The Positive Externalities of CEO *Delta*[*]

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Prior literature documents that a CEO's pay–performance incentives (*Delta*) can improve the market performance of his own firm. This paper shows that firms' *Delta* incentives can predict the market performance of their industry peers. When a small group of firms (leader firms) experiences substantial growth in *Delta* incentives, industry peers experience positive abnormal returns and abnormal improvement in fundamentals despite having no significant change in *Delta*. This positive market performance spillover from the leader firms to their industry peers hinges on peer CEOs' response to the competitive pressure and turnover threat generated by leader firms. The aggressive growth in *Delta* of the leader firms stimulates their CEOs to improve operational efficiency, puts additional competitive pressure on industry peers and consequently increases industry peer CEOs' career concern and turnover threat. We find, in response to this increasing competitive pressure, peer CEOs voluntarily exert extra effort into running their firms more efficiently in order to enhance their firms' fundamentals and market performance.

JEL Classification: G14, G34
Keywords: CEO *Delta* incentive, Positive externality, Incentive spillover,

1 Introduction

Prior literature finds that, due to managerial labor market competition, the CEO pay–for–performance sensitivity (*Delta*) of one firm can affect its competitors' choices of *Delta* (eg., Acharya and Volpin (2009); Albuquerque et al. (2013); Faulkender and Yang (2010); Bizjak et al. (2008)). Consequently, a negative externality of *Delta* arises because more generous incentive compensation in one firm induces its industry competitors to overpay their managers. However, *Delta* incentive pay in one firm can also have positive externalities on industry peer firms. For instance, when Expedia Inc. Chief Executive Dara Khosrowshahi's incentive pay grew tenfold in 2015 (*Wall Street Journal*, 1 May 2016), its main competitor–Priceline's stock price climbed from $1,084.87 (1 February 2016) to $1,445.83 per share (8 September 2016). This is not an isolated case. We observe when large firms such as Bestbuy, P&G, and IBM significantly increase their *Delta*, the stock prices of their industry competitors jump. Also, the price jumps of these competitors are due to their strong fundamentals. Motivated by the above evidence, this paper documents that one firm's substantial growth in *Delta* incentive compensation predicts better operating and stock market performance of the firm's industry competitors.

As a corporate governance device (e.g., Holmström (1999); Acharya and Volpin (2009)), *Delta* in one firm stimulates its CEO to exert extra effort in the firm's operation and thus enhances the stock market performance of his firm (eg., Cooper et al. (2014); Kale et al. (2009); Lilienfeld-Toal and Ruenzi (2014)). The CEO's extra effort improves the operating efficiency of his company (Lilienfeld-Toal and Ruenzi (2014)), putting competitive pressure on its industry peer firms (e.g., Dixit (1986)). Previous literature in industry organization concludes that peer firms experience a product price cut and negative market performance, implying a negative externality from one firm to its peers.

However, the prior literature only emphasizes the negative influence of production market competition on industry peers and fully ignores peer CEOs' active response to the competition. Peer CEOs' implicit incentives such as mitigating the turnover threat and keeping the reputation can reverse the negative impact of production market competition on peer firms. To mitigate the turnover threat and maintain their reputation, CEOs in peer firms can either increase their level of effort or their skill-set to run the firms more efficiently and enhance product differentiation. The extra efforts or extra ability of CEOs in rival companies are then incorporated in their companies' future stock prices. Thus, the competitive pressure generated by the substantial increase in one firm's *Delta* generates two opposite effects on its peer firms: (i). negative externality on peer firms' market performance because of peer firms' product price cut generated by the increased industry competition (e.g., Dixit (1986)); and (ii). positive externality on peer firms' market performance because of increasing operating efficiency from peer CEOs' extra effort. It is then an empirical question to explore which effect dominates.

In this study, we explore one firm's CEO incentive spillover to its peer firms' market performance and operations. We document a positive CEO incentive externality by showing that a firm's stock return can be positively predicted by the substantial increase in the CEO *Delta* incentives of other firms within the same industry. Similarly, peer firms' managerial discretion-related operating efficiency and product differentiation can also be positively predicted by other companies' CEO *Delta* incentives. Following a substantial increase in *Delta* incentive in an industry driven by a small group of firms (incentive leaders), peer firms in the same industry experience a significant improvement in their operating performance as well as better stock market performance despite having significant *Delta* incentive increase by themselves. Our findings reveal that CEO incentive leaders have positive externality on peer firms' operation and market performance. That is, peer CEOs' extra effort in firms' operation dominates the increased industry competition brought in by CEOs of incentive leaders.

Specifically, we define *Delta* incentive leaders as a small group of firms with high *Delta* incentive growth within industries having high aggregate *Delta* incentive growth. In other words, incentive leaders are the firms driving the industry aggregate *Delta* growth. We then classify as peers the remaining firms in the same industries as leaders. For our sample period from 1992 to 2015, we identify 735 firm-year observations as CEO incentive leaders and 6,615 as peers. The average CEO *Delta* incentive growth rate for the leaders is almost 10 times higher than that for the peers (102% vs 11%), indicating a large distinction between these two types of firms.

We find that both *Delta* incentive leaders and peers experience positive abnormal returns following their identification. An equal-weighted portfolio of leaders has an annualized Carhart (1997) four factor alpha of 11.03%. Similarly, an equal-weighted portfolio of peers has an annualized abnormal return of 9.19%. The value-weighted annualized abnormal returns for leaders and peers are 10.45% and 8.89%, respectively. The significant positive abnormal returns for the portfolio of *Delta* leaders are in line with Giroud and Mueller (2011) and Lilienfeld-Toal and Ruenzi (2014). More importantly, the significant positive abnormal returns for the portfolio of peers indicates a positive *Delta* incentive spillover from leaders to peers on stock market performance. To identify the marginal explanatory power of peers on returns, we also perform the Fama-Macbeth regressions controlling for firm characteristics and peers' *Delta*. We find peers continue to have significantly positive abnormal returns even after controlling for multiple firm characteristics and peers' *Delta*. That is, the positive *Delta* incentive spillover exists because incentive peer firms experience positive abnormal market performance even without significant increase in CEO pay–performance incentives.

We then explore multiple explanations for why CEO incentive peers experience positive abnormal returns. First, we investigate whether the peer firms' positive abnormal market performance is due to the real effect on peer firms or the investors' inattention. We find that both *Delta* leaders and peers experience positive sales growth, gross profitability, and return on assets in the two years following identification. The results are robust even after controlling for different firm characteristics and *Delta*. In contrast, investor inattention has no explanatory power on peer firms' market performance. These findings reveal that peer and leader firms' market performance is due to the strong fundamentals but cannot be attributed to a behavioral story.

The strong fundamentals of leader and peer firms indicate real improvement in these firms. Specifically, the strong fundamentals of leaders come from CEOs' extra effort in running their firms (Lilienfeld-Toal and Ruenzi (2014)). Hinged on leader CEOs' allocation of their extra effort, the real improvement in peers' fundamentals has two different explanations. First, if CEOs in leader firms allocate their effort to R&D investment, the strong fundamentals of peers are then caused by technology spillover. In contrast, if leader firms' CEOs allocate effort to firms' operating efficiency, leader firms' incentive spillover gives rise to peers' strong fundamentals. The next two paragraphs present the two explanations in detail.

The first potential explanation for peer firms' strong fundamentals assumes leader CEOs contribute their effort in increasing R&D investment. Corporate investment in research and development (R&D) spending generates new ideas and technology, creates extra demand for the entire industry, and thus improves industry-wide productivity (e.g., Hall (1993); Jiang et al. (2015)). If the *Delta* incentive increase in leaders drives their CEOs to allocate extra efforts in R&D, the peer firms can benefit from the creation of extra demand and productivity improvement, thus experiencing increase in fundamentals and better market performance. This explanation treats CEOs in peer firms as "free-riders" and does not require peer firms' CEOs to exert more effort in running their firms.

The second explanation assumes leader CEOs allocate their effort to firms' operating efficiency. If CEOs in incentive leader firms allocate their extra effort in running firms more efficiently, the industry-wide production market competition will increase (e.g., Chamberlin et al. (1933); Grossman and Shapiro (1984)). Consequently, peer firms encounter more competitive pressure and the corresponding threat of CEO turnover in peer firms increases (e.g., Dasgupta et al. (2014)). Due to the increasing threat of turnover, the peer firms' CEOs also increase their effort level to run their firm more efficiently and increase peer firms' product differentiation. This explanation treats the *Delta* incentive increase in leader companies as an external corporate governance device for peer companies' CEOs.

To shed light on these two explanations, we conduct multiple tests in sequence. We test whether the peer firms' market performance and strong fundamentals are caused by peer CEOs careful effort in firms' operating efficiency or in firms' R&D investment. To measure peer CEOs' extra effort and ability in firms' operation, we use managerial scores (Demerjian et al. (2012)). We find managerial scores in both leader and peer firms significantly increase after their identification, indicating that CEO incentive increase in leaders stimulates CEOs in both leader and peer firms. More importantly, the peers with high managerial score fully captures the peer firms' positive abnormal returns and strong fundamentals.

We also find that the good market performance of peer firms is not due to leaders' or peers' investment in R&D. We find neither leader nor peer firms experience significant increase in contemporaneous or future R&D investment. Thus, the positive externality on peers' stock market performance and fundamentals does not come from leader firms' R&D spillovers[1]. Compared with the results on R&D investment, we can conclude that the spillover effects of incentive leaders on peers comes from stimulating peer CEOs' effort to run firms more efficiently.

Finally, to confirm the positive relationship between the threat of CEO turnover and peer CEOs' effort devoted to firm operation, we use CEO characteristics to capture the managerial entrenchment against CEO turnover and conduct tests for its implications. Specifically, we find that peers with CEOs who are younger, have shorter tenure and are more overconfident give rise to their firms' stronger fundamentals and better market performance. These findings confirm that stronger turnover threat stimulates CEOs to align their effort to maximize firm value.

In contrast to the prior literature, to the best of our knowledge, this paper is the first to document a positive externality of CEO pay incentive on peer firms market performance and

[1]In other words, the CEO *Delta* incentive spillover has different information contents than the R&D spillover in Jiang et al. (2015)

fundamentals. Per Acharya and Volpin (2009), “firms with weaker governance offer managers more generous incentive compensation, which induces firms with good governance to also overpay their management.” As a result, bad governance characteristics prevail. In contrast, our results show that the increase in CEO incentive payment, although as a weak governance character in Acharya and Volpin (2009), can mitigate or even reverse the negative impact of CEOs’ overpayment in peer firms by stimulating them to work hard. The overpayment of peer firms to their CEOs can eventually be compensated by their managerial hard work, better operation efficiency, and positive abnormal stock market performance.

Our paper also relates to recent literature on the link among corporate governance, CEO incentive, and asset pricing. These groups of literature demonstrate that good corporate governance (e.g., Giroud and Mueller (2010); Giroud and Mueller (2011)) and high CEO incentive (e.g., Cooper et al. (2014); Lilienfeld-Toal and Ruenzi (2014)) benefit the firms’ stock market performance. This paper extends these works by documenting how one firm’s CEO incentive contract can affect not only its own company’s equity price but also peer firms’ price.

Our baseline results also provide new insight in the theory of industry organization. The industry organization literature predicts that an improvement in target firms’ operating efficiency or productivity can put competitive pressures on peer firms to respond by dropping their product prices (e.g., Dixit (1986); Chamberlin et al. (1933); Tirole (2010)). However, the literature of industry organization ignores the impact of managerial discretion on firm decisions. Our results reveal that CEOs in peer firms respond to competitive pressure from incentive leader firms by inputting extra efforts and running peer firms more efficiently.

The remainder of this paper is structured as follows. Section 2 discusses the origin of incentive spillover and proposes hypotheses. Section 3 discusses the data and our methodology. Section 4 provides our main results. Section 5 concludes.

2 Hypothesis Development

In this section, we briefly discuss the incentive spillover effect from leaders to peers to motivate our hypotheses.

It is well documented in the prior literature regarding CEOs' concern on the threat of turnover (Murphy (2013), Kaplan and Minton (2012), Jenter and Kanaan (2015), Dikolli et al. (2013), Dasgupta et al. (2014)). Turnover threat can come from multiple sources, one of which is the firms' bad market performance (e.g., Dasgupta et al. (2014)). That is, firms' bad market performance leads to high turnover threat for CEOs. In this study, peer firms' bad market performance is generated by increasing industry competition initiated by CEO *Delta* incentive leaders. To mitigate the threat of turnover, peer CEOs must strive to improve their firms' market performance. Peer CEOs' effort in mitigating turnover threat is the foundation of CEO *Delta* incentive spillover. If the effect of peer CEOs' effort dominates the impact of product price cut from industry competition, *Delta* increase in the incentive leaders gives rise to a positive externality on incentive peers' market performance. Otherwise, a negative externality arises. To first explore the sign of CEO *Delta* spillover on peer firms' market performance, we spell out the following hypothesis:

- **H1** (Positive Externality Hypothesis): *Delta* incentive peers' stock returns can be positively predicted by the CEO *Delta* incentive leaders within the same industry.

We actually confirm this hypothesis using multiple approaches in Section 4.1. However, we realize that peer CEOs' extra effort is not the only explanation for the positive externality on peer firms' market performance. The positive abnormal return spillover to incentive peers can also be attributed to investors' category learning in incentive event industries (e.g., Mondria (2010); Peng and Xiong (2006)), those industries with significant industry-average increase in CEO *Delta* incentive. With limited attention, investors tend to process the information on the industry-wide *Delta* increase rather than the information on firm-specific *Delta* increase. Thus, incentive peers are considered by investors the same as incentive leaders (in the same industry) and also experience future abnormal returns as incentive leaders. If the category learning hypothesis holds, the positive market performance of incentive peers comes from investor attention but not CEOs' effort in firm operation. In contrast, a strong increase in peer firms' fundamentals refutes the category learning hypothesis and supports the CEOs' extra effort hypothesis. We formally spell out these two contrast hypotheses as follows:

- **H2a** (Category Learning Hypothesis): The positive abnormal returns of incentive peers are due to investors' category learning.

- **H2b** (Strong Fundamentals Hypothesis): The positive abnormal returns of incentive peers are due to peer firms' strong fundamentals.

This pair of hypotheses cannot be justified through abnormal returns. We test hypothesis **H2a** by exploring peer firms' investor attention and test **H2b** by looking at firm fundamentals. Section 4.2 confirms hypothesis **H2b** and refutes the category learning hypothesis. Therefore, the positive externality to peer firms' abnormal returns comes from peer firms' strong fundamentals.

Strong fundamentals can also come from different resources. At least three methods exist for peer CEOs to generate strong fundamentals and thus create positive abnormal returns for their firms. The first explanation is based on the technology spillover. If CEOs in incentive leaders allocate extra effort (Lilienfeld-Toal and Ruenzi (2014)) to their firms' R&D investment (but not to the operating efficiency), the R&D investment can create new demand for the industry and thus benefit other firms in the same industry (Jiang et al. (2015)). Second, if leader firms' CEOs allocate their effort in increasing operating efficiency, the industry competition increases and gives pressure to peer CEOs. Due to the industry competitive pressure, incentive peer firms' CEOs increase their effort level to match that of incentive leaders' CEOs and thus increase their firms' market performance. Finally, the strong firm fundamentals can also come from peer CEOs' earnings management. We go one step further to explore the exact channels for peer CEOs to allocate their effort and increase firm fundamentals.

The severe industry competitive pressure from incentive leaders, as the external corporate governance device, can largely mitigate the CEOs' propensity to conduct earnings management (e.g., Giroud and Mueller (2010), Giroud and Mueller (2011)). Thus, the more realistic tool for CEOs to improve market performance is through exerting extra effort and talent on either firms' operation or R&D expenditure. We explore peer CEOs' effort allocation by providing two contrasting hypotheses:

- **H3a** (R&D Spillover Hypothesis): The positive abnormal returns and the strong fundamentals of incentive peers come from incentive leader and peer CEOs' effort in increasing R&D investment.

- **H3b** (Incentive Spillover Hypothesis): The positive abnormal returns and the strong fundamentals of incentive peers come from peer CEOs' effort in operating their firms more efficiently and enhancing product differentiation.

The empirical tests for the above hypotheses are in Section 4.3. We will now turn to the empirical tests of our hypotheses.

3 Data, Sample, and Summary Statistics

CEO compensation data for the sample period of 1992–2014 are from the Standard&Poor's Execucomp database for firms in the S&P 500, S&P Midcap 400, and S&P Smallcap 600. The stock return and accounting data are from CRSP and COMPUSTAT, respectively. We exclude financial (SIC 6000-6999) and utility (SIC 4900-4999) stocks.

3.1 CEO Incentives and Incentive Leaders & Peers

Our main independent variables are CEO *Delta* incentive leader and peer. Incentive leader is the dummy variable indicating a firm has significant increase in its *Delta* incentive pay to the CEO. Incentive peer is the dummy variable indicating a firm has strong economic link with incentive leaders but no significant increase in CEO pay incentive. Before defining the incentive leader and peer, we first follow exactly the same approach of Coles et al. (2006) to construct the CEO *Delta*.

- Ln(*Delta*): Logarithm of one plus the dollar change in CEO wealth associated with a 1% change in the firm's stock price (in $000s).

We then identify incentive "Leader" and "Peer" for each year during the period 1992–2014. We classify firms into 48 industries following Fama and French (1997) classifications. An industry must have at least ten firms in a year to be included in the sample. To identify *Delta* leaders and peers, we first define *Delta* increase events for industries. An industry has a *Delta* increase event if its aggregate *Delta* growth rate is greater than 10% in a given year. This accounts for approximately 35% of industry-year observations in the whole sample. Then, within an identified industry year, we define *Delta* leaders as those firms that have *Delta* growth rates ranked among the top 10% (or top 5, whichever has the larger number of firms) in the industry. We define the remaining firms in the identified industry, excluding those classified as *Delta* leaders during the previous three years, as peers. For the industry years without significant average increase in CEO *Delta* incentive, all firms are classified as non-event firms.

- *Leader*: A dummy equal to 1 if the firm belongs to an industry year that experiences a *Delta* increase event and the firm is a *Delta* leader. We define *Leaders* as those firms with *Delta* growth rates ranking among the top 10% in the industry.

- *Peer*: A dummy equal to 1 if the firm belongs to an industry year that experiences a *Delta* increase event and the firm is not a *Leader* during the current year. We exclude those classified as leaders during the previous three years.

Thus, our sample contains three types of firms: incentive leaders, peers, and non-event firms. To isolate the marginal impact of CEO incentive spillover, we also control other firm characteristics. These variables include firm's own market capitalization (ln(size)), the book-to-market ratio (B/M), R&D expenditure, sales growth, capital expenditure (CAPEX), and the cumulative monthly stock returns during the previous 11 months from month t-1 to month t-11. We define all firm characteristics in the appendix.

Table 1 reports the summary statistics of sample firms from 1992 to 2014. The firm-year sample contains 21056 observations, including 843 observations for *Delta* incentive leaders and 7560 as incentive peers. The incentive leaders and peers account for almost 35% of the full sample. Table 1 also presents the CEO and firm characteristics for all three types of firms: incentive leaders, peers, and non-event firms. More importantly, we tests the significance of the differences in the mean characteristics of three types of firms.

First, the comparison in Table 1 reveals that consistent with our definition, incentive leaders have a significantly higher *Delta* growth than that of the other two types of firms. Specifically, the increase in the level of *Delta* ($\Delta Delta$) for leaders is more than 10 times larger than that for peers (716.135 versus 68.948). Consequently, the *Delta* incentive in leaders becomes 86.33% higher than peers (1423.9 versus 764.2) and 106.28% higher than non-event firms (1423.9 versus 690.8). In contrast, the *Delta* growth difference between peers and non-event firms is only marginally significant (68.948-(-89.234)=158.182). As a consequence, the *Delta* incentive difference between peers and non-event firms is insignificant (764.2 versus 690.8). Thus, the *Delta* increase event in industries is actually driven by the small group of incentive leaders. Table 1 also indicates *Delta* incentive event firms (leaders and peers) are firms with larger market capitalization than non-event firms.

Moreover, the comparison of firm characteristics across types of firms gives the preliminary tests on the two explanations of the positive incentive spillover. Based on the first explanation, if the positive incentive spillover is due to peer firms' additional investment in R&D, we expect a contemporaneous R&D increase in peers. However, Table 1 indicates that there is no significant difference in R&D changes (ΔR&D) across three types of firms (0.002 for leaders versus 0.002 for peers and 0.001 for non-event firms), casting doubt on the first explanation[2].

In contrast to firm investment, the operating efficiency and sales growth for leaders are significantly higher than non-event firms. The high operating efficiency of *Delta* incentive leaders is consistent with McConnell and Servaes (1990), Lilienfeld-Toal and Ruenzi (2014), and McConnell et al. (2008): *Delta* incentive drives CEOs to focus on running their firms more efficiently rather than investing more in R&D expenditure. More importantly, Table 1 indicates that the CEOs in peers run their firms more efficiently than CEOs in non-event firms even without significantly higher *Delta* incentive than CEOs in non-event firms. Without significantly higher incentive, what is the driving force for CEOs to run their firms more efficiently? As argued in our second explanation, it is due to peer CEOs' extra effort as a response to the competitive pressure from leaders. To better test our second explanation, we construct proxies for CEOs' characteristics in Section 3.2.

3.2 CEOs' Characteristics

The validation of the second explanation requires peer CEOs' response to leaders' competitive pressure. Peer CEOs have heterogeneity which can generate different responses to incentive leaders' competitive pressure. To explore the impact of this heterogeneity on incentive spillover effect, we first construct four CEOs' characteristics (managerial score, CEO overconfidence, CEO age, and CEO tenure) and then interact them with the CEO peer dummy.

Managerial score[3] (Demerjian et al. (2012)), as a measure of CEOs' extra effort and ability, can affect the degree of incentive spillover because it captures the peer CEOs' ability to respond to the competitive pressure from incentive leaders. CEOs' personal characteristics such as overconfidence and age, relates to their risk taking (e.g., Coles et al. (2006); Graham et al. (2013); Holmström (1999); Serfling (2014)) and thus impacts CEOs' action to incentive

[2]The levels of R&D and capital expenditure also have no significant difference across three types of firms.

[3]The construction of managerial score is in Appendix A.2.

leaders.

Table 1 presents the managerial score (MGscore) across different types of firms. Even though leader and peer firms have no significant difference in managerial score, firms in event industries (leader and peer) have significantly higher managerial scores than firms in non-event industries, indicating that higher *Delta* incentive contracts are allocated to CEOs with higher level of effort and ability (0.025 and 0.024 versus 0.009). More importantly, the average MGscore for peers is almost three times as large as that for non-event firms (0.024 versus 0.009). In other words, peer CEOs have more effort and better ability to competitive pressures than CEOs from non-event firms.

To interact the managerial score with the incentive peer variable, we create the following dummy variables high and low managerial score peers.

- *Low Managerial Score Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with low (below-median) managerial score.
- *High Managerial Score Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with high (above-median) managerial score.

Based on our second explanation, CEOs with higher (lower) effort and managerial ability respond more efficiently (negatively) to the competitive pressure brought in by incentive leaders. If the second explanation holds, we expect to see that the spillover effect concentrates in the group of peers with higher CEO managerial score. We test this hypothesis in Section 3.

The other three CEOs' personal characteristics which can affect CEOs' decision making are defined as follows:

- *Managerial Overconfidence*: CEOs as overconfident if they held options that were fully vested five years before expiration and were at least 67% in the money (Malmendier and Tate (2003) and Malmendier and Tate (2005)).
- *Age*: Logarithm of one plus the CEO age.

- *Tenure*: Logarithm of one plus the number of years from the first year when the CEO became the CEO of the current company.

To explain the influence of CEOs' personal characteristics on the incentive spillover effect, we interact these characteristics with incentive peer dummy variable to generate new dummy variables representing peers with high and low characteristics[4].

3.3 Industry Similarity

The theory of industry organization predicts that under competitive pressure from leaders, peer CEOs allocate their extra effort in increasing their product differentiation. We employ the industry similarity measure[5] (Hoberg and Phillips (2015)) as the proxy for product differentiation.

- *Industry Similarity*: They calculate the firm-by-firm pairwise similarity scores by parsing the product descriptions from the firm 10Ks and forming word vectors for each firm to compute continuous measures of product similarity for every pair of firms in our sample in each year.

Higher industry similarity means low product differentiation. A negative relation between incentive peer dummy and future industry similarity supports the prediction of industry organization.

4 Empirical Results

4.1 Stock Market Performance of *Delta* Leaders and Peers

In this section, we test the hypothesis **H1** by exploring the stock market performance of *Delta* incentive leaders and that of peers in the year following their identification. We

[4]The detailed definition of peers with high and low characteristics is in Appendix A.2.

[5]The dataset is from Hoberg Data Library.

employ both portfolio approach and regression approach.

First, we use the portfolio approach to explore their market performance of incentive leaders and peers. In each calendar year, we identify incentive leaders and peers when their *Delta* incentive is released in a specific month t. To insure the incentive information is known by the public, we skip one quarter after the identification and then form equal-weighted and value-weighted portfolios for incentive leaders and peers, respectively. Specifically, after identified at month t, the portfolios of leaders and peers remain the same for the subsequent 12 months from month $t + 4$ to month $t + 15$. For the equal-weighted (value-weighted) portfolio, the average monthly portfolio returns for leaders and peers are 1.02% (0.99%) and 0.96% (0.92%), respectively. The monthly returns are all significantly different from zero at the 1% level.

We then explore their abnormal market performance by computing Carhart (1997) four-factor alpha based on the monthly time-series portfolio returns. Table 2 reports the abnormal returns and factor loadings for incentive leader and peer portfolios. The table reveals that the abnormal monthly return for equal-weighted incentive leader portfolio is 0.92% (i.e., annualized abnormal return of 11.04%). The abnormal monthly return for value-weighted incentive leader portfolio is 0.87% (i.e., annualized abnormal return of 10.44%). The abnormal returns for the incentive leader portfolio confirm previous studies such as Cooper et al. (2014) and Lilienfeld-Toal and Ruenzi (2014).

More importantly, the incentive peers also experience abnormal positive market performance. Specifically, the abnormal monthly return for equal-weighted incentive peer portfolio is 0.77% (i.e., annualized abnormal return of 9.19%). Similarly, the abnormal return for value-weighted portfolio is 0.74% (i.e., annualized abnormal return of 8.89%). The factor loadings for the two portfolios are not significantly different from each other. The portfolio alpha for peer portfolio has an even higher statistical significance than that for leader portfolio (t=4.03 for leaders versus t=6.24 for peers). Although without a significant increase in the *Delta* incentive, incentive peer firms experience comparable positive stock market performance as does the performance of incentive leaders.

One may be concerned that the positive market performance of peers is not driven by the *Delta* incentive spillover but by peers' own *Delta* or other characteristics. To address this concern, we employ regression analysis to examine the incentive spillover effect while controlling for other variables. Table 3 presents the results of Fama-Macbeth regressions. The dependent variable is the stock return during the 12-month holding period (from month $t+4$ to month $t+15$) and the main independent variables are incentive leader and peer dummy variables. To isolate the impact of leaders and peers, we include non-event firms in the regression. We include firms' own *Delta* incentive to mitigate the concern that incentive peers' positive abnormal return comes from their own *Delta*. If peer firms' abnormal return comes from incentive spillover, the explanatory power of peer firms' *Delta* cannot absorb that of the incentive peer dummy. We also control for the managerial score because one may also be concerned that peer CEOs' own ability and effort give rise to their firms' positive market performance.

Following Cooper et al. (2014) and Lilienfeld-Toal and Ruenzi (2014), we also include in the regression additional variables such as market capitalization, book-to-market ratio, and momentum. We measure market capitalization as of June in year t. Book-to-market ratio (B/M) is the ratio of equity's book value to market value at the end of fiscal year $t-1$. The momentum (MOM) is measured by the past 11-month cumulative returns.

Table 3 reports the times-series average coefficients and the corresponding t statistics using Fama-MacBeth regression of returns on incentive leader and peer dummy variables and other controls. Column (1) of Table 3 includes only leader and peer dummies as independent variables. Column (2) includes firms' own *Delta* incentive and other firm characteristics. The coefficients of incentive peer dummy are all significant at 1% level under both specifications, indicating that the positive abnormal returns of incentive peers cannot be explained by their own *Delta* or any other firm characteristics.

One may also be concerned that if peer CEOs have a high level of talent or work ethic, their firms can still experience good market performance without spillovers from leader firms. To mitigate this concern, we include in our regression the managerial score as the proxy for CEOs' ability and effort. Column (3) reports the time-series average coefficients including managerial score. Although the managerial score has a significant explanatory power on stock returns, the managerial score and incentive peer dummy neither drive out nor dominate each other. The peer dummy even has a greater statistical significance when including the managerial score. Column (4) shows that the explanatory power of peer dummy is not affected by including industry similarity as an independent variable.

Across all specifications, the coefficients of incentive leader dummy are significant. However, when we include leader firms' *Delta* and other control variables, the coefficients of leader become marginally significant, suggesting that the leader firms' *Delta* and other firm characteristics absorb most of the explanatory power of the incentive leader dummy. The incentive leader dummy, as an indicator of leaders' sharp increase in *Delta*, contains no additional information other than leader firms' *Delta*.

In unreported results, we also include in the regressions sales growth, R&D growth, industry momentum, and change in *Delta* as control variables. The results are highly comparable to the ones in Table 3. Because the explanatory power of these additional variables is trivial in our sample, we ignore these additional results for brevity.

To sum up, the results in Tables 2 and 3 reveal that the substantial *Delta* incentives increase in leader firms gives rise to the abnormal positive market performance of peer firms within the same industry.

4.2 Category Learning *vs* Strong Fundamentals

This section inspects the mechanism for incentive peer firms' abnormal returns by testing hypotheses **H2a** and **H2b**. To identify the exact channels, we explore the real effects of incentive spillover on peers' fundamentals. We use three measures of firm fundamentals by going from the top to the bottom of the income statement. Sales are on the top of the income statement. We use sales growth to capture the firms' market expansion. Gross profitability (Novy-Marx (2013)) and return on assets (ROA) incorporate cost of goods sold (COGS) and we use them to gauge firms' operating performance. We use the Fama-MacBeth regression approach. For each regression, the dependent variable is one of the three fundamental measures in the subsequent year. The main independent variables are the *Delta* incentive leader and peer dummies. The rest of the control variables are the corresponding lagged fundamental measure, sales, R&D, and capital expenditure (CAPEX).

Table 4 reports corresponding coefficients for the Fama-MacBeth regressions. For all of the three fundamental measures, the coefficients on incentive peer dummy are significant even controlling for peer firms' own *Delta* and different firm characteristics. The results reveal that the positive abnormal returns of incentive peers come from their strong fundamentals. In contrast to that of incentive peer dummy, the coefficients of the incentive leader dummy lose its explanatory power on fundamentals when we include incentive leaders' own *Delta*. This is consistent with portfolio sorts results for incentive leaders and explains the less robust positive abnormal returns of incentive leaders.

We then test whether the positive abnormal returns of incentive peers come from investors' category learning. To capture the degree of category learning, we use proxies of investor attention. Investor attention is inversely related to category learning. With more attention allocated to one specific firm, more firm specific information can be incorporated in the stock price. Following the previous literature (Chichernea et al. (2015); Hou and Moskowitz (2005); Jiang et al. (2015); Lehavy and Sloan (2005)), we use analyst coverage, institutional ownership, and advertising expense as proxies for investor attention. Stocks with high analyst coverage, high institutional ownership, and high advertising expense are the ones with high investor attention and thus a low degree of category learning.

We divide the incentive peers into two groups: peers with a high degree (above the median) of investors' category learning and ones with a low degree (below the median) during the identification year. For the category learning hypothesis to hold, the high category learning peers should experience significantly higher abnormal returns than the low category learning peers. We find positive abnormal returns exist in both the high and low category learning groups. Specifically, for the equal-weighted incentive peer portfolios, the high category learning peer portfolio experiences a positive monthly abnormal return of 0.79%, while the low category learning peer portfolio has a monthly abnormal return of 0.72%. The difference in their abnormal returns is not significant. There is also no significant difference in the future fundamentals of the high and low category learning incentive peer groups. Moreover, we run Fama-MacBeth regressions of future investor attention on leaders and peers. The results reveal that there is no significant increase in incentive peers' future investor inattention.

These results indicate that the positive abnormal returns of incentive peers is unlikely due to investors' category learning but comes from the incentive peers' strong fundamentals. The natural next question is: what leads to the strong fundamentals of incentive peers?

4.3 Incentive Spillover *vs* Technology Spillover

Two alternative explanations exist for the peer firms' strong fundamentals: R&D spillover and incentive spillover. To test the R&D spillover hypothesis, we divide the incentive peer firms into two groups in the identification year: the high R&D incentive peers with higher than median R&D expenditure in the peer identification year and the low R&D incentive peers. If CEOs' extra effort relates to higher R&D expenditure, the abnormal returns and fundamentals of high and low R&D incentive peers will differ. However, we find no specific differences in abnormal returns and fundamentals of high and low R&D incentive peer portfolios. Moreover, Neither incentive leaders nor peers experience any significant increase in R&D investment in subsequent years, consistent with the results in Table 1. That evidence contradicts the R&D spillover hypothesis.

We then turn to the tests for incentive spillover hypothesis. CEOs in incentive peers can respond to the competitive pressure from incentive leaders through two channels: (i).

Exert extra effort in running their firms more efficiently; (ii). Increase their firms' product differentiation. We use managerial scores (MGscore) to capture peer CEOs' effort in increasing firms' operating efficiency because MGscore gauges the impact of CEOs on firms' sales/cost ratio maximization. If the incentive spillover hypothesis holds, peer CEOs with higher MGscore can respond more efficiently to the competitive pressure than those with low MGscores, consequently experiencing significantly better fundamentals and higher abnormal returns. To measure product differentiation, we use firm-level industry similarity (IndSim) following Hoberg and Phillips (2015). Higher industry similarity indicates lower product differentiation. The incentive spillover hypothesis implies that CEOs in peer firms decrease firms' product similarity to alleviate competitive pressure. Consequently, low industry similarity peers can experience better fundamentals and higher abnormal returns than can high industry similarity peers.

One common advantage of using MGscore and IndSim to test the incentive spillover hypothesis is that both measures incorporate managerial discretion. MGscore is driven by managerial discretion because it filters out the impact of firm characteristics on firm operating efficiency and leaves only the component of operating efficiency contributing to CEOs' effort and ability. IndSim is determined by managerial discretion by considering the information in the Management Discussion and Analysis part (MD&A) which contains managers' own opinions regarding product differentiation. Therefore, both measures can gauge CEOs' effort-related improvement in firms' operation. We test the two hypotheses by using both portfolio approach and regression approach.

First, we use the portfolio approach to detect the impact of MGscore on peer firms' abnormal returns. Similar to the methods in Table 2, in each calendar year, we identify incentive peers when their *Delta* incentives are released in a specific month t. We then divide incentive peers into two groups: high MGscore and low MGscore. To insure the incentive information is known by the public, we skip one quarter after the identification and then form equal-weighted and value-weighted portfolios for high and low MGscore incentive peer groups, respectively. After the identification at month t, we carry the portfolios of high and low MGscore for 12 months from month $t+4$ to month $t+15$ and calculate the return difference between the two portfolios.

Table 5 presents the corresponding results. For the equal-weighted high MGscore peer portfolio, the monthly average abnormal return is 1.11% ((i.e. annualized abnormal return of 13.37%). In contrast, the monthly average alpha for equal-weighted low MGscore peer portfolio is only 0.53% (i.e. annualized abnormal return of 6.36%). The average monthly return for the high MGscore portfolio is more than twice as much as that for the low MGscore portfolio. The monthly average abnormal return difference between the high and low MGscore peer portfolios is 0.58% (i.e. annualized return of 7.01%) with the t statistics of 4.85. The value-weighted high and low MGscore peer portfolios yield similar results. Specifically, the magnitude of value-weighted monthly average abnormal return difference is 0.577%, similar to that of equal-weighted difference.

To examine whether the explanatory power of MGscore on peer portfolio returns is independent from the explanatory power of other firm and CEO characteristics, we use regression analysis by adding additional control variables. Following Fama and MacBeth (1973), we perform yearly cross-sectional regressions and then compute the time-series average of the coefficients. The dependent varaible is annualized stock returns accumulated from month $t+4$ to month $t+15$. The main independent variables are HighMGscorePeer and LowMGscorePeer. HighMGscorePeer is a dummy variable for peers with an above-median managerial score. LowMGscorePeer is a dummy variable for peers with a below-median managerial score. Based on incentive spillover hypothesis **H2b** and the baseline results in Table 5, we expect HighMGscorePeer has a much stronger explanatory power than that of LowMGscorePeer.

Table 7 presents the average coefficients of Fama and MacBeth regressions with the corresponding t statistics. The control variables are defined the same as those in Table 3. Consistent with the portfolio sort results and incentive spillover hypothesis, HighMGscorePeer has a strong positive explanatory power on peer firms' future stock returns. In contrast, LowMGscorePeer has an insignificant influence on peer firms' future returns when controlling for additional variables. These results augment the findings in Tables 3 and 4 by revealing that peer firms' abnormal returns come from peer CEOs' extra effort and ability. In other words, peer CEOs who exert extra effort and ability to firms perform better to competitive pressure brought in by incentive leaders. To reinforce this argument, we also test whether HighMGscorePeer and LowMGscorePeer have real effects on firm fundamentals.

Table 9 reports the results of Fama and MacBeth regressions of firm fundamentals on HighMGscorePeer and LowMGscorePeer. Again, we still use sales growth, gross profitability, and return on assets to capture various aspects of fundamentals. Across all specifications, HighMGscorePeer has a strong positive relationship with a firm's future fundamentals even controlling for lagged one period's firm fundamentals (AutoLag). Thus, peer CEOs' high effort and ability in firms' operation is the origin of peer firms' strong fundamentals and positive abnormal returns.

Although we set the release date for CEO incentive to be three months ahead of the date we construct MGscore, one may still be concerned that the time length is not sufficient for CEOs to exert their extra effort in firms' operation. To mitigate this concern, we explore peer CEOs' future effort, that is, their MGscore in the next year. We perform Fama-MacBeth regression of CEOs' future MGscore on *Delta* incentive leader, peer dummies and also other control variables. Table 11 reveals that peer CEOs exert significantly more effort in the future even controlling for various firm characteristics. The pattern in Table 11 is also consistent with Gorton et al. (2014) and Lilienfeld-Toal and Ruenzi (2014), implying market prices cannot fully reflect the future effort of CEOs.

We then explore the impact of product differentiation on peer firms' abnormal returns by using the exact same approach as that for MGscore. Again, we first discuss the portfolio approach. In each calendar year after we identify incentive peers, we divide peers into two groups: peers with industry similarity (IndSim) above- and below-median. We skip one quarter after the identification of peers and then form equal-weighted and value-weighted portfolios for high and low IndSim incentive peer groups, respectively. After the identification at month t, we carry the portfolios of high and low MGscore for 12 months from month $t+4$ to month $t+15$ and calculate the return difference between the two portfolios.

Table 6 reports the portfolio sort results for product differentiation. For equal-weighted high IndSim peer portfolio, the monthly average abnormal return is 0.669%. In contrast, the monthly average alpha for equal-weighted low IndSim peer portfolio is 0.993%. That is, the equal-weighted portfolio of low IndSim (high product differentiation) outperforms that of high IndSim (low product differentiation) of 0.325% with the t statistics of 2.46. The results are consistent with our incentive spillover hypothesis that incentive peer CEOs improve their firms' market performance by increasing product differentiation.

Table 8 confirms the results in Table 6 by using Fama-MacBeth regressions of returns on high and low IndSim peer dummies. It is shown in Table 8 that the positive externality on peers' market performance exists only in the low industry similarity incentive peer group. Table 10 strengthens our hypothesis by showing that only the low IndSim incentive peer group has a real effect on firm fundamentals.

Table 11 explores the relationship between the incentive peer dummy and future industry similarity by performing the Fama and MacBeth regression of future industry similarity on incentive leader and peer dummies. We find peer firms' future industry similarity significantly decreases, implying CEOs in peer firms increase their product differentiation to survive in industry competition.

To sum up, the results in this section reject the technology spillover hypothesis **H3a** and support the incentive spillover hypothesis **H3b**. Peer firms' CEOs respond to competitive pressure from incentive leaders by exerting extra effort in operating efficiency and product differentiation.

4.4 Turnover Threat, CEO Characteristics, and Incentive Spillover

The previous section proves that peer CEOs' extra effort is the foundation for the positive *Delta* incentive spillover. Going one step further, the motivation hided below their extra effort is to mitigate the turnover risk coming from increased competitive pressure generated by incentive leaders. Larger turnover threat stimulates peer CEOs to exert more effort in running their firms. This section explores the hidden motivation of peer CEOs' extra effort by testing the relation between the change in CEO turnover risk and the magnitude of positive incentive spillover.

Since the ex ante change in CEO turnover risk cannot be directly estimated, we use three CEO characteristics to indirectly capture it in different aspects: CEOs' age, CEOs' tenure, and CEOs' overconfidence. Campbell et al. (2010) among others demonstrate that younger CEOs and CEOs with shorter tenure have relatively less entrenchment, thus experiencing higher turnover threat when market performance falls. We expect a negative relation between CEO turnover risk and CEO age and tenure. That is, to protect their position, peer CEOs who are younger and with shorter tenure will exert more effort to increase their firms' operation and thus to improve their firms' market performance. Moreover, Dikolli et al. (2013) shows that overconfidence can lead CEOs to choose the first best level of investment, thus giving a better response to the industry competitive pressure. We then expect a positive relation between CEO overconfidence and peer firms' fundamentals (and market performance).

We use regression approach for our analysis. Table 12 examines the effect of CEO characteristics on the firm fundamentals of incentive peers. The regression specification is similar to that used in Table 9. The dependent variable is the firm fundamentals in the subsequent year after the identification of incentive leaders and peers. As in Table 9, we include control variables such as the lagged one period firm fundamentals, size, book-to-market ratio (B/M), past returns (MOM), sales, incentive leader dummy, and CEO *Delta*. Unlike Table 9, we include two dummy variables – LowPeer and HighPeer – to classify CEO characteristics for peers. LowPeer represents peer firms with CEOs of above-median age, above-median length of tenure, and below-median confidence level. HighPeer represents peer firms with CEOs of below-median age, above-median length of tenure, and below-median confidence level.

The results in Table 12 show that, across all specifications, the coefficients for HighPeer are significantly larger than those for LowPeer. For instance, when we measure HighPeer as peers with younger CEOs, the coefficients on HighPeer are 0.004, 0.008, 0.033 respectively. The corresponding t statistics are all significant at 1% level. In contrast, when we measure LowPeer as peers with older CEOs, the coefficients are 0.002, 0.002, and 0.017 respectively with insignificant t statistics. The differences in coefficients (0.002, 0.006, 0.016) are all significant at 1% level. Therefore, the peers with younger CEOs, shorter tenures, and higher confidence level outperform those with older CEOs, longer tenure, and lower confidence level in operating performance. These results are consistent with our hypothesis that peer firms with CEOs facing higher turnover threat experience more positive externality from incentive leaders.

4.5 Robustness Checks

In this section, we perform multiple robustness checks by considering two alternative methods to define *Delta* incentive leaders and peers.

First, when we define the *Delta* incentive increase event industry, we use 15% (instead of 10%) aggregate *Delta* growth rate in a given year for industries as the absolute cutoff. We then define incentive leaders and peers as before. Second, instead of using absolute cutoff for *Delta* increase industry, we define an industry to be a *Delta* increase industry if, in a given year, its aggregate *Delta* increase is ranked among the top six in the 48 industries. The incentive leaders and peers are defined as before.

We perform portfolio sorts, stock return regressions, and operating performance regressions with the sample created using these two alternative methods. The results are even stronger than those presented in Tables 2 to 12. We only describe the tests and results here without presenting the tabulated results for brevity. The tabulated results are available upon request.

5 Conclusions

The impact of *Delta* incentive increase in one firm goes beyond the firm itself. This study documents that one firm's increase in its CEO's *Delta* incentive results in its peer firms' improvement in market performance. Even though previous literature argues that one firm's *Delta* incentive increase has a negative externality on its peer firms' corporate governance, our findings suggest the increase has a positive externality on peer firms' market performance.

We find the positive externality comes from CEOs' effort spillover. Specifically, the incentive increase in leader firms stimulates their CEOs to exert more effort to run their firms more efficiently and increase the industry competition. The increased competitive pressure consequently raises up the turnover threat for peer firms' CEOs. To mitigate the threat of turnover, peer CEOs also exert more effort in their firms' operating efficiency and product differentiation. Peer CEOs' effort results in peer firms' strong fundamentals and good market performance. Further, we find evidence that peer CEOs' effort level is related to the degree of their turnover threat. More turnover threat sitmulates more effort from CEOs and thus stronger firm fundamentals.

Appendix A Variable Definitions

A.1 Firm Characteristics

The stock return and accounting data are from the CRSP and COMPUSTAT. We exclude financial (SIC 6000-6999) and utility (SIC 4900-4999) stocks. We winsorize all continuous variables at 1% and 99% levels to ensure that our results are not driven by outliers. We apply the log transformation to most variables to make them more symmetrically distributed.

- *Capex*: Capital expenditure, the ratio of capital expenditures (CAPX) to total assets.
- *R&D*: Research and development expenditure (XRD, replaced by 0 when missing) divided by total assets.
- *Sales*: The logarithm of *Sales* (e.g., Coles et al. (2006)).
- *Ret*: The next-month stock returns.
- *Market Cap*: The logarithm of market capitalization.
- *B/M*: The ratio of the book value of equity to the market value of equity.
- *Mom*: The 11-month cumulative return up to one month ago.

A.2 Interaction Terms with Peers

- *Low Similarity Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with low (below-median) industrial similarity.
- *High Similarity Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with high (above-median) industrial similarity.
- *Older Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with older manager.

- *Younger Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with younger manager.
- *Shorter Tenured Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with shorter tenured manager.
- *Longer Tenured Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with longer tenured manager.
- *Less Confident Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with less confident manager.
- *More Confident Peer*: A dummy variable that takes the value of 1 if a firm is a Peer with more confident manager.

Appendix B Construction of Managerial Score

To estimate the managerial score, we first estimate the firm efficiency for each of the Fama and French (1997) 48 industry groups. We follow Demerjian et al. (2012) to estimate firm efficiency within industries, comparing the sales generated by each firm, conditional on the following inputs used by the firm: Cost of Goods Sold (COGS, Selling and Administrative Expenses (SG&A), Net PP&E (PPE), Net Operating Leases (OL), Net Research and Development (R&D), Purchased Goodwill (GW), and Other Intangible Assets:

$$max_v \Theta = \frac{Sales}{(v_1 COGS + v_2 SG\&A + v_3 PPE + v_4 OL + v_5 R\&D + v_6 GW)}. \quad (1)$$

The firm efficiency measure, Θ, takes a value between 0 and 1, reflecting constraints in the optimization program. We then run the following regression by industry:

$$\Theta_i = \alpha_0 + \alpha_1 TA_i + \alpha_2 MS_i + \alpha_3 FCF_i + \alpha_4 Age_i + \alpha_5 Conct_i + \alpha_6 FC_i + Year_i + v_i, \quad (2)$$

where Θ is the firm efficiency measure; TA is the total assets; MS stands for the market share; FCF is the free cash flow; Age is the firm age; Conct is the business segment concentration; FC is the foreign currency indicator. The residual of the above regression in Demerjian et al. (2012) is largely attributable to the manager and is defined as managerial ability.

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Table 1: Summary Statistics

This table presents the summary statistics of sample firms for the period from 1992 to 2014. Panel A reports the summary statistics of CEO characteristics. *Delta* is the CEO *Delta* incentive in year t. $\Delta Delta$ is the growth in *Delta* from year $t-1$ to year t. MGscore is the managerial score capturing CEOs' extra effort and ability. IndSim is the industry similarity as defined in Hoberg and Phillips (2015). Confidence is the dummy variable which equals to one if the CEO is overconfident and equals to zero elsewhere. Panel B reports the summary statistics of firm characteristics. $GP(t+1)$ is the firm's gross profitability in year $t+1$. $ROA(t+1)$ is the return on equity in year $t+1$. ΔSales is the sales growth from year $t-1$ to year t. CAPEX is the capital expenditure in year t. Log(Sales) is the level of sales in year t. R&D is the research and development expenditure divided by total assets. ΔR&D is the R&D growth from year $t-1$ to year t. B/M is the book–to–market equity. Columns (1) through (3) report the summary statistics for leader, peer, and non-event firms, respectively. Columns (4) through (6) report the differences in mean for the three types of firms in the sample. The t statistics for the differences in mean are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) Leader	(2) Peer	(3) Non-Event	(1)–(2)	(1)–(3)	(2)–(3)
Panel A: CEO Characteristics						
Delta	1423.919	764.161	690.281	659.758***	733.638***	73.88
$\Delta Delta$	716.135	68.948	-89.234	647.187***	805.369***	158.182**
MGscore	0.025	0.024	0.009	0.001	0.016***	0.015***
IndSim	6.269	5.411	5.171	0.858***	1.098***	0.24
Confidence	0.494	0.471	0.382	0.023	0.112	0.089**
Panel B: Firm Characteristics						
GP(t+1)	0.288	0.293	0.283	-0.005	0.005	0.01
ROA(t+1)	0.057	0.048	0.042	0.009	0.015	0.006
B/M	0.472	0.491	0.507	-0.019	-0.035	-0.016
Size	9178.362	7557.419	7405.794	1620.943***	1772.569***	151.625
ΔSales	0.168	0.127	0.068	0.041***	0.102***	0.059***
Log(Sales)	7.876	7.624	7.767	0.252	0.109	-0.143
R&D	0.015	0.015	0.013	0	0.002	0.002
ΔR&D	0.002	0.002	0.001	0	0.001	0.001

Table 2: Performance of the Portfolios of Leaders and Peers

This table reports the abnormal returns for equal- and value-weighed portfolios of incentive leaders and peers. To form portfolios for incentive leaders and peers, we skip one quarter after their identification. Specifically, after identified at month t, the portfolios of leaders and peers remain the same for the subsequent 12 months from month $t+4$ to month $t+15$. The abnormal returns are estimated using Carhart (1997) four-factor model. MKTRF, SMB, HML, and UMD are the market excess return, the size, book-to-market, and momentum factors from Kenneth French's website. The Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Equal–Weighted		Value–Weighted	
	Leader	Peer	Leader	Peer
Alpha	0.919	0.766	0.871	0.741
	(4.03)***	(6.24)***	(3.90)***	(6.11)***
MKTRF	1.085	0.993	1.072	0.988
	(19.89)***	(33.49)***	(20.06)***	(33.76)***
SMB	0.467	0.304	0.442	0.269
	(6.69)***	(7.96)***	(6.46)***	(7.14)***
HML	0.666	0.558	0.639	0.542
	(9.12)***	(14.00)***	(8.93)***	(13.78)***
UMD	-0.133	-0.131	-0.131	-0.126
	(-3.02)***	(-5.38)***	(-3.02)***	(-5.31)***

Table 3: Fama-MacBeth Regressions of Stock Returns

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine stock returns to incentive leaders, peers and non-event firms. The dependent variable is the annual stock returns from month $t+4$ to month $t+15$. The main independent variables are leader and peer. Leader is the dummy variable for CEO *Delta* incentive leaders. Peer is the dummy variable for incentive peers. Ln(Delta) is the natural logarithm of CEO *Delta* incentive. Ln(Size) is the natural logarithm of market capitalization. B/M is the book to market ratio. MOM is the cumulative monthly return of past 11 months up to one month ago. MGscore is the managerial score. IndSim is the industry similarity. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Intercept	0.981	1.35	1.322	1.842
	(3.11)***	(1.16)	(1.09)	(1.42)
Leader	0.377	0.312	0.396	0.381
	(1.88)*	(1.79)*	(1.99)**	(1.89)*
Peer	0.279	0.321	0.368	0.351
	(2.98)***	(3.77)***	(4.22)***	(3.94)***
Ln(Delta)		0.133	0.051	0.126
		(4.17)***	(1.79)*	(3.52)***
Ln(Size)		-0.191	-0.083	-0.137
		(-1.47)	(-1.10)	(-1.76)*
B/M		0.716	0.892	0.529
		(4.82)***	(5.60)***	(3.50)***
MOM		-0.632	-1.213	-1.721
		(-0.23)	(-0.41)	(-0.55)
MGscore			2.481	
			(7.61)***	
IndSim				0.039
				(1.43)
R^2	0.006	0.067	0.071	0.069

Table 4: Fama-MacBeth Regressions of Fundamentals

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine firm fundamentals to incentive leaders, peers and non-event firms. The dependent variables are the firm fundamentals measures after the identification of CEO incentive leaders and peers. We use three firm fundamentals measures to capture different aspects of firms' operation: sales growth (SalesGrowth), gross profitability (GP), and return on assets (ROA). The main independent variables are leader and peer. Leader is the dummy variable for CEO *Delta* incentive leaders. Peer is the dummy variable for incentive peers. Ln(Delta) is the natural logarithm of CEO *Delta* incentive. Ln(Sales) is the natural logarithm of sales. R&D is research and development expenditure. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	GP		ROA		Sales Growth	
	(1)	(2)	(1)	(2)	(1)	(2)
Auto Lag	0.671	0.677	0.216	0.243	0.004	0.013
	(26.18)***	(26.36)***	(5.28)***	(5.92)***	(0.1)	(0.3)
Leader	0.002	0.006	0.008	0.014	0.021	0.035
	(0.44)	(3.45)***	(3.57)***	(2.74)***	(1.41)	(2.48)**
Peer	0.003	0.003	0.006	0.009	0.018	0.022
	(2.76)***	(2.77)***	(2.94)***	(2.63)***	(3.90)***	(4.53)***
Ln(Delta)	0.004		0.011		0.025	
	(0.34)		(6.38)***		(6.37)***	
Ln(Sales)	-0.013	-0.013	-0.012	-0.008	-0.239	-0.228
	(-3.8)***	(-3.72)***	(-3.04)***	(-2.06)**	(-12.33)***	(-12.15)***
R&D	0.151	0.149	0.408	0.409	-0.042	-0.071
	(1.60)	(1.6)	(3.01)***	(2.97)***	(-0.16)	(-0.27)
CAPEX	-0.144	-0.143	0.076	0.092	-0.234	-0.175
	(-2.83)***	(-2.84)***	(1.49)	(1.80)*	(-1.70)*	(-1.3)
R^2	0.451	0.451	0.82	0.823	0.376	0.371

Table 5: High and Low MGscore Peer Portfolio Performance

This table reports the abnormal returns for equal- and value-weighed portfolios of incentive peers with high and low managerial score. To form portfolios for high and low managerial score incentive peers, we skip one quarter after their identification. Specifically, after the identification of incentive peers at month t, we divide incentive peers into two groups: the peers with lower than median managerial scores (LowMGPeer) and the ones with higher than median managerial scores (HighMGPeer) in the identification year. The portfolios of LowMGPeer and HighMGPeer remain the same for the subsequent 12 months from month $t+4$ to month $t+15$. The abnormal returns are estimated using Carhart (1997) four-factor model. MKTRF, SMB, HML, and UMD are the market excess return, the size, book-to-market, and momentum factors from Kenneth French's website. The Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Equal-Weighted			
	LowMGPeer	HighMGPeer	H-L
Alpha	0.525	1.114	0.589
	(3.85)***	(7.42)***	(4.85)***
MKTRF	1.016	1.008	-0.008
	(30.84)***	(27.77)***	(-0.29)
SMB	0.392	0.347	-0.045
	(9.24)***	(7.43)***	(-1.19)
HML	0.535	0.478	-0.057
	(12.08)***	(9.79)***	(-1.45)
UMD	-0.209	-0.073	0.136
	(-7.79)***	(-2.48)**	(5.67)***
Panel B: Value-Weighted			
	LowMGPeer	HighMGPeer	H-L
Alpha	0.507	1.083	0.577
	(3.78)***	(7.32)***	(4.86)***
MKTRF	1.009	1.003	-0.006
	(31.14)***	(28.06)***	(-0.2)
SMB	0.351	0.312	-0.038
	(8.40)***	(6.79)***	(-1.03)
HML	0.515	0.459	-0.055
	(11.81)***	(9.55)***	(-1.44)
UMD	-0.206	-0.068	0.139
	(-7.82)***	(-2.33)**	(5.94)***

Table 6: High and Low IndSim Peer Portfolio Performance

This table reports the abnormal returns for equal- and value-weighed portfolios of incentive peers with high and low industry similarity. To form portfolios for high and low industry similarity incentive peers, we skip one quarter after their identification. Specifically, after the identification of incentive peers at month t, we divide incentive peers into two groups: the peers with lower than median industry similarity (LowIndSimPeer) and the ones with higher than median managerial scores (HighIndSimPeer) in the identification year. The portfolios of LowIndSimPeer and HighIndSimPeer remain the same for the subsequent 12 months from month $t + 4$ to month $t + 15$. The abnormal returns are estimated using Carhart (1997) four-factor model. MKTRF, SMB, HML, and UMD are the market excess return, the size, book-to-market, and momentum factors from Kenneth French's website. The Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Equal-Weighted			
	High	Low	L-H
Alpha	0.669	0.993	0.325
	(4.94)***	(6.35)***	(2.46)**
MKTRF	1.016	0.978	-0.038
	(32.17)***	(29.76)***	(-1.07)
SMB	0.415	0.215	-0.201
	(10.31)***	(5.14)***	(-4.36)***
HML	0.581	0.625	0.045
	(13.51)***	(14)***	(0.92)
UMD	-0.131	-0.116	0.014
	(-5.07)***	(-4.35)***	(0.48)
Panel B: Value-Weighted			
	High	Low	L-H
Alpha	0.645	0.963	0.318
	(4.82)***	(6.23)***	(2.32)**
MKTRF	1.016	0.973	-0.043
	(32.48)***	(30.11)***	(-1.19)
SMB	0.381	0.185	-0.195
	(9.56)***	(4.5)***	(-4.28)***
HML	0.568	0.606	0.038
	(13.36)***	(13.78)***	(0.78)
UMD	-0.126	-0.115	0.011
	(-4.96)***	(-4.40)***	(0.36)

Table 7: Fama-MacBeth Regressions of Returns on High and Low Managerial Score Peers

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine stock returns to incentive leaders, peers and non-event firms. The dependent variable is the annual stock returns from month $t + 4$ to month $t + 15$. The main independent variables are leader and peer. Leader is the dummy variable for CEO *Delta* incentive leaders. HighMGscorePeer is the dummy variable indicating incentive peers with higher than median managerial score in the identification year. LowMGscorePeer is the dummy variable indicating incentive peers with lower than median industry similarity in the identification year. Ln(Delta) is the natural logarithm of CEO *Delta* incentive. Ln(Size) is the natural logarithm of market capitalization. B/M is the book to market ratio. MOM is the cumulative monthly return of past 11 months up to one month ago. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	y=Ret_{t+1}
Intercept	1.241
	(1.06)
Leader	0.546
	(2.35)**
HighMGscorePeer	0.682
	(5.66)***
LowMGscorePeer	0.072
	(0.79)
Ln(Delta)	0.121
	(3.87)***
Ln(Size)	-0.092
	(-1.33)
B/M	0.757
	(5.17)***
MOM	-0.932
	(-0.34)

Table 8: Fama-MacBeth Regressions of Returns on High and Low industry Similarity Peers

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine stock returns to incentive leaders, peers and non-event firms. The dependent variable is the annual stock returns from month $t+4$ to month $t+15$. The main independent variables are leader and peer. Leader is the dummy variable for CEO *Delta* incentive leaders. HighIndSimPeer is the dummy variable indicating incentive peers with higher than median industry similarity in the identification year. LowIndSimPeer is the dummy variable indicating incentive peers with lower than median industry similarity in the identification year. Ln(Delta) is the natural logarithm of CEO *Delta* incentive. Ln(Size) is the natural logarithm of market capitalization. B/M is the book to market ratio. MOM is the cumulative monthly return of past 11 months up to one month ago. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	y=Ret_{t+1}
Intercept	1.391
	(-1.20)
Leader	0.512
	(2.40)**
LowIndSimPeer	0.366
	(2.90)***
HighIndSimPeer	0.245
	(1.94)*
Ln(Delta)	0.131
	(4.17)***
Ln(Size)	-0.126
	(-1.51)
B/M	0.712
	(4.76)***
MOM	-0.627
	(-0.23)

Table 9: Fama-MacBeth Regressions of Fundamentals on Managerial Scores

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine firm fundamentals to incentive leaders, peers with high MGscore, and peers with low MGscore. The dependent variables are the firm fundamentals measures in the subsequent year after the identification of CEO incentive leaders and peers. We use three firm fundamentals measures to capture different aspects of firms' operation: sales growth (SalesGrowth), gross profitability (GP), and return on assets (ROA). The main independent variables are dummy variables indicating peers with above- and below-median managerial score (HighMGscorePeer and LowMGscorePeer). Auto Lag is the corresponding lagged one period fundamentals. For instance, Auto Lag for the regression of GP is the lagged one period GP. Leader is the dummy variable for CEO *Delta* incentive leaders. Ln(Delta) is the natural logarithm of CEO *Delta* incentive. Ln(Sales) is the natural logarithm of sales. R&D is research and development expenditure. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	GP	ROA	SalesGrowth
Auto Lag	0.67	0.212	0.004
	(26.06)***	(5.21)***	(0.09)
Leader	0.002	0.009	0.021
	(0.44)	(1.59)	(1.42)
HighMGscorePeer	0.004	0.009	0.037
	(2.93)***	(4.56)***	(3.41)***
LowMGscorePeer	0.002	-0.001	0.021
	(1.81)*	(-0.16)	(1.11)
Ln(Delta)	0.004	0.011	0.025
	(0.36)	(6.34)***	(6.45)***
Ln(Sales)	-0.013	-0.012	-0.239
	(-3.81)***	(-3.14)***	(-12.28)***
R&D	0.151	0.402	-0.041
	(1.61)	(2.98)***	(-0.16)
CAPEX	-0.142	0.071	-0.231
	(-2.81)***	(1.41)	(-1.68)*
R^2	0.451	0.82	0.376

Table 10: Fama-MacBeth Regressions of Fundamentals on Industry Similarity

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine firm fundamentals to incentive leaders, peers with high industry similarity, and peers with low industry similarity. The dependent variables are measures of the firm fundamentals in the subsequent year after the identification of CEO incentive leaders and peers. We use three firm fundamentals measures to capture different aspects of firms' operation: sales growth (SalesGrowth), gross profitability (GP), and return on assets (ROA). The main independent variables are dummy variables indicating peers with above- and below-median industry similarity (HighIndSimPeer and LowIndSimPeer). Auto Lag is the corresponding lagged one period fundamentals. For instance, Auto Lag for the regression of GP is the lagged one period GP. Leader is the dummy variable for CEO *Delta* incentive leaders. Ln(Delta) is the natural logarithm of CEO *Delta* incentive. Ln(Sales) is the natural logarithm of sales. R&D is research and development expenditure. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	GP	ROA	SalesGrowth
Auto Lag	0.672	0.216	0.004
	(26.18)***	(5.29)***	(0.09)
Leader	0.002	0.008	0.021
	(0.46)	(1.57)	(1.43)
LowIndSimPeer	0.007	0.004	0.043
	(2.88)***	(2.62)***	(2.78)***
HighIndSimPeer	0.002	0.002	0.016
	(1.55)	(1.72)*	(1.04)
Ln(Delta)	0.004	0.011	0.025
	(0.37)	(6.41)***	(6.37)***
Ln(Sales)	-0.014	-0.012	-0.241
	(-3.88)***	(-3.06)***	(-12.32)***
R&D	0.149	0.408	-0.045
	(1.58)	(3.02)***	(-0.17)
CAPEX	-0.144	0.076	-0.233
	(-2.84)***	(1.49)	(-1.69)*
R^2	0.449	0.817	0.382

Table 11: Fama-MacBeth Regressions of MGscore and IndSim on Leader and Peer

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine future managerial score and industry similarity to incentive leaders and peers. The dependent variables are managerial score and industry similarity in the subsequent year after the identification of CEO incentive leaders and peers. The main independent variables are incentive leader and peer. Ln(*Delta*) is the natural logarithm of CEO *Delta* incentive. Ln(Sales) is the natural logarithm of sales. R&D is research and development expenditure. CAPEX is capital expenditure over total assets. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Managerial Score		Industry Similarity	
	(1)	(2)	(1)	(2)
Leader	0.025	0.018	0.002	-0.006
	(5.24)***	(3.84)***	(0.01)	(-0.04)
Peer	0.014	0.013	-0.316	-0.317
	(8.02)***	(7.39)***	(-5.68)***	(-5.69)***
Ln(Delta)		0.01		0.014
		(11.15)***		(0.52)
Ln(Sales)	0.011	0.004	0.223	0.215
	(4.29)***	(1.87)*	(3.07)***	(2.92)***
R&D	-0.129	-0.115	9.703	9.713
	(-2.15)**	(-1.92)*	(4.58)***	(4.58)***
CAPEX	0.063	0.041	0.641	0.597
	(2.49)**	(1.58)	(0.76)	(0.7)
R^2	0.64	0.645	0.85	0.852

Table 12: CEO Characteristics and Incentive Spillover

This table reports the average coefficients and corresponding t statistics of Fama-MacBeth regressions that examine firm fundamentals to incentive leaders, high and low peers. The dependent variables are the firm fundamentals measures in the subsequent year after the identification of CEO incentive leaders and peers. We use three firm fundamentals measures to capture different aspects of firms' operation: sales growth (SalesGrowth), gross profitability (GP), and return on assets (ROA). The main independent variables are dummy variables indicating peers with above- and below-median CEO characteristics in the identification year. We explore three CEO characteristics: CEO age, CEO tenure, and CEO overconfidence level. Peers with below-median CEO age, below-median tenure, and above-median over confidence level are HighPeer. Leader is the dummy variable for CEO *Delta* incentive leaders. Auto Lag is the corresponding lagged one period fundamentals. For instance, Auto Lag for the regression of GP is the lagged one period GP. Ln(Delta) is the natural logarithm of CEO *Delta* incentive. Ln(Sales) is the natural logarithm of sales. R&D is research and development expenditure. CAPEX is the captial expenditure. The reported coefficients are the time-series average of cross-sectional regression coefficients. The corresponding Newey and West (1987) adjusted t statistics with six lags are reported in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: GP			Panel B: ROA			Panel C: SalesGrowth		
	Age	Tenure	Confidence	Age	Tenure	Confidence	Age	Tenure	Confidence
AutoLag	0.669	0.669	0.669	0.216	0.216	0.216	0.004	0.003	0.004
	(26.15)***	(26.18)***	(26.15)***	(5.28)***	(5.29)***	(5.27)***	(0.09)***	(0.08)***	(0.09)***
Leader	0.002	0.002	0.002	0.009	0.009	0.007	0.024	0.025	0.018
	(0.48)	(0.47)	(0.51)	(2.62)***	(2.61)***	(2.38)**	(1.42)	(1.43)	(1.27)
LowPeer	0.002	0.001	0.003	0.002	0.002	0.002	0.017	0.015	0.016
	(1.64)	(0.35)	(1.83)*	(0.63)	(0.73)	(0.68)	(2.03)**	(1.87)*	(1.92)*
HighPeer	0.004	0.006	0.006	0.008	0.007	0.004	0.033	0.036	0.029
	(2.54)**	(2.82)***	(2.93)***	(3.23)***	(2.89)***	(3.23)***	(4.06)***	(3.45)***	(2.87)***
Ln(Delta)	0.004	0.004	0.004	0.009	0.009	0.009	0.025	0.025	0.025
	(0.31)	(0.26)	(0.33)	(6.33)***	(6.31)***	(6.46)***	(6.41)***	(6.38)***	(6.42)***
Ln(Sales)	-0.014	-0.014	-0.013	-0.012	-0.012	-0.012	-0.239	-0.24	-0.239
	(-3.82)***	(-3.86)***	(-3.81)***	(-3.12)***	(-3.05)***	(-3.03)***	(-12.38)***	(-12.39)***	(-12.31)***
R&D	0.151	0.153	0.149	0.411	0.407	0.409	-0.049	-0.039	-0.048
	(1.61)	(1.64)	(1.58)	(3.04)***	(3.01)***	(3.02)***	(-0.19)	(-0.15)	(-0.18)
CAPEX	-0.143	-0.143	-0.143	0.076	0.075	0.076	-0.233	-0.23	-0.231
	(-2.83)***	(-2.83)***	(-2.82)***	(1.49)	(1.47)	(1.49)	(-1.69)*	(-1.67)*	(-1.67)*
R^2	0.45	0.447	0.457	0.821	0.827	0.819	0.372	0.376	0.381