likely to have direct competition. Thus, I expect that the anti-competitive incentives are also more likely to be given to firms with similar products. My third hypothesis is the following:

Hypothesis 3: CEO compensation is more likely to have positive sensitivity to the performance of a co-owned peer when the firm is in a more competitive industry, has lower joint market share with the co-owned peer, and has products that are more similar to those of the co-owned peer.

3. Sample Selection and Summary Statistics

3.1 Sample selection

The sample contains U.S. public firms during the sample period 1992-2013. I obtain compensation data from Standard & Poor's ExecuComp database. Institutional holdings data are obtained from Thomson Reuters Institutional Holdings Database (13-F filings). Stock return data are obtained from the Center for Research in Security Prices (CRSP). Industry classification and other financial statement items are from Compustat. I drop observations with non-positive or missing values for total compensation, total assets, market values, and common equity. I also exclude observations with no industry classification or

[5]Under the SEC's 2006 executive compensation disclosure rules, firms are required to provide details on how relative performance targets are used in setting executive pay.

stock return data. As the pay-performance sensitivity analysis is performed at pairwise level, I create a firm-pair panel. I match each firm with its $n_j - 1$ peers in the same three-digit SIC industry (industry j with n_j firms) to construct firm pairs. The reason for using three-digit SIC industry instead of a more refined four-digit SIC industry is that some four-digit SIC industries have only two firms, making the benchmarking difficult. However, using four-digit SIC industry gives me qualitatively similar results. As a result, for each firm-year, I create $n_j - 1$ pairwise observations. For each year and for each industry j, there will be $n_j \times (n_j - 1)$ pairs of observations. Therefore, every pair of the same-industry firms will appear twice. For instance, consider firm A and firm B which are in the same industry. These two firms will appear once as "Firm A, Firm B, Year X" and again as "Firm B, Firm A, Year X". In this example, firm A serves once as a focal firm and again as a peer firm for firm B. This sample selection process results in 761,273 firm-pair-years used in baseline regressions or on average 34,603 firm pairs per year. Table 1 summarizes the basic compensation and firm-specific variables for the full sample.

3.2 Variable measurement

3.2.1 Measuring common ownership

For each quarter in the sample period, I obtain institutional holding information from Thomson Reuters (13-F). Thomson Reuters data include ownership information by institutional investment managers with $100 million or more in Assets Under Management. An institutional block-holding is defined as a holding by an institutional shareholder that is not less than 5% of the total shares outstanding. To identify the co-owned peers, I examine each institutional block-holding in each quarter and account for common ownership when a block-holder of a focal firm also has another block-holding in a peer firm (in the same three-digit SIC industry). I then match these quarterly data with Compustat data and aggregate over the four quarters prior to the fiscal year end date to obtain annual common ownership data.

To measure common ownership status at each firm-pair in any given fiscal year, I use a co-owned dummy variable as the main measure for common ownership. The co-owned dummy takes the value of one if the firm-pair is co-owned in any of the four quarters prior to the fiscal year end, and zero otherwise. The advantage of using a firm-pair panel in this study is that I can refine the common ownership measure to the specific firm-pair. This research design enables the study to identify different strategic incentive schemes for co-owned pairs and non-co-owned pairs.

3.2.2 Measuring CEO compensation

Each firm's executive is identified by ExecuComp as CEO given by the variable annual CEO flag (CEOANN) in ExecuComp. The annual CEO flag variable indicates that the executive served as CEO for all or most of the indicated fiscal year. Following the majority of the literature, I impose the requirement that the ExecuComp sample is limited to the value CEO for this variable, because other executives may have an incentive to strategically influence each other in order to improve their own benefits (Holmstrom, 1982). I also delete observations for which there is more than one CEO per firm-year. Following Bertrand and Mullainathan (2001) and Albuquerque (2009, 2013), in the analysis I use the natural logarithm of total annual flow compensation (TDC1 in ExecuComp), which is the sum of salary, bonus, other annual compensation, total value of restricted stocks granted, total value of stock options granted, long-term incentive payouts, and all other compensation. I focus on the flows because they are representative of the actions taken by the board regarding executive compensation. Compensation committees usually make compensation decisions once a year, usually shortly after the end of the firm's fiscal year. This timing of compensation decisions is made so that stock returns and other accounting performance metrics can be observed.

3.2.3 Other variables

The stock return performance measure I use is annual compounded stock returns (including dividends). I measure annual stock returns for both the focal firm and its peer firm from the beginning of the fiscal year. I also measure accounting based operating performance, return on asset (ROA), using earnings before interest, tax, depreciation, and amortization (EBITDA) divided by lagged total assets.

I include a set of control variables that could potentially affect CEO compensation. Following the literature, I control for firm size (natural logarithm of total assets), book leverage, cash-to-asset ratio, ownership of institutional investors, and measure of financial constraints (Whited-Wu Index) for both focal firms and peer firms. I also control for Herfindahl-Hirschman Index (HHI) and pairwise correlation with industry peer. In addition to these controls, I include CEO characteristics, such as CEO age and CEO tenure.

3.3 Summary statistics

Table 1 presents the summary statistics for key variables used in this paper. Panel A provides summary statistics at the firm-year level. The mean (median) of total annual compensation is $4.53 million ($2.60 million). Since the total compensation is positively skewed, I take the natural logarithm of total compensation throughout analysis in the study. In my sample, 77% of the firm-year observations are co-owned by at least one institutional investor. In other words, these firms share at least one common blockholder with any number of same-industry peers. The institutional common ownership measure in the firm-year panel is for demonstration purpose. The actual variable of interest for institutional common ownership is measured between two firms. Figure 1 shows how prevalent institutional common ownership has become over the past decades. The percentage of co-owned firms rises from 35% in 1992 to 82% in 2013. I measure annual firm performance using both stock return and accounting-based operating performance. The average firm stock return is 7% and the

average ROA (defined as EBITDA/Asset) is 15%.

The rest of panel A summarizes the control variables at the firm-year panel. On average, a firm in the sample has a book value of asset of $8.5 billion, a cash-to-asset ratio of 17%, and a leverage of 35%. The average total institutional ownership is 68% of the outstanding shares. As for CEO characteristics, on average, CEO tenure is 8 years and CEO age is 56 years.

Panel B in Table 1 summarizes the common ownership and correlation at the firm-pair-year level. In my sample, 34% of the firm-pair-years are co-owned by at least one institution. This average is much smaller than the average in the firm-year panel. This is expected because I increase the total number of observations when I duplicate each focal firm-year observation to the number of peers in each year, leading to a larger denominator of the fraction. Also, the average correlation between peer firms is 0.32.

Figure 1 about here

Table 1 about here

4. Empirical Analysis and Results

Following previous literature on an implicit approach to test for the use of relative performance evaluation (RPE), I examine the compensation patterns among rival firms that share common blockholders. It would not be possible to expect firms to have a compensation contract indicating a positive pay sensitivity to co-owned peer-firms or any other firms' performance, as this would be an outright collusion that could trigger antitrust investigations. On the other hand, negative pay sensitivity to peer-firms' performance can be simply achieved through the practice of RPE. Using explicit compensation contracts, Gong et al. (2010) confirm that CEO compensation is negatively sensitive to contractual RPE peers' performance.

Therefore, in order to achieve positive pay sensitivity to co-owned peer firms' performance, common blockholders can potentially influence the compensation setting process to avoid listing co-owned firms as RPE peers. Therefore, one potential test is to examine whether co-owned peers are less likely to be listed as RPE peers.[6] However, there are several reasons necessitating a regression analysis. First of all, large part of CEO compensation is in the form of discretionary awards. De Angelis and Grinstein (2015) show that the discretionary awards are on average about half of total CEO compensation. Firms can implement the strategic compensation contracts through boards' subjective discretion, rather than pre-committing to a formulaic explicit contract. In addition, researchers do not observe the detailed contractual terms in the compensation contracts before 2006. Prior to 2006, the disclosure on the details of contracts in the U.S. had been voluntary. The approach in this study allows me to examine the compensation patterns even when the contractual terms are not available.

4.1 Performance and compensation benchmarking

To test whether the pay sensitivity to rival firms' performance varies with the presence of common ownership by institutional investors, I estimate the following pooled cross-sectional, time series regression model:

$$\begin{aligned}\text{Total Compensation}_{it} &= c + \eta_1 \text{Ret}_{it} + \eta_2 \text{Peer Ret}_{it} \\ &\quad + \eta_3 \text{Peer Ret}_{it} \times \text{Co-owned}_{it} + \eta_4 \text{Peer Ret}_{it} \times \text{Correlation}_{it} \\ &\quad + \gamma \text{Control Var}_{it-1} + \text{Year}_t + \text{Firm}_i + \epsilon_{it}\end{aligned}$$

where Total Compensation$_{it}$ is the total compensation of the CEO of firm i at time t. The performance of firm i at time t is measured by its annual stock return, Ret$_{it}$. Similar to

[6]Since RPE is mostly rank-based, firms that are trying to avoid competition with co-owned peers can include more "easy to beat" peers so that co-owned peers are listed as highest ranked peers. This then leads to CEOs competing with middle ranked peers.

Albuquerque (2009), the peer firm performance of firm i at time t, Peer Ret$_{it}$, is measured by the annual stock return of the peer firm in the same three-digit SIC industry as firm i. The co-owned status is represented by the dummy variable co-owned$_{it}$. The correlation between focal-firm and peer-firm stock return performance is represented by Correlation$_{it}$. Interaction between Peer Ret$_{it}$ and Correlation$_{it}$ is included as well. The pay-for-peer-performance sensitivity is allowed to vary with the correlation between the focal-firm and the peer-firm performance. To facilitate the interpretation of the results, the Correlation$_{it}$ in the interaction term is adjusted by mean correlation (demeaned correlation). As a result, the coefficient of Peer Ret$_{it}$ is interpreted as sensitivity at the mean correlation level. Other control variables capture variation in CEO pay that is not related to firm or industry performance. Year$_t$ captures year fixed effects and Firm$_i$ captures firm fixed effects. I cluster standard errors at the firm level. The variables have been discussed in Section 3.

I focus on change in firm value (i.e., stock return or total shareholder return (TSR)) as the main firm performance signal. Stock returns are not so easily manipulated as accounting variables such as return on assets (ROA) (Antle and Smith, 1986). Furthermore, CEOs are usually given stock options as part of their compensation whose value directly depends on the firm's future stock returns, creating incentives for CEOs to maximize firm value. With the use of stock options, firms provide CEOs with substantial rewards and penalties based on long-run stock market value. Thus, stock returns are a reasonable performance measure of the firm and its peers.

Table 2 reports the results from estimating CEO compensation on own-firm and peer-firm stock returns in samples with different log asset distances, calculated as the difference between the asset of focal firm and that of peer firms. I measure the distance in assets using $|log(A) - log(B)|$, which is the absolute value of the difference between log(Assets) of firm A and that of peer firm B. Peer firms of similar size are more ideal benchmarks for the observed firm.[7] Columns (1) to (5) show that, consistent with CEOs being rewarded for better

[7]Albuquerque (2009) finds evidence of relative performance evaluation using industry-size peer groups.

firm performance, CEO compensation is positively associated with own-firm stock return for each specification with a coefficient of approximately 0.15. At the average correlation level of 0.32, CEO compensation is positively associated with peer-firm stock return, but is not significant.[8] The coefficient on the interaction between peer performance and pairwise stock return correlations is negative and significant. The results indicate that the CEO compensation is tied to firm's performance measured against the performance of its peers provided that the observed firm has higher-than-average stock return correlation with its industry peers. This is consistent with the prediction in Holmstrom and Milgrom (1987) that relative performance evaluation (RPE) use will be higher for firms with high performance correlation with industry peers. The variable of interest is the interaction between peer return and a dummy variable indicating whether focal firm shares common blockholder with peer firm. The coefficient on this interaction term is positive and significant (coefficient of 0.02 to 0.039, with t-statistic of 2.259 to 3.267). The results provide evidence that among the co-owned firm-pairs, firms put higher weight on peer performance, which supports the argument that firms use less RPE towards their peer firms that they share common blockholders with. To measure the observed firm's compensation sensitivity to co-owned peer, I sum up the coefficients for return and the interaction term between peer return and co-owned dummy. Since $\eta_2 + \eta_3 > 0$ (p-value < 0.01), this shows that the observed firm's CEO is rewarded positively if the co-owned peer firms are performing well. In terms of control variables, I find that firms of larger size, lower leverage, and higher percentage of institutional ownership also reward CEOs with significantly higher total compensation. Overall, the findings are robust across samples with different asset distances. In further analysis, I show only the results for peers within 70% asset distance and all peers.[9]

Next, I evaluate the economic significance of institutional common ownership by comparing the percentage change in total compensation that occurs due to a shock to co-owned peer

[8]In unreported results, I include only own-firm stock return and peer-firm stock return and obtain similar results. The results are consistent with previous literature on mixed evidence on the use of RPE.

[9]I also run tests using other asset distances. The results with other asset distances are qualitatively similar and are not reported for brevity.

performance, measured as percentage changes by one standard deviation, while keeping all else equal to the one brought by a shock to own-firm performance. Table 2 column (1) shows the results based on peers within 40% asset distance. One standard deviation of peer performance is 44% per year (see Table 1) and represents a typical shock to peer performance. An increase (decrease) in peer performance of 0.44 leads to a 1.7% (equal to 0.039 $\times$ 0.44) increase (decrease) in total CEO compensation, all else being equal. Instead of looking at the absolute change in CEO compensation brought up by the shock to peer performance, I compare this percentage change in compensation with the one brought by shock to own-firm performance. An increase (decrease) in own-firm performance of 0.44 leads to a 6.6% (0.151 $\times$ 0.44) increase (decrease) in total CEO compensation, all else being equal. So the change to the firm's compensation brought by shock to co-owned peer is about 26% of the change brought by shock to its own-firm performance, while arguably, the own-firm performance is the most important determinant for executive compensation.

Table 2 about here

While the use of stock-based compensation can align CEOs' interests with stockholders' interests, stock prices are often a noisy measure because stock prices include movements caused by factors uncontrollable by the CEOs such as market-wide movements in equity values (Sloan, 1993). Earnings are less sensitive to market-wide noise in stock prices and therefore reflect factors that are more under CEOs' control. Since accounting earnings help shield top executive compensation from market-wide movement in equity values, they may contain information that is useful for the purpose of performance evaluation beyond the information provided by stock returns. As a result, firms often include certain measures of accounting profit or market (stock return) performance into executive compensation contracts. In the baseline analysis, I use stock returns as the main performance measure. Also, I include return on assets (ROA) as another performance measure for further analysis.

Table 3 shows the results for the test estimating CEO compensation using stock returns as well as operating performance as performance measures. For both own firm and its peer firm,

I include stock returns and return on assets (ROA), defined as the earnings before interest, tax, depreciation, and amortization (EBITDA) divided by lagged total assets. First, the coefficient of own-firm ROA is positive and statistically significant, consistent with CEOs being rewarded for better performance measured by ROA. In Table 3, columns (1) to (2) consider observations where the asset distances between focal firm and peer firm are within 70%. Columns (1) and (2) show that the coefficient of peer ROA is generally positive and insignificant, but the coefficient estimate of the interaction between peer ROA and a co-owned dummy variable in column (2) is positive and significant. The results suggest the importance of the ROA on the positive association between CEO pay and performance measures for co-owned peers. The coefficient on the interaction between peer performance and a co-owned dummy variable is still positive and significant with the inclusion of peer ROA, indicating that both stock market return performance and operating performance of peer are positively related to the total compensation when the focal firm and its peer firm share common blockholder(s). In columns (3) to (4), I obtain similar results when I consider observations with all industry peers.

Table 3 about here

The role of the competitive labor market for CEO talent is reflected in the practice of paying CEOs for luck, that is, for performance outside the CEOs' control. Oyer (2004) argues that firms adjust the pay to employee in a way that is correlated with the outside options presented by the outside labor market rather than pay a fixed wage. When there is a high demand for managerial talent and CEO talent is scarce, firms adjust the pay to the CEO to minimize the chance that he will leave to another firm. Firms justify their CEOs' compensation by benchmarking their executive compensation against a peer group and rationalize the peer group by claiming that the firms compete for managerial talent with those selected companies. To determine the effects of peer-firm compensation benchmarking on CEO pay, I add peer-firm total compensation into the regression.[10] This is done based

[10]Bizjak, Lemmon, and Naveen (2008) find that peer group compensation benchmarking is common and

on the premise that firms benchmark CEO compensation not only on peer performance but also on peer compensation to reflect the increased value of a CEO's outside options.

Table 4 presents the results from regressing CEO compensation on peer-firm performance and compensation. Similar to the results obtained in Table 2, the coefficient on the interaction between peer-firm performance and a co-owned dummy variable is positive and significant in all specifications. Consistent with the prediction in Oyer (2004) that CEO compensation is benchmarked to industry peers in order to retain talents, I find that CEO compensation is positively associated with peer-firm compensation. The variable of interest here is the interaction between peer-firm compensation and a co-owned dummy variable. Columns (2) and (4) show that the coefficient estimate on the interaction between peer-firm compensation and a co-owned dummy variable is positive and significant, suggesting that the observed firm's executive compensation exhibits additional sensitivity towards the co-owned peer firm's executive compensation. These results provide further evidence that the positive pay sensitivity to co-owned peer performance remains significant after controlling for peer compensation.

Table 4 about here

While compensation is given in the form of cash compensation and equity compensation (stocks and options awards), prior research (Hall and Liebman, 1998) examines pay-to-performance responsiveness that includes the change in the value of stocks and stock options in the measure; it also documents that changes in the value of stocks and options account for virtually all of the sensitivity, whereas salary and bonus are quite insensitive to changes in firm performance. To examine the use of equity-based incentive compensation (stocks and options, in particular) to incentivize managers of co-owned portfolio firms, I decompose total compensation into the cash component, which includes salary and bonus, and the stocks and options component, which includes the total value of restricted stocks granted and the total

significantly affects CEO compensation. Other studies that also focus on how the use of peer group may affect the compensation setting process are Albuquerque, De Franco, and Verdi, 2013; Bizjak, Lemmon, and Nyugen, 2011; Faulkander and Yang, 2010; Faulkander and Yang, 2013.

value of stock options granted. I then examine whether short-term incentives (i.e., the cash component) and long-term incentives (i.e., the stocks and options component) exhibit the positive sensitivity to the performance of co-owned peers.

To evaluate the compensation sensitivity to own-firm and peer-firm stock return performance, I estimate a similar specification as in Table 2. Table 5 presents the specifications where the dependent variables are either cash compensation or stocks and options compensation. While the coefficient on the interaction between peer-firm stock return and a co-owned dummy variable is not statistically significant when the dependent variable is cash compensation, it is positive and statistically significant when the dependent variable is stocks and options compensation. This relation provides some evidence of co-owned firms' board of directors using equity-based incentives to incentivize managers to mitigate direct competition with their co-owned peers.

Table 5 about here

4.2 Identification

A potential endogeneity concern is that omitted variables that are unobservable correlate with firms' institutional cross-holding status and their compensation benchmarking practice. Blockholders may choose to invest in some same-industry firms based on corporate culture or managerial traits, and these firms could be correlated in certain ways. The correlation may affect the pay-performance sensitivity among these firms. As a result, the positive correlations between CEO compensation and co-owned peer performance from the baseline results could be bias. Also, institutional blockholders never randomly initiate a stake in a firm. It is possible that institutional blockholders cross-hold firms when these firms are going to coordinate in the product market and exhibit positive benchmarking in compensation. Therefore, the baseline results in the beginning of the paper could be subjected to omitted variables and reverse causality issues. In order to claim causality between the common

ownership and positive compensation benchmarking, I resort to exogenous change to the number of common blockholders between firms.

To address the above-mentioned issues, I exploit a quasi-natural experiment involving asset management firms merger using difference-in-difference (DiD) approach. He and Huang (2014) are the first to use a similar identification strategy where they use all mergers between financial institutions. Specifically, I make use of arguably the largest asset management firms' merger, the merger between BlackRock Inc. ("BlackRock") and Barclays Global Investors (BGI), to create exogenous change in the number of common blockholders. (On June 11, 2009, BlackRock announced that it had agreed to acquire BGI from UK-based bank Barclays PLC ["Barclays"]. The merger was completed on December 1, 2009.)

As the benchmarking analysis is done in the firm-pair-year panel, I identify treatment and control firm pairs instead of individual treatment and control firms. To identify a treatment firm pair, I require that the focal firm and peer firm be block-held separately by one of the merging institutions one year before the merger completion. These two blockholders in focal firm and peer firm cannot be the same institution, otherwise this firm-pair is considered a co-owned firm pair before the merger. After the merger, the focal firm and peer firm in a treatment firm pair will become co-owned due to the asset management firms merger. As for the control firm pairs, I require that only one of the focal and peer firms be block-held by one of the merging institutions one year before the merger completion. The requirement for the control firm pairs helps to control for the managerial skills of the merging asset management firms in difference-in-difference analysis. I use a seven-year window, which comprises three years before and three years after the event year and excludes the event year.

I estimate the following multivariate DiD model around the merger:

$$\begin{aligned}\text{Total Compensation}_{it} \;=\; & c + \beta_1 \text{Peer Ret}_{it} \times \text{Treat} \times \text{Post} + \beta_2 \text{Peer Ret}_{it} \times \text{Treat} \\ & + \beta_3 \text{Peer Ret}_{it} \times \text{Post} + \beta_4 \text{Treat} \times \text{Post} + \beta_5 \text{Ret}_{it} + \beta_6 \text{Peer Ret}_{it} \\ & + \beta_7 \text{Peer Ret}_{it} \times \text{Correlation}_{it} + \gamma \text{Control Var}_{it-1} + \text{Year}_t + \text{Firm}_i + \epsilon_{it}\end{aligned}$$

Table 6 reports the results from the DiD analysis. In different asset distance samples, the coefficient of Treat × Post is positive and significant except for in column (5), suggesting that the focal firms whose number of common blockholder with peer firms increases due to asset management firms merger put additional positive pay sensitivity on the co-owned peer firms' stock return performance.

Table 6 about here

4.3 Implications of institutional common ownership for future product market characteristics

In this section, I investigate the effect of common ownership on future product market characteristics, such as product differentiation, combined market share, and geographic focus overlap, as a way to examine the effect of the anti-competitive incentive contracts. In the following study, I keep one observation for every two firm-pair-year observations (that comprise the same two firms), because the dependent and independent variables would be essentially the same for observations of "Firm A, Firm B, Year X" and "Firm B, Firm A, Year X".

I first conduct an analysis based on future product similarity using Text-Based Network Industry Classifications (TNIC) pairwise data of Hoberg and Phillips (2010 and 2015). TNIC system is explicitly constructed based on the product similarities of firms. The higher the similarity score between two firms, the more likely these two firms are engaging head-to-head competition in the product market. The TNIC pairwise data sets a threshold on the similarity score; only the firm pairs that have a high enough similarity score will appear in the TNIC network. Since TNIC is built from 10-K filings that firms file each year, the network for each firm evolves over time. Unlike the traditional standard industry classification where the relation between same-industry firms is static, TNIC assigns each firm to a different set of firms every year. This unique feature allows me to capture the dynamics of the

product market relations between focal firms and peer firms. In other words, I can observe two firms that were previously in the same network but are not so in the next period. To examine whether firms with common block ownership differentiate their products to avoid direct competition with each other, I estimate the linear probability model (LPM) where the dependent variables are TNIC linkage in year $t + 1$ and year $t + 2$. Table 7 presents the results for the implication of institutional cross-holding for future product similarity. The results show that co-owned firm pairs are more likely to have product differentiation in the future. This suggests that co-owned firm pairs distance away from each other in the product market to avoid direct competition.

Table 7 about here

I conduct a further test as to whether co-owned firms are more likely to have a higher combined market share in the future. As argued earlier, I expect that firms with common block ownership will enjoy higher growth in joint market share, as firms differentiate their products if they want to avoid direct competition with each other. Table 8 presents the results of specifications that use a dummy variable for co-owned as the independent variable, use a natural logarithm of combined market share in one year (Ln CombinedMktShr$_{t+1}$) as the dependent variable in Model 1 and 2, and use a natural logarithm of combined market share in two years (Ln CombinedMktShr$_{t+2}$) as the dependent variable in Models 3 and 4. I find that there is a strong positive association between being a co-owned firm-pair and future combined market share.

Table 8 about here

Lastly, I examine whether co-owned firms are more likely to have higher geographic focus overlap measured by overlapped state name count percentage in the future. In particular, I look at the relation between the co-owned dummy and future overlapped state name count percentage. Following Garcia and Norli (2012), I extract state name counts from annual reports filed with the Securities and Exchange Commission (SEC) on 10-K filings and calculate

the percentage of state name counts for each firm in each state. To account for the overlap of geographic focus, if two firms have an overlapping state name count, I take the smallest percentage of each overlapped state and sum up across all the states to find the total state count percentage overlap. Table 9 presents the results from testing how co-owned firm pairs experience state overlap for one and two years in the future. I find no evidence of a strong relation between being a co-owned firm pair and having state overlap in one year, but there is a strong positive relation between being a co-owned firm and having state overlap in two years for the sample where I consider observations with all peers. The evidence shows that co-owned firm pairs are coordinating in geographic focus. Combining the results from product similarity and geographic focus, these co-owned peer firms are aware that they will not be in fierce competition even if they are focusing on the same geographic product market. As a result, they are encouraged to go into each other's geographic market to jointly capture more market share.

Table 9 about here

4.4 Subsample tests based on product market characteristics

In this section, I study when common blockholders initiate the coordinating program through a compensation setting. I divide the sample into subsamples based on the product market characteristics, such as the industry Herfindahl-Hirschman Index (HHI), combined market share, and product similarity.

First, I examine how firms in different level of industry competition benchmark their CEO compensation to their peer firms' performance. I measure industry competitiveness using the Herfindahl-Hirschman Index (HHI), which is defined as the sum of squared percentage market shares in sales based on three-digit SIC industry classification. The HHI ranges from 0 to 1, moving from a large number of small firms to a single monopolistic firm. Next, I partition the sample into three subsamples based on the HHI and estimate column (5) in Table 2, where I consider all peer firms, in each subsample. Firm-pair-year observations that

belong to the first, second, and third terciles of the HHI are classified as the low, medium, and high group, respectively. Table 10 reports the performance benchmarking results for the three HHI groups. The coefficient estimate of the interaction between peer performance and a dummy variable for co-owned firm pair is positive and statistically significant only in the low HHI subsample. This suggests that CEOs of firms in highly competitive industries are being rewarded if co-owned peer firms are performing well. These results are consistent with the findings in Aggarwal and Samwick (1999): the positive pay-sensitivity to the performance of co-owned peers is used to discourage competition in industry with more competition. On the other hand, considering the litigation risk of collusion/coordination in a concentrated market, it is arguably unnoticeable to carry out such a strategic incentive program in a competitive market where many small firms coexist.

Table 10 about here

Next, I examine whether firm pairs' current combined market share level has any implications for the implementation of the strategic incentive program. I divide the sample into three subsamples based on combined market share. Firm-pair-year observations that belong to the first, second, and third terciles of the combined market share are classified as the low, medium, and high group, respectively. From the low group to high group, the combined market power of the firm-pairs is increasing. Table 11 shows the performance benchmarking results where I estimate the same specification as in the baseline test for firm-pair-year observations with different levels of combined market share. The results show that the coefficient estimate of the interaction between peer performance and a dummy variable for co-owned firm pair is positive and statistically significant only for the firm-pair-years with low combined market share, indicating that only CEOs of firms with low combined market share are rewarded when co-owned peer firms are performing well. This supports the argument that the strategic incentive program is more evident when firm pairs are in a competitive market and have lower joint market share.

Table 11 about here

I further examine how product market similarity affects the implementation of positive pay sensitivity to co-owned peer performance for managers. Similar to the last section, I define cases in which focal firm and peer firm appear in the same TNIC network as an indication of firms having similar products. Table 12 reports performance benchmarking results for firm pairs with and without similar products, respectively. I find that focal firms' CEO compensation responds positively to the co-owned firm stock return performance only in the subsample where firm pairs have similar products. This is consistent with the hypothesis that positive pay sensitivity to co-owned peer's performance is taken as a strategy to soften the competition between firms with similar products.

Table 12 about here

Overall, the results provide strong evidence that common blockholders are strategically intervening compensation setting condition on the co-owned portfolio firms' product market competition.

4.5 Alternative industry definitions

In this section, I conduct robustness tests to verify the main results of the paper. Specifically, I re-estimate the baseline tests in Table 2 using alternative industry classifications: the four-digit Standard Industry Classification (SIC) and Hoberg-Phillips Text-based Network Industry Classification (TNIC). Columns (1) to (3) of Table 13 replicate the baseline results using four-digit SIC, and columns (4) to (6) of Table 13 replicate the baseline results using Hoberg-Phillips TNIC. The results are robust to alternative industry classifications.

Table 13 about here

5. Conclusion

In this paper, I examine the effect of common ownership of firms by diversified institutional investors on CEOs' compensation setting. Using a CEO pay model common in the literature, I find evidence that common ownership by institutional investors makes firms more likely to have positive pay sensitivity to co-owned peer performance (i.e., it gives firms more incentive to cooperate in the product market). I also find evidence that CEO pay in co-owned firm is positively associated with co-owned peer compensation. A decomposition of total compensation reveals that only long-term incentives, such as stocks and options, have positive sensitivity to the performance of co-owned peers.

To establish the causal effect of cross-ownership on firms' CEO compensation setting, I use a DiD approach that relies on the exogenous variation in common ownership generated by a merger between BlackRock Inc. and Barclays Global Investors. The evidence is consistent with the conjecture that firms linked through institutional cross-holding have additional positive sensitivity to the co-owned peer performance.

Further analyses on the effect of institutional cross-holding on future product market characteristics show that common ownership helps firm pairs avoid direct competition through product market differentiation, enhance joint market share, and thus can coexist in the same local market. An investigation into cases in which common blockholders are more likely to adopt the positive pay sensitivity to co-owned peer performance for managers shows that the positive peer pay-performance sensitivity is more likely to occur in more competitive industries and among firm pairs with lower joint market share and more similar products. Overall, this study offers evidence that institutional common ownership uses CEO compensation contracts to mitigate competition and increase joint performance among rival portfolio firms.

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Appendix: Variable definitions

- Total Compensation: The total annual compensation flow is calculated as the sum of salary, bonus, other annual compensation (e.g., perquisites and other personal benefits, tax reimbursements, above market earnings on restricted stock, options or deferred compensation paid during the year but deferred by the officer), total value of restricted stocks granted, total value of stock options granted (using the Black-Scholes formula), long-term incentive payouts, and all other compensation (e.g., payouts for cancellation of stock options, signing bonuses, 401(k) contributions, life insurance premiums).
- Ln Total Compensation: The logarithm of the total annual compensation flow.
- Cash Compensation: Cash compensation comprises the salary and bonus. Salary is the dollar value of the base salary (cash and non-cash) earned by the named executive during the fiscal year. Bonus is the dollar value of the bonus (cash and non-cash) earned by the named executive during the fiscal year.
- Stocks and Options Compensation: Stocks and options compensation is the total value of restricted stocks granted and the total value of stock options granted.
- Co-owned (d): A dummy variable that equals 1 if the focal firm shares common blockholder with peer firm in any of the four quarters prior to the fiscal year end, and 0 otherwise.
- Ln Firm Return: The natural logarithm of annual stock returns including dividends.
- Ln Peer Return: The natural logarithm of peer-firm annual stock returns including dividends.
- CEO Age: The natural logarithm of the CEO's age.
- CEO Tenure: The natural logarithm of CEO tenure. Tenure is defined as the difference between the current fiscal year for which the CEO is still in office and the year in which the CEO assumed office (obtained from the variable BECAMECEO from ExecuComp).
- SIC3 HHI: The Herfindahl-Hirschman Index (HHI) based on the Compustat three-digit SIC industry classification. This is based on the sum of squared percentage market shares in sales.
- Institutional Ownership: The percentage of shares held by all institutional investors listed in 13F, calculated as a ratio of the total number of the firm's shares outstanding.
- Size: The natural logarithm of total assets.
- EBITDA/Asset: EBITDA/Asset is calculated as the earnings before interest, tax, depreciation, and amortization (EBITDA) divided by lagged total assets.
- Correlation: Correlations were calculated using past one year firm-pair weekly returns.
- Cash: The cash and short-term investments divided by lagged total assets.
- Leverage: The sum of long-term debt and debt in current liabilities divided by beginning-of-year total assets.
- Whited-Wu Index: The WW Index is equal to -0.091 $\times$ Cash Flow/Assets - 0.062 $\times$ I(Cash Dividend Dummy) + 0.021 $\times$ Long Term Debt/Assets - 0.044 $\times$ Ln(Assets) + 0.102 $\times$ 3-digit SIC Industry Sales Growth - 0.035 $\times$ Sales Growth.

Figure 1: The percentage of co-owned firms

The plots in this figure represent the percentage of co-owned firms each year in Compustat/CRSP universe from 1992 to 2013.

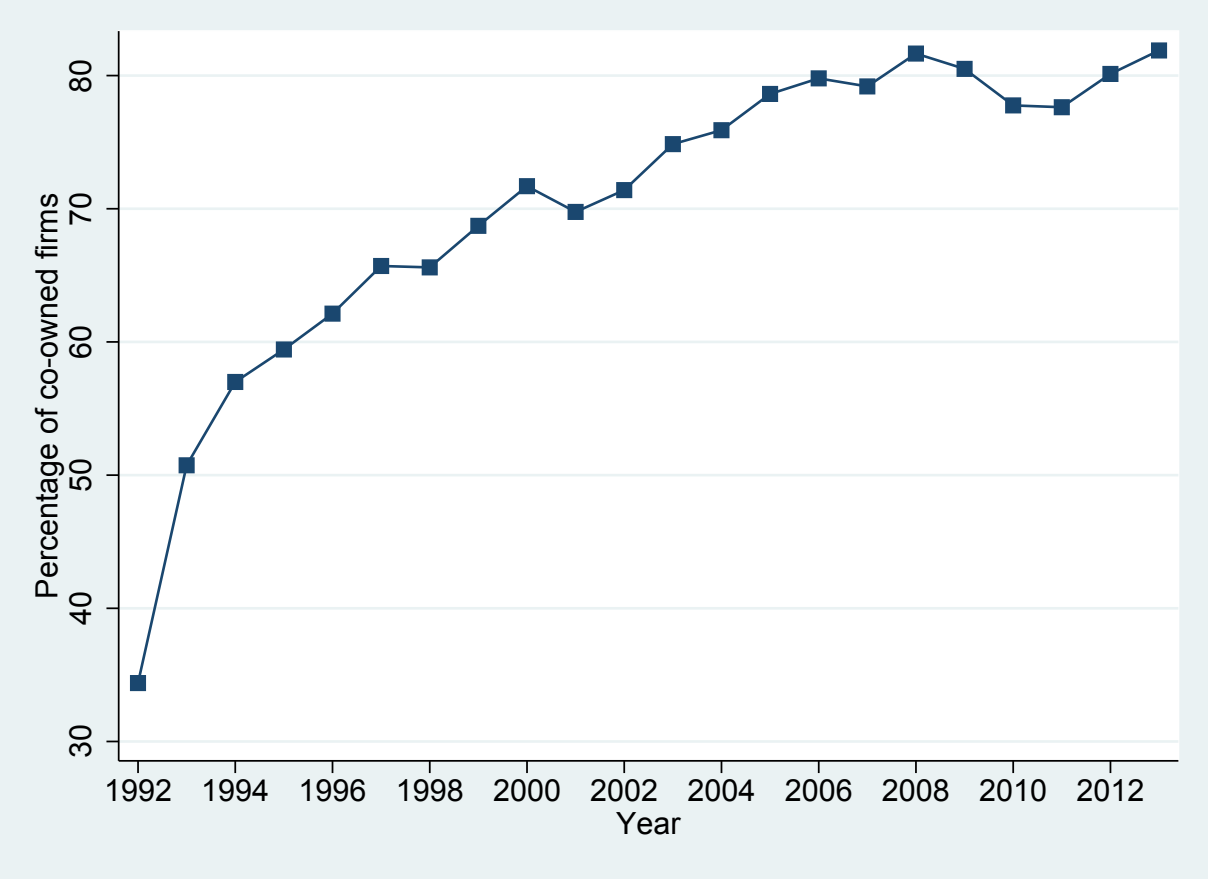

Table 1: Summary statistics

This table contains summary statistics on the variables defined in the Appendix. Panel A and Panel B present the summary statistics at firm level and firm-pair level, respectively. The statistics reported are Mean, the k^{th} percentile, (Pk for $k = 25, 50, 75$), and St. Dev. (standard deviation) of each variable. I use (d) to indicate that the variable is a dummy variable. I report only the mean for dummy variables.

Variable	Mean	P25	P50	P75	St. Dev.
Panel A:					
Total Compensation (thousands)	4,531.95	1,239.37	2,602.32	5,548.5	5,428.29
Ln Total Compensation	7.87	7.12	7.86	8.62	1.06
Co-owned (d)	0.77	-	-	-	-
Stock Return	0.07	-0.13	0.11	0.31	0.44
EBITDA/Asset	0.15	0.08	0.14	0.21	0.12
Asset ($MM)	8,532.79	462.05	1,422.43	5,096.31	24,880.22
Leverage	0.35	0.1	0.33	0.52	0.81
Cash	0.17	0.03	0.08	0.23	0.23
Whited-Wu Index	-0.36	-0.43	-0.36	-0.29	0.09
Institutional Ownership	0.68	0.54	0.7	0.84	0.22
CEO Tenure	7.81	3	6	10	7.1
CEO Age	55.68	51	56	60	7.17
SIC3-HHI	0.15	0.05	0.11	0.19	0.14
Panel B:					
Co-owned (d)	0.34	-	-	-	-
Comovement (Correlation)	0.32	0.17	0.32	0.48	0.22

Table 2: Performance benchmarking using stock returns

This table reports the results from regressing the natural logarithm of total CEO compensation on firm performance (measured by the natural logarithm of annual stock returns including dividends), peer-firm performance, and control variables. In columns (1) to (4), I restrict the samples to peer firms with a certain log asset distance. The distance in assets is calculated as the difference between the log asset of focal firm and that of peer firms. Column (5) presents the results for the sample with all peers. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: Ln Total Compensation	(1) $\leq 40\%$	(2) $\leq 50\%$	(3) $\leq 60\%$	(4) $\leq 70\%$	(5) All peers
Ln Peer Return × Co-owned (d)	0.039***	0.036***	0.036***	0.037***	0.020**
	(3.267)	(3.234)	(3.309)	(3.559)	(2.259)
Ln Firm Return	0.151***	0.153***	0.154***	0.155***	0.160***
	(6.280)	(6.352)	(6.541)	(6.611)	(7.290)
Ln Peer Return	0.000	0.004	0.004	0.001	0.005
	(0.023)	(0.367)	(0.438)	(0.138)	(0.724)
Ln Peer Return × Correlation	-0.090***	-0.098***	-0.102***	-0.106***	-0.081***
	(-2.597)	(-2.842)	(-3.052)	(-3.186)	(-2.979)
Correlation	0.110***	0.106***	0.110***	0.108***	0.122***
	(3.917)	(3.900)	(4.071)	(3.989)	(5.296)
Co-owned (d)	0.003	0.002	0.003	0.003	0.012*
	(0.345)	(0.206)	(0.376)	(0.314)	(1.838)
CEO Age	-0.314	-0.307	-0.314	-0.325	-0.245
	(-1.501)	(-1.489)	(-1.538)	(-1.589)	(-1.410)
CEO Tenure	0.031	0.030	0.030	0.029	0.039**
	(1.477)	(1.469)	(1.474)	(1.408)	(2.050)
SIC3 HHI	-0.300	-0.297	-0.309	-0.296	-0.210
	(-1.340)	(-1.333)	(-1.424)	(-1.372)	(-1.088)
Institutional Ownership	0.544***	0.568***	0.574***	0.579***	0.617***
	(5.072)	(5.432)	(5.521)	(5.621)	(6.601)
Ln Asset	0.289***	0.292***	0.294***	0.295***	0.280***
	(7.407)	(7.765)	(8.088)	(8.205)	(8.695)
Leverage	-0.552***	-0.568***	-0.551***	-0.555***	-0.516***
	(-3.972)	(-4.293)	(-4.337)	(-4.261)	(-4.670)
Cash	0.001	-0.001	0.001	0.004	0.017
	(0.008)	(-0.015)	(0.021)	(0.057)	(0.280)
Whited-Wu Index	-0.474	-0.431	-0.396	-0.414	-0.392
	(-1.100)	(-0.997)	(-0.923)	(-0.982)	(-1.098)
Peer Institutional Ownership	-0.026*	-0.022	-0.023*	-0.020	-0.022***
	(-1.701)	(-1.600)	(-1.738)	(-1.580)	(-3.092)
Peer Ln Asset	0.009	0.007	0.003	0.004	0.006*
	(0.948)	(0.986)	(0.515)	(0.750)	(1.700)
Peer Leverage	-0.005	-0.003	-0.013	-0.014	-0.011
	(-0.264)	(-0.185)	(-0.814)	(-0.972)	(-1.353)
Peer Cash	-0.002	0.000	-0.000	-0.001	0.005
	(-0.268)	(0.050)	(-0.055)	(-0.109)	(1.160)
Peer Whited-Wu Index	0.181*	0.168*	0.123	0.134	0.122*
	(1.844)	(1.768)	(1.319)	(1.492)	(1.929)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.662	0.660	0.661	0.661	0.700
Observations	122,363	152,252	181,001	209,487	761,273
P-value ($\eta_2 + \eta_3$)	0.001	0.001	0.000	0.001	0.006

Table 3: Performance benchmarking using both stock returns and operating performance

This table reports the results from regressing the natural logarithm of total CEO compensation on firm performance (measured by the natural logarithm of annual stock returns including dividends and by the firm return on assets [calculated as EBITDA divided by lagged total assets]), peer-firm performance, and control variables. In columns (1) and (2), I restrict the sample to peer firms with log asset distance less than or equal to 70%. Columns (3) and (4) present the results for the sample with all peers. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)
Ln Total Compensation	$\leq 70\%$	$\leq 70\%$	All peers	All peers
Ln Peer Return × Co-owned (d)	0.037***	0.030***	0.020**	0.016*
	(3.581)	(2.905)	(2.278)	(1.814)
Peer EBITDA/Asset × Co-owned (d)		0.106***		0.068***
		(2.953)		(3.239)
Ln Firm Return	0.116***	0.116***	0.128***	0.128***
	(5.406)	(5.411)	(6.039)	(6.042)
Ln Peer Return	-0.004	-0.001	-0.001	0.000
	(-0.417)	(-0.133)	(-0.146)	(0.019)
Ln Peer Return × Correlation	-0.098***	-0.098***	-0.076***	-0.076***
	(-3.054)	(-3.057)	(-2.834)	(-2.829)
EBITDA/Asset	1.164***	1.161***	0.828***	0.827***
	(7.489)	(7.475)	(5.993)	(5.985)
Peer EBITDA/Asset	0.035	-0.004	0.041***	0.023*
	(1.591)	(-0.162)	(2.878)	(1.696)
Correlation	0.093***	0.092***	0.111***	0.111***
	(3.400)	(3.394)	(4.812)	(4.808)
Co-owned (d)	0.003	-0.011	0.012*	0.002
	(0.416)	(-1.103)	(1.760)	(0.345)
CEO Age	-0.323	-0.323	-0.226	-0.226
	(-1.573)	(-1.576)	(-1.297)	(-1.299)
CEO Tenure	0.023	0.023	0.031*	0.031*
	(1.121)	(1.124)	(1.674)	(1.675)
SIC3 HHI	-0.437**	-0.435**	-0.320*	-0.320*
	(-2.059)	(-2.052)	(-1.679)	(-1.680)
Institutional Ownership	0.421***	0.421***	0.500***	0.500***
	(4.146)	(4.148)	(5.378)	(5.377)
Ln Asset	0.355***	0.355***	0.312***	0.312***
	(10.394)	(10.397)	(9.888)	(9.887)
Leverage	-0.523***	-0.523***	-0.488***	-0.488***
	(-3.855)	(-3.857)	(-4.283)	(-4.285)
Cash	0.037	0.037	0.035	0.035
	(0.581)	(0.584)	(0.576)	(0.577)
Whited-Wu Index	0.150	0.147	-0.013	-0.016
	(0.361)	(0.355)	(-0.036)	(-0.043)
Peer Institutional Ownership	-0.029**	-0.027**	-0.028***	-0.027***
	(-2.317)	(-2.154)	(-4.037)	(-3.891)
Peer Ln Asset	0.002	0.002	0.005	0.006
	(0.325)	(0.307)	(1.533)	(1.584)
Peer Leverage	-0.007	-0.007	-0.007	-0.007
	(-0.502)	(-0.510)	(-0.878)	(-0.873)
Peer Cash	0.002	0.001	0.007	0.006
	(0.290)	(0.188)	(1.583)	(1.566)
Peer Whited-Wu Index	0.068	0.064	0.115*	0.117*
	(0.698)	(0.663)	(1.732)	(1.752)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.672	0.672	0.706	0.706
Observations	209,153	209,153	760,101	760,101

Table 4: Performance and compensation benchmarking

This table estimates the sensitivity of CEO compensation to its peer-firm performance and compensation. It reports the results from regressing the natural logarithm of total CEO compensation on firm performance (measured by the natural logarithm of annual stock returns including dividends), peer-firm performance, peer-firm compensation (measured by the natural logarithm of peer firm total CEO compensation), and control variables. In columns (1) and (2), I restrict the sample to peer firms with log asset distance less than or equal to 70%. Columns (3) and (4) present the results for the sample with all peers. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: Ln Total Compensation	(1) $\leq 70\%$	(2) $\leq 70\%$	(3) All peers	(4) All peers
Ln Peer Return × Co-owned (d)	0.036***	0.032***	0.020**	0.018**
	(3.475)	(3.046)	(2.218)	(2.049)
Ln Peer Total Compensation × Co-owned (d)		0.023***		0.011***
		(4.432)		(4.534)
Ln Firm Return	0.155***	0.155***	0.160***	0.160***
	(6.621)	(6.623)	(7.295)	(7.294)
Ln Peer Return	-0.002	-0.001	0.003	0.004
	(-0.188)	(-0.065)	(0.467)	(0.523)
Ln Peer Return × Correlation	-0.105***	-0.105***	-0.080***	-0.080***
	(-3.148)	(-3.145)	(-2.954)	(-2.948)
Ln Peer Total Compensation	0.019***	0.010***	0.011***	0.008***
	(7.583)	(3.364)	(8.132)	(5.069)
Correlation	0.105***	0.105***	0.120***	0.119***
	(3.879)	(3.859)	(5.191)	(5.190)
Co-owned (d)	0.002	-0.177***	0.012*	-0.073***
	(0.276)	(-4.247)	(1.810)	(-3.651)
CEO Age	-0.323	-0.323	-0.244	-0.244
	(-1.578)	(-1.580)	(-1.406)	(-1.407)
CEO Tenure	0.029	0.029	0.039**	0.039**
	(1.402)	(1.409)	(2.047)	(2.048)
SIC3 HHI	-0.298	-0.291	-0.210	-0.208
	(-1.386)	(-1.355)	(-1.089)	(-1.078)
Institutional Ownership	0.581***	0.582***	0.617***	0.617***
	(5.641)	(5.659)	(6.610)	(6.610)
Ln Asset	0.296***	0.296***	0.281***	0.280***
	(8.225)	(8.233)	(8.699)	(8.693)
Leverage	-0.553***	-0.554***	-0.515***	-0.515***
	(-4.251)	(-4.255)	(-4.665)	(-4.666)
Cash	0.003	0.003	0.017	0.016
	(0.054)	(0.049)	(0.278)	(0.277)
Whited-Wu Index	-0.416	-0.415	-0.395	-0.394
	(-0.985)	(-0.983)	(-1.105)	(-1.103)
Peer Institutional Ownership	-0.035***	-0.032**	-0.031***	-0.030***
	(-2.690)	(-2.443)	(-4.338)	(-4.165)
Peer Ln Asset	-0.005	-0.005	0.001	0.001
	(-0.832)	(-0.928)	(0.255)	(0.298)
Peer Leverage	-0.010	-0.010	-0.010	-0.011
	(-0.703)	(-0.718)	(-1.245)	(-1.341)
Peer Cash	-0.004	-0.004	0.003	0.003
	(-0.571)	(-0.561)	(0.772)	(0.770)
Peer Whited-Wu Index	0.124	0.121	0.116*	0.113*
	(1.385)	(1.352)	(1.836)	(1.795)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.662	0.662	0.700	0.700
Observations	209,487	209,487	761,273	761,273

Table 5: Compensation by components

This table estimates the sensitivity of each component in CEO compensation to own-firm and peer-firm performance. The dependent variables are the cash component, which consists of salary and bonus, and the stocks and options component, which consists of the total value of restricted stocks granted and the total value of stock options granted. In columns (1) and (2), I restrict the sample to peer firms with log asset distance less than or equal to 70%. Columns (3) and (4) present the results for the sample with all peers. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	$\leq 70\%$		All peers	
	(1)	(2)	(3)	(4)
Dependent Variable:	Cash	Stocks and Options	Cash	Stocks and Options
Ln Peer Return × Co-owned (d)	0.001	0.077**	-0.013	0.056*
	(0.068)	(2.020)	(-0.861)	(1.826)
Ln Firm Return	0.167***	0.165**	0.148***	0.206***
	(5.301)	(2.315)	(4.174)	(3.063)
Ln Peer Return	-0.013	0.021	0.000	0.026
	(-0.921)	(0.579)	(0.049)	(0.901)
Ln Peer Return × Correlation	-0.005	-0.223*	0.044	-0.197**
	(-0.127)	(-1.886)	(1.121)	(-2.005)
Correlation	0.043	0.203**	0.036	0.257***
	(1.414)	(2.173)	(1.186)	(3.296)
Co-owned (d)	0.039*	-0.003	0.056***	0.023
	(1.790)	(-0.081)	(2.849)	(0.919)
CEO Age	-0.271	-2.558***	-0.042	-2.207***
	(-0.716)	(-4.047)	(-0.105)	(-4.023)
CEO Tenure	0.054*	-0.001	0.051*	-0.008
	(1.733)	(-0.018)	(1.865)	(-0.149)
SIC3 HHI	0.185	-0.773	0.130	-0.979
	(0.518)	(-1.087)	(0.436)	(-1.566)
Institutional Ownership	0.201	1.449***	0.261	1.590***
	(0.989)	(4.154)	(1.529)	(4.942)
Ln Asset	0.112*	0.466***	0.066	0.417***
	(1.860)	(3.982)	(0.974)	(4.125)
Leverage	-0.365**	-0.969**	-0.322**	-0.975**
	(-1.978)	(-2.342)	(-2.044)	(-2.572)
Cash	-0.047	-0.241	-0.044	-0.183
	(-1.483)	(-1.468)	(-1.156)	(-1.188)
Whited-Wu Index	-0.991	-1.049	-0.714	-1.328
	(-1.293)	(-0.863)	(-0.836)	(-1.341)
Peer Institutional Ownership	0.019	-0.059	-0.033**	-0.052**
	(0.968)	(-1.308)	(-2.491)	(-1.972)
Peer Ln Asset	-0.002	0.019	0.003	0.026**
	(-0.208)	(0.835)	(0.552)	(2.273)
Peer Leverage	-0.025	0.016	0.003	0.005
	(-0.745)	(0.338)	(0.178)	(0.201)
Peer Cash	-0.008	-0.012	0.001	-0.003
	(-0.838)	(-0.578)	(0.203)	(-0.185)
Peer Whited-Wu Index	0.204*	0.446	0.062	0.444**
	(1.707)	(1.485)	(0.649)	(2.131)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.523	0.454	0.517	0.474
Observations	209,487	209,487	761,273	761,273

Table 6: BlackRock and Barclays Global Investors (BGI) merger

This table reports the results from difference-in-differences (DiD) analysis. The dependent variable is the natural logarithm of total CEO compensation. *Treat* is an indicator variable that equals one for the firm pair that become co-owned due to the asset managers' merger, and zero otherwise. *Post* is an indicator variable that equals one for the post-merger period, and zero otherwise. *Ln Firm return* is measured by the natural logarithm of annual stock returns including dividends. *Ln Peer return* is measured by the natural logarithm of peer-firm annual stock returns including dividends. In columns (1) to (4), I restrict the samples to peer firms with a certain log asset distance to determine the closeness of the firm and its peers. The distance in assets is calculated as the difference between the log asset of focal firm and that of peer firms. Column (5) presents the results for the sample with all peers. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)	(5)
Ln Total Compensation	$\leq 40\%$	$\leq 50\%$	$\leq 60\%$	$\leq 70\%$	All peers
Ln Peer return × Treat × Post	0.198***	0.187**	0.137*	0.135*	0.064
	(2.659)	(2.273)	(1.695)	(1.652)	(1.028)
Ln Peer return × Treat	-0.137***	-0.143***	-0.141***	-0.117**	-0.035
	(-3.003)	(-3.115)	(-3.022)	(-2.442)	(-0.770)
Ln Peer return × Post	-0.003	-0.002	0.008	0.011	0.004
	(-0.128)	(-0.067)	(0.320)	(0.457)	(0.178)
Treat × Post	-0.071**	-0.059*	-0.049	-0.053*	-0.034
	(-2.198)	(-1.743)	(-1.517)	(-1.700)	(-1.309)
Ln Firm return	0.115**	0.119**	0.124**	0.121**	0.133***
	(2.206)	(2.304)	(2.522)	(2.483)	(2.660)
Ln Peer return	0.013	0.000	-0.006	-0.010	-0.001
	(0.734)	(0.007)	(-0.334)	(-0.579)	(-0.102)
Ln Peer return × Return correlation	-0.080	-0.044	-0.035	-0.041	-0.047
	(-1.263)	(-0.695)	(-0.563)	(-0.675)	(-0.880)
Return correlation	0.040	0.052	0.054	0.050	0.028
	(0.834)	(1.103)	(1.151)	(1.073)	(0.659)
Ln Age	-0.261	-0.290	-0.281	-0.307	-0.286
	(-0.661)	(-0.744)	(-0.744)	(-0.829)	(-0.804)
Ln Tenure	0.019	0.023	0.022	0.024	0.011
	(0.478)	(0.583)	(0.559)	(0.623)	(0.287)
SIC3 HHI	-1.237	-1.167	-1.279	-1.402	-1.331
	(-0.877)	(-0.828)	(-0.931)	(-1.060)	(-0.996)
Institutional ownership	0.696***	0.681***	0.690***	0.683***	0.636***
	(3.586)	(3.450)	(3.550)	(3.599)	(3.432)
Ln Asset	0.412***	0.401***	0.404***	0.419***	0.378***
	(4.246)	(4.203)	(4.322)	(4.544)	(4.329)
Leverage	-0.176	-0.205	-0.203	-0.208	-0.076
	(-0.674)	(-0.787)	(-0.799)	(-0.825)	(-0.312)
Cash	0.125	0.128	0.118	0.130	0.081
	(1.059)	(1.108)	(1.046)	(1.171)	(0.744)
Whited-Wu Index	-0.386	-0.457	-0.455	-0.382	-0.719
	(-0.576)	(-0.707)	(-0.725)	(-0.622)	(-1.220)
Peer Institutional ownership	-0.036	-0.027	-0.025	-0.027	-0.008
	(-1.396)	(-1.060)	(-1.200)	(-1.327)	(-0.938)
Peer Ln Asset	0.001	0.009	0.004	-0.006	-0.000
	(0.056)	(0.731)	(0.383)	(-0.670)	(-0.104)
Peer Leverage	0.069***	0.055***	0.042**	0.044***	0.008
	(2.982)	(2.999)	(2.503)	(2.702)	(1.373)
Peer Cash	0.002	0.005	-0.005	0.002	0.002
	(0.177)	(0.471)	(-0.569)	(0.195)	(0.704)
Peer Whited-Wu Index	-0.151	-0.078	-0.133	-0.112	0.012
	(-1.486)	(-0.779)	(-1.447)	(-1.287)	(0.220)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.791	0.791	0.792	0.793	0.806
Observations	11,302	14,082	16,823	19,533	65,933

Table 7: Future product similarity

This table reports the linear probability model results from regressing firms' future product market relation (TNIC linkage) on the co-owned dummy variable, while controlling for variables expected to explain product market relation. TNIC Peers$_{t+1}$ is the one-year-ahead TNIC linkage, and TNIC Peers$_{t+2}$ is the two-year-ahead TNIC linkage. Columns (1) and (2) present the results for the estimation that uses TNIC Peers$_{t+1}$ as the dependent variable when I restrict the sample to peer firms with log asset distance less than or equal to 70% and when I use the sample with all peers, respectively. Columns (3) and (4) present the results for the estimation that uses TNIC Peers$_{t+2}$ as the dependent variable when I restrict the sample to peer firms with log asset distance less than or equal to 70% and when I use the sample with all peers, respectively. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	TNIC Peers$_{t+1}$		TNIC Peers$_{t+2}$	
	(1) $\leq 70\%$	(2) All peers	(3) ≤ 70	(4) All peers
Co-owned (d)	-0.016***	-0.006***	-0.006	-0.005**
	(-3.873)	(-3.099)	(-1.381)	(-2.252)
Institutional Ownership	0.011	0.012*	0.042**	0.016**
	(0.678)	(1.713)	(2.414)	(2.012)
Ln Asset	-0.007	0.008***	-0.020**	0.007***
	(-0.992)	(3.839)	(-2.426)	(3.266)
Leverage	-0.040**	-0.003	-0.037*	-0.016*
	(-2.143)	(-0.429)	(-1.778)	(-1.782)
Cash	0.003	0.002	-0.002	-0.003**
	(1.036)	(1.551)	(-0.587)	(-2.259)
Whited-Wu Index	0.114**	0.078***	0.053	0.070***
	(2.429)	(4.444)	(1.137)	(3.913)
Peer Institutional Ownership	-0.012	-0.023***	-0.013	-0.017*
	(-0.698)	(-2.730)	(-0.670)	(-1.813)
Peer Ln Asset	0.018**	0.014***	0.028***	0.011***
	(2.165)	(4.770)	(3.083)	(3.695)
Peer Leverage	0.001	-0.014	0.012	-0.038***
	(0.044)	(-1.424)	(0.533)	(-3.569)
Peer Cash	0.017***	0.016***	0.006	0.014***
	(2.584)	(5.557)	(0.954)	(4.748)
Peer Whited-Wu Index	0.156***	0.177***	0.053	0.169***
	(2.765)	(6.884)	(0.919)	(6.180)
Firm-pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.589	0.572	0.553	0.533
Observations	98,954	359,418	93,385	338,276

Table 8: Future combined market share

This table reports the results from regressing firms' future combined market share on the co-owned dummy variable, while controlling for variables expected to explain combined market share. LnMktShr_{t+1} is the one-year-ahead combined market share, and LnMktShr_{t+2} is the two-year-ahead combined market share. Columns (1) and (2) present the results for the estimation that uses LnMktShr_{t+1} as the dependent variable when I restrict the sample to peer firms with log asset distance less than or equal to 70% and when I use the sample with all peers, respectively. Columns (3) and (4) present the results for the estimation that uses LnMktShr_{t+2} as the dependent variable when I restrict the sample to peer firms with log asset distance less than or equal to 70% and when I use the sample with all peers, respectively. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	LnMktShr_{t+1}		LnMktShr_{t+2}	
	(1) $\leq 70\%$	(2) All peers	(3) ≤ 70	(4) All peers
Co-owned (d)	0.008*	-0.001	0.012***	0.005**
	(1.857)	(-0.656)	(2.646)	(2.181)
Institutional Ownership	0.185***	0.083***	0.191***	0.121***
	(8.502)	(7.967)	(9.100)	(10.942)
Ln Asset	0.191***	0.154***	0.165***	0.123***
	(22.790)	(40.757)	(17.252)	(31.584)
Leverage	-0.071***	-0.055***	-0.084***	-0.057***
	(-3.512)	(-4.908)	(-3.640)	(-4.521)
Cash	-0.014***	-0.027***	-0.014***	-0.024***
	(-2.729)	(-11.817)	(-3.226)	(-10.633)
Whited-Wu Index	-0.067	-0.131***	0.087	-0.019
	(-1.117)	(-4.885)	(1.469)	(-0.692)
Peer Institutional Ownership	0.155***	0.141***	0.183***	0.155***
	(6.509)	(10.631)	(7.836)	(10.978)
Peer Ln Asset	0.177***	0.200***	0.134***	0.160***
	(17.018)	(40.293)	(11.672)	(29.765)
Peer Leverage	-0.082***	-0.057***	-0.092***	-0.072***
	(-3.467)	(-4.322)	(-3.582)	(-4.902)
Peer Cash	-0.018**	-0.036***	-0.007	-0.023***
	(-1.977)	(-7.692)	(-0.752)	(-5.253)
Peer Whited-Wu Index	-0.270***	-0.279***	-0.118	-0.083**
	(-3.308)	(-7.773)	(-1.606)	(-2.220)
Firm-pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.976	0.971	0.976	0.970
Observations	90,379	329,026	76,398	278,283

Table 9: Future state count percentage overlap

This table reports the results from regressing firms' future state count percentage overlap on the co-owned dummy variable, while controlling for variables expected to explain state count percentage overlap. Ste Cnt % Overlap$_{t+1}$ is the one-year-ahead state count percentage overlap, and Ste Cnt % Overlap$_{t+2}$ is the two-year-ahead state count percentage overlap. Columns (1) and (2) present the results for the estimation that uses Ste Cnt % Overlap$_{t+1}$ as the dependent variable when I restrict the sample to peer firms with log asset distance less than or equal to 70% and when I use the sample with all peers, respectively. Columns (3) and (4) present the results for the estimation that uses Ste Cnt % Overlap$_{t+2}$ as the dependent variable when I restrict the sample to peer firms with log asset distance less than or equal to 70% and when I use the sample with all peers, respectively. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	Ste Cnt % Overlap$_{t+1}$		Ste Cnt % Overlap$_{t+2}$	
	(1) $\leq 70\%$	(2) All peers	(3) $\leq 70\%$	(4) All peers
Co-owned (d)	0.001	0.001	0.002	0.002**
	(0.575)	(0.577)	(0.710)	(1.995)
Institutional Ownership	0.015*	0.013***	0.023**	0.011***
	(1.690)	(3.348)	(2.375)	(2.722)
Ln Asset	-0.000	-0.000	-0.004	0.001
	(-0.002)	(-0.346)	(-0.891)	(0.641)
Leverage	-0.009	-0.009**	-0.025**	-0.024***
	(-0.843)	(-2.264)	(-2.040)	(-4.881)
Cash	-0.003*	-0.000	-0.002	-0.002**
	(-1.903)	(-0.409)	(-1.142)	(-2.350)
Whited-Wu Index	-0.016	-0.018**	-0.047*	-0.007
	(-0.680)	(-2.021)	(-1.861)	(-0.811)
Peer Institutional Ownership	0.004	0.012**	-0.005	-0.003
	(0.385)	(2.419)	(-0.453)	(-0.524)
Peer Ln Asset	0.004	0.002	0.005	0.001
	(0.990)	(1.425)	(1.068)	(0.753)
Peer Leverage	-0.020*	-0.013***	-0.008	-0.007
	(-1.746)	(-2.604)	(-0.639)	(-1.127)
Peer Cash	-0.009***	-0.004***	-0.002	-0.004**
	(-3.576)	(-3.480)	(-0.805)	(-2.497)
Peer Whited-Wu Index	0.032	0.026**	0.017	-0.010
	(1.098)	(2.093)	(0.595)	(-0.739)
Firm-pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.792	0.766	0.801	0.772
Observations	42,198	153,085	34,247	123,431

Table 10: Subsample test by product market characteristics: HHI

This table reports the results from regressing the natural logarithm of total CEO compensation on firm performance (measured by the natural logarithm of annual stock returns including dividends), peer-firm performance, and control variables. In columns (1) to (3), the full sample is divided into three subsamples based on the level of competitiveness measured by the Herfindahl-Hirschman Index (HHI). All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	(1)	(2)	(3)
Ln Total Compensation	Low	Medium	High
Ln Peer Return × Co-owned (d)	0.028*	0.002	0.019
	(1.908)	(0.147)	(1.485)
Ln Firm Return	0.132***	0.140***	0.170***
	(3.588)	(3.960)	(4.228)
Ln Peer Return	0.000	0.005	-0.009
	(0.023)	(0.749)	(-0.884)
Ln Peer Return × Correlation	-0.115***	-0.011	-0.076**
	(-2.597)	(-0.304)	(-2.090)
Correlation	0.053	0.061*	0.172***
	(1.499)	(1.773)	(6.559)
Co-owned (d)	0.002	0.012	0.008
	(0.195)	(1.154)	(1.034)
CEO Age	-0.001	-0.016	-0.562***
	(-0.004)	(-0.039)	(-2.839)
CEO Tenure	0.048	-0.014	0.058**
	(1.489)	(-0.415)	(2.327)
SIC3 HHI	5.031	-1.055	-0.159
	(1.199)	(-0.206)	(-1.265)
Institutional Ownership	0.606***	0.816***	0.494***
	(3.924)	(4.802)	(4.344)
Ln Asset	0.223***	0.244***	0.231***
	(4.519)	(4.318)	(4.263)
Leverage	-0.542***	-0.514***	-0.481***
	(-2.600)	(-3.228)	(-2.830)
Cash	0.200***	0.037	-0.000
	(2.617)	(0.775)	(-0.004)
Whited-Wu Index	-0.507	-0.713	-0.299
	(-0.906)	(-1.399)	(-0.466)
Peer Institutional Ownership	-0.013	-0.014*	-0.042***
	(-1.136)	(-1.663)	(-4.157)
Peer Ln Asset	0.019***	0.001	0.002
	(2.768)	(0.330)	(0.335)
Peer Leverage	-0.027***	0.001	-0.031***
	(-2.957)	(0.198)	(-2.968)
Peer Cash	0.011**	0.002	0.003
	(2.354)	(0.719)	(0.954)
Peer Whited-Wu Index	0.331***	0.021	0.071
	(2.832)	(0.703)	(0.621)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adjusted R^2	0.777	0.747	0.720
Observations	264,050	251,381	245,842

Table 11: Subsample test by product market characteristics: Combined market share

This table reports the results from regressing the natural logarithm of total CEO compensation on firm performance (measured by the natural logarithm of annual stock returns including dividends), peer firm performance, and control variables. In columns (1) to (3), the full sample is divided into three subsamples based on combined market shares of a firm pair. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	(1)	(2)	(3)
Ln Total Compensation	Low	Medium	High
Ln Peer Return × Co-owned (d)	0.031**	0.007	0.008
	(2.466)	(0.516)	(0.456)
Ln Firm Return	0.137***	0.160***	0.179***
	(4.519)	(5.934)	(4.942)
Ln Peer Return	0.017*	-0.007	-0.004
	(1.872)	(-0.552)	(-0.315)
Ln Peer Return × Correlation	-0.057*	-0.078**	-0.086**
	(-1.648)	(-1.970)	(-2.348)
Correlation	0.112***	0.106***	0.129***
	(2.972)	(3.547)	(5.289)
Co-owned (d)	-0.005	0.018*	0.030***
	(-0.449)	(1.811)	(4.232)
CEO Age	-0.131	-0.134	-0.276**
	(-0.428)	(-0.551)	(-2.095)
CEO Tenure	-0.010	0.036	0.063***
	(-0.301)	(1.353)	(4.461)
SIC3 HHI	-2.795*	0.080	-0.128
	(-1.871)	(0.146)	(-0.906)
Institutional Ownership	0.747***	0.584***	0.561***
	(5.017)	(5.084)	(7.805)
Ln Asset	0.299***	0.253***	0.236***
	(6.195)	(5.982)	(7.798)
Leverage	-0.542***	-0.443***	-0.460***
	(-2.851)	(-3.552)	(-3.909)
Cash	-0.011	0.079	0.012
	(-0.164)	(1.370)	(0.268)
Whited-Wu Index	-0.252	-0.519	-0.643***
	(-0.462)	(-1.357)	(-3.214)
Peer Institutional Ownership	-0.009	-0.008	-0.047***
	(-0.796)	(-0.720)	(-3.415)
Peer Ln Asset	-0.006	-0.005	0.011*
	(-1.553)	(-0.786)	(1.921)
Peer Leverage	0.014	0.001	-0.032**
	(1.514)	(0.109)	(-2.317)
Peer Cash	0.001	0.004	0.007
	(0.250)	(0.637)	(0.376)
Peer Whited-Wu Index	0.036	0.143*	0.281***
	(0.666)	(1.775)	(3.111)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adjusted R^2	0.626	0.682	0.748
Observations	253,683	253,762	253,685

Table 12: Subsample test by product market characteristics: Product similarity

This table reports the results from regressing the natural logarithm of total CEO compensation on firm performance (measured by the natural logarithm of annual stock returns including dividends), peer firm performance, and control variables. In columns (1) to (2), the full sample is divided into two subsamples based on whether two firms have TNIC linkage. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: Ln Total Compensation	(1) Non-TNIC peers	(2) TNIC peers
Ln Peer Return × Co-owned (d)	0.016	0.023*
	(1.591)	(1.869)
Ln Firm Return	0.157***	0.165***
	(6.627)	(6.696)
Ln Peer Return	0.003	0.015
	(0.500)	(1.389)
Ln Peer Return × Correlation	-0.055*	-0.133***
	(-1.913)	(-3.682)
Correlation	0.120***	0.121***
	(4.637)	(4.346)
Co-owned (d)	0.016**	0.007
	(2.237)	(0.771)
CEO Age	-0.335*	-0.012
	(-1.693)	(-0.055)
CEO Tenure	0.030	0.050**
	(1.369)	(2.359)
SIC3 HHI	-0.017	-0.576**
	(-0.076)	(-2.348)
Institutional Ownership	0.596***	0.666***
	(5.497)	(6.394)
Ln Asset	0.279***	0.291***
	(7.477)	(8.746)
Leverage	-0.505***	-0.578***
	(-4.032)	(-4.884)
Cash	0.000	0.067
	(0.003)	(1.155)
Whited-Wu Index	-0.489	-0.206
	(-1.099)	(-0.742)
Peer Institutional Ownership	-0.017**	-0.026**
	(-2.272)	(-2.413)
Peer Ln Asset	0.001	0.015***
	(0.418)	(2.982)
Peer Leverage	-0.004	-0.035***
	(-0.494)	(-3.084)
Peer Cash	0.001	0.018*
	(0.329)	(1.938)
Peer Whited-Wu Index	0.043	0.296***
	(0.669)	(3.378)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Adjusted R^2	0.699	0.711
Observations	491,790	269,483

Table 13: Robustness tests with alternative industry definitions

This table shows robustness of the results from Table 2 using alternative industry definitions: the four-digit Standard Industry Classification (SIC) in columns (1) to (3) and the Hoberg-Phillips Text-Based Network Industry Classification (TNIC) in columns (4) to (6). In columns (1), (2), (4) and (5), I restrict the samples to peer firms with certain log asset distance. The distance in assets is calculated as the difference between the log asset of focal firm and that of peer firms. Columns (3) and (6) present the results for the sample with all peers. All variables are defined in the Appendix. The t-statistics using standard errors clustered by firms are reported in parentheses below each coefficient estimate. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	SIC4			TNIC		
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Ln Total Compensation	$\leq 40\%$	$\leq 70\%$	All peers	$\leq 40\%$	$\leq 70\%$	All peers
Ln Peer Return × Co-owned (d)	0.035**	0.021*	0.017*	0.036***	0.038***	0.029***
	(2.297)	(1.697)	(1.655)	(2.940)	(3.521)	(3.369)
Ln Peer Return	-0.001	0.010	0.008	0.002	-0.000	0.001
	(-0.051)	(0.866)	(0.868)	(0.191)	(-0.042)	(0.082)
Ln Peer Return × Correlation	-0.108***	-0.125***	-0.097***	-0.120***	-0.123***	-0.114***
	(-2.603)	(-3.269)	(-3.074)	(-3.459)	(-3.929)	(-4.233)
Ln Firm Return	0.160***	0.161***	0.178***	0.154***	0.153***	0.164***
	(6.372)	(6.546)	(8.050)	(8.480)	(8.652)	(9.396)
Correlation	0.129***	0.121***	0.128***	0.104***	0.108***	0.107***
	(3.982)	(3.856)	(5.001)	(4.287)	(4.559)	(4.960)
Co-owned (d)	-0.008	-0.006	0.004	0.004	-0.001	0.006
	(-0.736)	(-0.602)	(0.563)	(0.514)	(-0.176)	(1.021)
CEO Age	-0.303	-0.337	-0.242	-0.268	-0.303*	-0.287*
	(-1.365)	(-1.598)	(-1.396)	(-1.518)	(-1.751)	(-1.767)
CEO Tenure	0.056***	0.056***	0.059***	0.060***	0.059***	0.061***
	(2.641)	(2.709)	(3.143)	(3.533)	(3.494)	(3.549)
HHI	-0.138	-0.088	0.058	0.004	-0.020	-0.034
	(-0.752)	(-0.501)	(0.403)	(0.053)	(-0.250)	(-0.458)
Institutional Ownership	0.560***	0.581***	0.589***	0.637***	0.652***	0.665***
	(4.962)	(5.434)	(6.465)	(7.074)	(7.474)	(8.158)
Ln Asset	0.272***	0.275***	0.273***	0.284***	0.287***	0.276***
	(7.218)	(7.894)	(9.386)	(9.292)	(9.737)	(10.625)
Leverage	-0.519***	-0.492***	-0.515***	-0.528***	-0.513***	-0.507***
	(-4.293)	(-4.458)	(-5.058)	(-5.428)	(-5.528)	(-5.418)
Cash	0.043	0.041	0.049	0.146**	0.135**	0.123**
	(0.521)	(0.505)	(0.825)	(2.383)	(2.253)	(2.377)
Whited-Wu Index	-0.206	-0.250	-0.310	0.014	-0.009	-0.139
	(-0.458)	(-0.573)	(-0.899)	(0.057)	(-0.039)	(-0.721)
Peer Institutional Ownership	-0.002	-0.004	-0.022**	-0.004	-0.003	-0.011
	(-0.108)	(-0.243)	(-2.442)	(-0.271)	(-0.271)	(-1.502)
Ln Peer Asset	0.017	0.009	0.014***	0.014*	0.004	0.007***
	(1.311)	(1.168)	(3.030)	(1.709)	(0.943)	(2.646)
Peer Leverage	-0.032	-0.035*	-0.036***	-0.016	-0.007	-0.023***
	(-1.258)	(-1.757)	(-3.175)	(-1.004)	(-0.535)	(-3.195)
Peer Cash	0.017	0.014	0.018**	0.021	0.017	0.024***
	(1.264)	(1.182)	(2.470)	(1.618)	(1.490)	(2.880)
Peer Whited-Wu Index	0.259*	0.180	0.253***	0.140**	0.080	0.141***
	(1.891)	(1.480)	(3.090)	(2.040)	(1.327)	(2.869)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.678	0.676	0.713	0.697	0.694	0.719
Observations	66,738	114,007	396,395	121,205	205,697	714,823