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Does the Market for CEO Talent Explain Controversial CEO Pay Practices?

K. J. MARTIJN CREMERS[1] and YANIV GRINSTEIN[2]
[1]*University of Notre Dame and* [2]*Cornell University*

Abstract. Benchmarking, pay for luck, and the large compensation packages given to CEOs in recent years are three major controversial compensation practices. We examine the extent to which variation in the market for CEO talent explains these practices. We find that CEO compensation is benchmarked against other firms only in industries where CEO talent is not firm-specific, and that pay for luck is more prevalent there also. These findings are consistent with theories based on the market for CEO talent. However, CEO compensation levels do not depend on whether CEO talent is firm-specific, which seems inconsistent with the talent competition argument.

JEL Classification: G34

1. Introduction

Considerable debate remains among academics and practitioners regarding the economic forces that drive CEO compensation practices in the USA. Some view the market for CEO talent as the main economic force that drives the level and form of CEO compensation (e.g., Rosen, 1992; Himmelberg and Hubbard, 2000; Hubbard, 2005; Gabaix and Landier, 2008). Others argue that these forces have little effect on CEO compensation because of frictions such as managerial entrenchment, asymmetric information, and transaction costs of replacing managers, believing instead that compensation practices are by and large driven by the bargaining power that the CEO has vis-à-vis the board (e.g., Bebchuk and Fried, 2003).

The debate has intensified in recent years due to several controversial compensation practices, a first example of which is the tendency of firms to benchmark CEO compensation to that of other CEOs. Although some find benchmarking consistent with competitive compensation (Holmstrom and Kaplan, 2003; Bizjak, Lemmon, and Naveen, 2008), others argue it is a way for CEOs to increase their compensation by benchmarking themselves to highly paid CEOs (e.g., Faulkender and Yang, 2010).

A second controversial practice that has received much attention in the literature is the tendency of firms to compensate their CEOs for firm performance that is outside their control. For example, Bertrand and Mullainathan (2001) show that when oil prices go up, oil companies tend to increase the compensation to their CEOs even though the increase in oil prices (and hence in an oil company's value) is outside the CEO's control. Bertrand and Mullainathan term this "pay for luck" and argue that this practice is driven by CEO's self-interest. Others, such as Himmelberg and Hubbard (2000), argue that this practice reflects competitive compensation practices, as it embeds both CEO performance and the change in the value of CEO talent in the market (since higher market price reflects higher marginal contribution to CEO talent and therefore the higher price for CEO talent).

A third controversial practice has been the tendency of firms to provide large compensation packages to their CEOs in recent years. Some have attributed the large increase in pay to the power that CEOs have over their boards of directors (e.g., Bebchuk and Fried, 2003). Others argue that pay has risen because the return to CEO talent has increased. In particular, Gabaix and Landier (2008) point to the fact that the considerable rise in CEO compensation is commensurate with the large increases in firm size in recent years. They then argue that since CEO talent becomes more valuable to the firm as the firm becomes larger, CEO compensation should increase with firm size, consistent with the CEO talent argument.

This study sheds new light on the role that the market for CEO talent plays in explaining these three controversial compensation practices. Our approach is to examine the extent to which these controversial practices can be explained by cross-sectional variation in the importance of firm-specific talent as compared to more generic talent that boards are looking for when choosing their CEO. Our proxy for the importance of CEO firm-specific talent is the percentage of insider CEOs in the industry in which the firm operates. Parrino (1997) uses this measure to capture the costs of hiring CEOs from outside the firm, showing that industries in which CEOs usually come from outside the firm tend to be more homogeneous in the sense that CEO talent from other firms can readily replace CEO talent from inside the firm. In contrast, industries in which CEOs tend to come from inside their own firms are more heterogeneous in nature, implying that CEO talent from inside the firm is harder to replicate.

By measuring the importance of firm-specific talent at the industry level, our proxy measures constraints faced by the board when considering a new CEO. In industries with few outside CEOs, the potential outside options of both the CEO and the firm are more limited. Furthermore, as these are industry-wide constraints they seem largely outside the control of the board. In our appendix, we make our main industry-level CEO talent proxy variable (i.e., the percentage of insider CEOs in each of the forty-eight Fama-French industry groups) available for other researchers.

Our main contribution to the literature is to consider how this industry-level proxy for the importance of the CEO having worked inside the firm can shed light on the debate over the controversial pay practices outlined above. In general, we expect CEO compensation practices to be different across industries with few versus many insider CEOs. Under the view that CEO talent drives CEO compensation, what happens at the industry level should matter less for CEO pay at firms in industries where boards typically choose insider CEOs. Under the view that the CEO's bargaining power vis-à-vis is important, CEOs in industries with mostly insider CEOs are likely to have greater bargaining power. As a result, if the controversial pay practices are driven by entrenched CEOs taking advantage of strong bargaining positions, we would expect these practices to be more prevalent in industries with few outsider CEOs. Overall, we conclude that CEO talent pools are related to marginal decisions on CEO pay (such as benchmarking and pay for luck), but we cannot find evidence that it can explain the overall rise in CEO pay.

First, we examine the practice of benchmarking. If compensation practices are driven by competition in the market for CEOs, we hypothesize that then CEO compensation should be benchmarked to that of other CEOs in the industry only when the CEO has viable employment options in the industry. We find strong evidence that benchmarking is prevalent primarily in industries in which new CEOs tend to come from outside the firm. In contrast, the compensation to the CEO is not affected by changes in the compensation of CEOs in peer firms in industries in which CEOs tend to come from inside the firm. This finding supports the important role of the market for CEO talent in affecting benchmarking and is consistent with the interpretation in Bizjak, Lemmon, and Naveen (2008).

Second, we examine the practice of paying the CEO for luck, that is, for performance that is outside the CEO's control. Our approach is to decompose stock performance into industry performance and firm-specific performance and to examine the extent to which industry performance (the component of performance outside the CEO's control) explains changes in CEO compensation. According to Holmstrom (1979), CEOs should only be paid for the part of performance that they can influence, not for the performance that can be attributed to other factors such as industry-wide shocks. However, when a CEO's outside options are associated with industry conditions, a correlation between CEO compensation and industry performance could rise naturally (Himmelberg and Hubbard, 2000; Hubbard, 2005). For example, when the industry is booming, the CEO has more options to use his or her talents in other firms; therefore the CEO should receive higher compensation. This argument thus implies that the relation between CEO compensation and industry compensation (i.e., pay for luck) depends on the extent to which the CEO has outside options in the industry.

We find evidence that "pay for luck" is strongest in industries that have the largest percentage of outsider CEOs. In contrast, the relation between firm and industry performance is weaker in industries where CEOs tend to come from inside the firm. This result is again consistent with CEO labor market competition explaining the relation between CEO compensation and industry-wide performance.

Our main robustness check is to employ an alternative measure of CEO talent pools based on the number of other publicly traded firms in the same industry that have a headquarter within 100 miles of the firm's headquarter (see Coval and Moskowitz, 1999, 2001). We argue that the outside talent pool for firms that are closer to other peer firms is likely to be larger. Likewise, top executives at public firms in a geographical area that is reasonably close to other public firms in the same industry have better potential outside options. The correlation between the percentage of insiders in the industry and the number of other public firms close by equals −16%, indicating that this alternative proxy is substantially different (though with the expected sign). Using the alternative proxy, we find strong corroborating evidence for that benchmarking is only prevalent at firms with a large local CEO talent pool or where there are better outside options in the industry close by. The results for pay for luck using the alternative proxy are similarly consistent, though with weaker statistical power.

Finally, we study the extent to which variations in the talent pool structure across industries explain the increase in CEO compensation in recent years. Building on the insight of Rosen (1992), Gabaix and Landier (2008, henceforth GL) present a model in which more talented CEOs are attracted to larger firms, predicting that changes in CEO compensation should depend both on changes in the size of the firm in which the CEO operates and changes in the size distribution of firms in the economy (capturing the productivity of talent across firms, and hence the outside opportunities of CEOs with different talents). Their specification assumes that CEO skills are substitutable across firms and that profitability is a function of skills and firm size. Therefore, in equilibrium, more talented CEOs will be attracted to larger firms. If CEO skills are less transferable across firms, then they will be less able to move to larger firms if they are more talented, and the relation between talent and firm size should be weaker. Given our findings of the importance of firm-specific skills across industries in explaining CEO compensation practices, we expect industries with more firm-specific skills to have a weaker relation between compensation and firm size.

We find very little evidence of weaker relation between compensation and firm size in industries with more firm-specific skills. (We find an effect that is statistically significant but economically meaningless.) We further examine whether the firm-size distribution at the industry level (capturing talent variation within the industry) explains variation in compensation beyond what is captured by the firm-size distribution in the whole economy. We fail to find any economic relation between firm-size distribution at the industry level and compensation levels. The relation does not exist, regardless of whether CEOs in the industry tend to come from inside or outside of the firm. These results go against the argument that the market for CEO talent is a central force in the increase in CEO compensation in recent years. Instead, our results indicate that the size of the market-wide reference firm may be a proxy for something else that is not directly related to the equilibrium model in Gabaix and Landier.

This article is closely related to Bizjak, Lemmon, and Naveen (2008), who consider both benchmarking and pay for luck, both not the role of CEO talent pools (i.e., where CEOs come from). The article is further closely related to recent papers studying how peer groups are used to set CEO pay. Faulkender and Yang (2010), Cadman and Carter (2011), and Bizjak, Lemmon, and Ngyuen (2013) consider the compensation peer groups that firms report in their proxy statements. All three papers find results suggesting that better paying firms are more likely to be selected as peers, but provide varying interpretations of that result. Our article does not study self-selected peer groups but instead focuses on the importance of the CEO talent pool. The main advantage of our main proxy of the percentage of insider CEOs in the industry is that this proxy is largely exogenous to the firm. At the same time, our results are not inconsistent with the literature on self-selected peer groups, as choosing a peer group that pays above average could reflect either rent-seeking or potentially be a way for firms to justify higher salaries if faced with a more restricted CEO talent pool.

This article continues as follows. In Section 2, we describe our data collection process and the construction of the main variables, explain talent pool structure differences across industries, and finally explore how the CEO talent pool structure is related to the level, growth, and equity-based incentives in CEO compensation. Section 3 provides the analysis of the benchmarking results, and Section 4 explores pay for luck. Section 5 shows robustness results using an alternative proxy for CEO talent pools using geography. In Section 6, we revisit the Gabaix-Landier framework, and Section 7 concludes.

2. Research Design

2.1 MEASURING CEO TALENT POOLS

The relevant pool of candidates from which directors choose a new CEO will depend on the qualifications required of the new chief executive. In particular, if the firm needs candidates with firm-specific human capital, it will prefer current senior managers from within the firm, rather than outside candidates, to replace the CEO (Becker, 1975; Parrino, 1997; Murphy and Zabojnik, 2007). In contrast, the firm is more likely to choose outside candidates when running the firm requires skills that are more homogeneous across firms (Parrino, 1997; Zhang and Rajagopalan, 2003).

The talent pool structure will, in part, depend on the industry in which the firm operates. Parrino (1997) and Agrawal, Knoeber, and Tsoulouhas (2006) find that industries in which CEOs tend to come from outside the firm are more homogeneous in the sense that CEO talent from other firms can readily replace CEO talent that exists inside the firm.[1] Zhang and Rajagopalan (2003) find that outside succession is more likely when other firms in the industry follow the same strategy as the current firm.

Our identification strategy in this study is therefore to classify industries by the percentage of new CEOs who are insiders. Following the existing literature, we expect industries in which CEOs come from inside the firm to be more heterogeneous, making the human capital of the manager in one firm less transferable to other firms. We hypothesize that, to the extent that CEO compensation is driven by supply-and-demand forces for human capital, CEO compensation in these industries will be less influenced by shocks to compensation of other CEOs in the industry.[2]

Parrino (1997) uses the mean partial correlation measure as a proxy for industry homogeneity. The mean partial correlation is the average (across all firms in an industry) partial correlation coefficient for an industry's return,

[1] See also Bailey and Helfat (2003), who find that in industries where the CEOs' human capital is more firm-specific, there is a larger variation in strategy and performance across firms.

[2] The literature has also pointed to economic frictions that lead firms to choose insider CEOs: for example, commitment to choosing insiders in order to motivate lower ranked managers to exert effort (Chan, 1996), adverse selection problems when choosing outsider CEOs (Greenwald, 1980), and managerial entrenchment (Huson *et al.*, 2001; Borokhovitch, Parrino, and Trapani, 1996; Helmich, 1974; Helmich and Brown, 1972. See also Taylor, 2010). To the extent that these frictions reduce the effectiveness of the external market for CEO talent, they should lead to similar predictions regarding insider CEOs and the weaker relation between CEO compensation and compensation of other CEOs in the same industry.

from regressing firm stock returns on a two-factor model that includes the industry return and the market return. We find that this measure has a zero correlation with our proxy based on the percentage of inside CEOs. This is different from Parrino (1997), who finds more outside CEOs in industries with more homogeneous returns in a sample for 1969–89 that does not overlap with ours.

The lack of correlation between the percentage of outside directors and the average partial correlation in the industry means that if industry-wide shocks are more important for stock performance, this does not lead boards of the firms in our sample to be more likely to appoint an outside CEO. For example, a prime example of an industry where industry-wide shocks are important drivers of stock returns is the "Petroleum and natural gas" industry, in which energy price movements can explain much stock return variation. However, we find relatively few outside CEOs in this industry (only 19% of the 52 new CEOs in our sample). This suggests that dealing with industry shocks, while common across firms in the industry, is not one of the most important talent features qualifying one for an appointment as CEO, even in industries where industry-wide shocks are critical for firm performance. Consistent with this, we also do not find that the partial correlation measure is related to the controversial pay practices studied in this article.[3]

We further employ an alternative proxy for CEO talent pools for robustness. This alternative proxy is based on the number of local peer firms, which are defined as publicly traded firms in the same industry that are headquartered within 100 miles of the firm. We use the Fama-French forty-eight industry groups for the industry classification (from Kenneth French's website). This geographical measure is the main measure for finding "local" stocks in Coval and Moskowitz (1999, 2001), and subsequently used in many papers in the literature. As information on headquarter zip codes in Compustat is very limited, we use geographical information on the county the firm is headquartered in instead. For the exact details of the construction, see Coval and Moskowitz (1999).

[3] Results are unreported to save space. An alternative interpretation of the lack of any results using the mean partial correlation measure is a lack of robustness. However, as the measures are uncorrelated, lack of results seems to be uninformative about the results using the percentage of inside CEOs in an industry. Our robustness checks for our main results include considering different controversial pay practices, controlling for and interacting with the percentage of outside CEOs from outside the industry, controlling for and interacting with the percentage of forced turnovers in the industry, and using industry or firm fixed effects.

Table I. Data construction

The table shows the construction of the database of new CEOs. The sample consists of all CEOs in the ExecuComp database between 1993 and 2005. From that sample, a subsample of new CEOs was extracted. The final sample of new CEOs consists of 1,827 persons.

Total number of Execucomp firm-years (1993–2005)	24,084
Firm-years with unidentifiable CEOs	2,745
Total number of firm-years with CEOANN	21,339
Identifying additional CEOs	2,064
Total firms with CEO info	23,403
Number of firm-years with new CEOs	1,890
No proxy information about the past experience of the CEO	63
Total number of firm-years with new CEOs that have available data	1,827

2.2 IDENTIFYING NEW CEOs

We identify the background of new CEOs in the largest public US corporations. Our universe of firms includes all firms in the ExecuComp database for the years 1993–2005. ExecuComp provides information on the five highest paid top executives for firms included in the S&P 1500 composite index (or that have belonged to it in the past). Our sample starts in 1993, the 1st year that ExecuComp collected a complete set of this data. The database consists of 24,084 firm-year observations.

We first identify the entry of new CEOs into the sample. Table I shows the identification procedure. For some firms in the database, ExecuComp identifies the executive who is the CEO (variable *ceoann*), and the year in which the CEO was appointed or reappointed (variables *becamece* and *rejoin*, respectively). Firms for which these three variables are available, we define a "new CEO" as a CEO whose year of becoming CEO or of rejoining the firm is the same as the recorded firm-year. This procedure allows us to identify whether a CEO is new in a total of 21,339 firm-years.

For firms with missing data on *becamece* and *rejoin* but for which *ceoann* is not missing, we look at whether the same executive was identified by ExecuComp as a CEO in the previous year. If a different executive was the CEO, then we define the current CEO as a new CEO. If the variable *ceoann* is also missing or if the firm was not in the database the previous year, then we read the proxy statement in that year and in the previous year to identify whether the CEO is new. This procedure allows us to identify whether the CEO is a new CEO in an additional 2,064 firm-years. Our final sample therefore consists of 23,403 firm-years or 97% of the entire ExecuComp database. Of this total number of firm-years, we identify 1,890 in which the CEO is new.[4]

2.3 IDENTIFYING CEO BACKGROUND

Securities regulation section 229.401 requires that firms provide background information in their proxy filings about each executive officer and director. This information includes each person's principal occupations and employment during the past 5 years, the name and principal business of any corporation or other organization in which such occupations and employment were carried out, and whether such corporation or organization is a parent, subsidiary, or other affiliate of the present firm.

We read the background information for each new CEO from the proxy statements and identify the name of the previous employer of the CEO and the occupation of the CEO under that employer. We are able to find proxy statement information for 1,827 out of the 1,890 new CEOs (about 97%).

In some cases, new CEOs entered the firm a few months before becoming the chief executive to ensure a smooth transition with the current CEO. We argue that the last employer of these new CEOs (i.e., before becoming CEO) should not be the current firm, since the decision to have them as CEOs was most probably made before they entered the current firm. Instead, if the CEO was affiliated with the current firm for less than 2 years, we use the previous employer and position of the CEO as the new CEO's last position before becoming CEO.[5] In other cases, boards chose interim CEOs while looking for a new, noninterim CEO. We define a CEO as an interim CEO if the firm explicitly writes in the proxy statement that the CEO is an interim CEO or if the CEO is replaced within a year of becoming CEO. As a result, "inside CEOs" are CEOs who worked for the firm for at least 2 years prior to becoming a CEO.

We also identify the four-digit SIC industry code of the new CEOs' firms as well as the new CEOs' previous employers. If the previous employer is a public firm, the industry code is taken from the Center for Research in

[4] For 3% of firm years, we could not identify whether the CEO is a new CEO in the particular year for various reasons, such as the firm does not identify who the CEO is, or the firm has more than one CEO, or the firm does not have electronic filings in that particular year. In these cases, we cannot confirm that the CEO is new.

[5] This procedure is consistent with Bailey and Helfat (2003). Parrino (1997) classifies new CEOs as those who have been in the firm for 1 year or less. When we rerun all of our regressions classifying insider CEOs in accordance with Parrino (1997), none of our results change. Reclassification affects thirteen firms in our sample.

Security Prices (CRSPs) header file. If the employer is a private firm, the code is taken from the Hoover's database. In the few cases where the information is not available in CRSP or in Hoover's, we assign an industry code based on the SIC code description and the information that we collect about the previous employer.

Parrino (1997) argues that even when CEOs come from a different industry, they often have some industry-relevant experience, either because they worked in the industry in the past or because their present firm operates in more than one industry. To assess whether this is the case in our sample as well, we take a closer look at the past experience of the 235 CEOs who come from a different industry. Indeed, in most cases we do find some relevant past experience in the applicable industry and therefore focus our analysis on differences in compensation between CEOs that come from outside the firm and CEOs that come from inside the firm.

Our main proxy for the CEO talent pool structure is thus the percentage of CEOs in each particular industry that comes from inside the firm, which indicates the extent to which the CEO talent pool may be limited. Any CEO that is not an insider CEO is an interim CEO, an outside CEO from the same industry, or an outside CEO from another industry. Our secondary proxy distinguishes between the latter two groups and is the percentage of outside CEOs in each industry that comes from outside that particular industry, which indicates in which industries the potential talent pool seems particularly broad.

Table II presents summary statistics of our sample. The table shows that out of the 1,827 new CEOs, 1,147 (63%) are insiders whose prior employer was the firm for at least 2 years.[6] An additional 547 new CEOs (30%) are outsiders who did not work for at least 2 years in the firm before becoming CEOs. Another 133 new CEOs are interim CEOs (7%). The last column indicates that over half of the outside CEOs come from outside the firm's industry (19% of new CEOs, relative to 30% of CEO who are outsider CEOs more generally).

Table II also shows that these characteristics are relatively stable over the years 1993 and 1996, 63% of the new CEOs were insiders, 31% were outsiders, and 7% were interim CEOs, compared with 60, 32, and 9%, respectively, in the years 2003–05.

[6] Securities and Exchange Commission (SEC) regulations require directors to provide information about prior occupations in the past 5 years. We can therefore fully track the occupations of new CEOs up to 5 years before becoming CEOs. We find that about 93% of the new insider CEOs worked in their firms for at least 5 years before becoming CEOs.

Table II. Characteristics of new CEOs

The table shows the characteristics of new CEOs in the ExecuComp database, distinguishing Insiders, Outsiders, and Interim CEOs. Insider CEOs are CEOs whose previous position in the previous 2 years was with the same company. Interim CEOs are new CEOs who were replaced within a year from becoming CEOs or who declared in the proxy statement that they are interim CEOs once they took the position. If the CEO's past employment was for less than 6 months, we take the previous employment record.

Period	All CEOs	Insiders	Outsiders	Interim	Outsiders Outside Ind.
1993–96	498	312 (63%)	152 (31%)	34 (7%)	98 (20%)
1997–99	463	284 (61%)	146 (32%)	33 (7%)	96 (21%)
2000–02	466	313 (67%)	122 (26%)	31 (7%)	70 (15%)
2003–05	400	238 (60%)	127 (32%)	35 (9%)	80 (20%)
1993–2005	1,827	1,147 (63%)	547 (30%)	133 (7%)	344 (19%)

These findings are consistent with Murphy and Zabojnik (2007), who report that an average of 32.7% of new hires between 2000 and 2005 can be classified as outside hires. For the years 1990–2000, they find that an average of 27% of CEOs are outside hires; however, their sample for that period includes only Forbes 500 firms, which are larger firms than those in our study, and, as we find in our sample, larger firms tend to hire fewer outsider CEOs. The percentage of outside hires in our sample is also larger than the 15.57% of outside hires that Parrino (1997) finds. We believe that the reason for the difference is the different time period. His sample consists of hires between 1969 and 1989. Arguably, the market for CEO talent has evolved over the years, with an increase in the number of outside successions over the past 40 years, as suggested also by Murphy and Zabojnik (2007).

2.4 INSIDER AND OUTSIDER CEOs ACROSS INDUSTRIES

Our main proxy for the importance of firm-specific talent in the industry is thus the percentage of CEOs who come from inside the firm in that industry. Parrino (1997) shows that the percentage of inside CEOs in the industry captures homogeneity of firms within industries and is therefore a proxy for the ability of CEO to move from one firm to another and the constraints on the talent pool that boards face when choosing a new CEO. In our study, we examine whether this variable can explain variation in controversial CEO compensation practices across industries.

The secondary proxy based on where new CEOs come from captures the percentage of outside CEOs in the industry whose previous firm is outside the firm's industry, which we call the percentage of "Outside CEOs from Outside the Industry." When controlling for both this percentage and the percentage of inside CEOs in the industries, the category of CEOs "left out" are outside CEOs whose previous employers are in the same industry, as well as interim CEOs. However, all three of these groups are incorporated in our first and main proxy, the percentage of CEOs who come from inside that industry.

Table III shows the distribution of outsider and insider new CEOs across the Fama and French (1997) classification of forty-eight industry groups.[7] Among industries that have ten or more CEO replacements in the database, the industries that have the largest percentage of new CEO insiders are Construction (92%), Steel Works (85%), and Transportation (82%). Among the industries that have the smallest percentage of insiders are Trading (41%), Aircraft (47%), Computers (51%), and Personal Services (53%). Thus, there seems to be a large variation in this variable across industries—a variation that we will explore in the next sections. Our findings are largely consistent with Parrino (1997). For example, we similarly find that banks, insurance companies, and the companies in the fabricated metal products industry are among those with the largest percentages of insiders. However, there are also some differences. For example, we find that CEOs of petroleum and natural gas companies tend to come from inside the firm (19% outsiders), whereas Parrino finds a higher percentage of new CEOs that come from outside the firm (36% outsiders). We attribute these variations to the different sample periods across the two studies.

2.5 DEPENDENT VARIABLES, CONTROL VARIABLES, AND DESCRIPTIVE STATISTICS

To capture the level and growth of CEO compensation, we use the log of CEO total compensation (ExecuComp variable TDC1) and the changes in the log of CEO total compensation, respectively. Our main independent variable is the percentage of CEO appointments in the industry that come from inside the firm.

We further add a set of controls that have become standard in the executive compensation literature, including lagged total CEO compensation, the Herfindahl concentration index based on sales (using all firms in Compustat in the industry), stock price volatility, market beta, performance (return on equity, equity market capitalization and its 1-year lag, and growth in log sales), the market capitalization of the 250th largest firm in the current and

[7] The classification of industries is from Kenneth French's website.

Table III. Industry distribution of insider and outsider CEOs

The table shows the distribution of new CEOs across industries from the sample of all new CEOs between 1993 and 2005, and whose firm is in ExecuComp, using Fama-French forty-eight industry groups.

	Industry	Total	Total Insiders	Total Outsiders	Insiders (%)
1	Agriculture	4	3	1	75
2	Food products	33	18	15	55
3	Candy & soda	7	5	2	71
4	Beer & liquor	11	9	2	82
5	Tobacco products	5	3	2	60
6	Toys and recreation	10	7	3	70
7	Fun and entertainment	20	15	5	75
8	Books	18	12	6	67
9	Consumer goods	34	23	11	68
10	Apparel	19	13	6	68
11	Healthcare	24	16	8	67
12	Medical equipment	35	27	8	77
13	Pharmaceutical products	48	28	20	58
14	Chemicals	55	37	18	67
15	Rubber & plastic products	9	5	4	56
16	Textiles	7	7	0	100
17	Construction materials	29	22	7	76
18	Construction	13	12	1	92
19	Steel works, etc.	33	28	5	85
20	Fabricated products	3	3	0	100
21	Machinery	62	46	16	74
22	Electrical equipment	32	23	9	72
23	Automobiles & trucks	40	26	14	65
24	Aircraft	15	7	8	47
25	Shipbuilding equipment	5	4	1	80
26	Defense	1	1	0	100
27	Precious metals	8	7	1	88
28	Non-metallic and industrial metal mining	6	4	2	67
29	Coal	1	1	0	100
30	Petroleum and natural gas	52	42	10	81
31	Utilities	111	86	25	77
32	Communication	43	24	19	56
33	Personal services	19	10	9	53
34	Business services	158	96	62	61
35	Computers	79	40	39	51
36	Electronic equipment	93	64	29	69
37	Measuring and control equipment	38	23	15	61
38	Business supplies	35	25	10	71
39	Shipping containers	7	6	1	86
40	Transportation	34	28	6	82
41	Wholesale	44	35	9	80
42	Retail	101	73	28	72
43	Restaurants, hotels, motels	32	20	12	63
44	Banking	85	68	17	80
45	Insurance	66	53	13	80
46	Real estate	2	0	2	0
47	Trading	61	25	36	41
48	Miscellaneous	23	15	8	65

Table IV. CEO compensation—descriptive statistics

The table presents descriptive statistics of the variables used in the analysis: sample average ("Mean"), standard deviation ("St.Dev."), minimum ("Min."), and maximum ("Max."). $TDC1_t$ is the total CEO compensation in year t and is taken from ExecuComp. The forty-eight industry groups are from the Fama-French classification. The Herfindahl concentration measure is based on sales of all firms in Compustat. Volatility and the change in log Sales are from ExecuComp. ROE is net income over book value of equity from Compustat. MarketCap is the equity market capitalization. MarketCap_250 is the equity market capitalization of the 250th largest firm in Compustat. Tenure is the number of years since the CEO took over that position. Percentage of equity-based compensation measures the flow of incentives, that is, the ratio of the value of restricted stock grants and option grants over total compensation (TDC1). Stock Incentives is the stock of equity-based incentives, that is, the sum of the value of restricted stock holdings and option grants (exercisable and unexercisable), from ExecuComp.

	Mean (St.Dev.)	Min.	Max.
Log($TDC1_t$)	8.055 (1.013)	5.504	10.570
Outside CEO dummy	0.170 (0.376)	0.000	1.000
Percentage of Inside CEOs, in forty-eight industry group	0.732 (0.100)	0.553	0.909
Percentage of Outside CEOs from Outside the Industry, in forty-eight industry group	0.121 (0.053)	0.000	0.209
Herfindahl concentration	0.043 (0.020)	0.008	0.185
Stock price volatility	0.419 (0.224)	0.114	4.117
Market beta	0.964 (0.555)	0.042	2.804
Log($sales_t$) – Log($sales_{t-1}$)	0.106 (0.224)	-0.683	1.024
ROE	0.096 (0.297)	-1.843	1.340
Log($MarketCap_t$)	7.663 (1.572)	1.787	13.180
Log($MarketCap\_250_t$)	9.081 (0.239)	8.499	9.328
Tenure	6.976 (6.943)	0.000	54.000
Percentage of equity-based compensation	0.388 (0.246)	0.000	0.918
Log(stock incentives)	8.211 (1.914)	0.000	16.650

the previous year (see GL), and CEO tenure. Table IV presents descriptive statistics for CEO pay, the CEO talent pool proxies, and all controls.

3. Benchmarking

Our goal is to study the extent to which differences in talent pools across industries explain cross-sectional variation in CEO compensation. We conduct three tests of the effects of the talent pool structure on the structure of CEO compensation. The first test measures the extent of benchmarking CEO compensation, the second explores the importance of "pay for luck" or pay for industry-wide performance, and the last considers the relation between firm size and compensation, following GL.

In determining CEO compensation, public corporations and compensation advisors turn to compensation to CEOs in similar firms. This practice, called benchmarking, is perhaps the most convenient way to ensure that CEO compensation is adjusted for changes in the supply-and-demand forces in the economy for CEO talent and to establish a CEO's reservation wage (Holmstrom and Kaplan, 2003). Benchmarking opponents worry that firms pick peer firms that generally give high compensation in order to increase CEO compensation, regardless of performance (Faulkender and Yang, 2009).[7]

Bizjak, Lemmon, and Naveen (2008) find widespread evidence that firms are benchmarking CEO compensation to that of other firms but find no systematic evidence that the use of benchmarking is more prevalent in firms with weaker governance. They also find that benchmarking is more likely for executives with shorter tenure and better firm performance. Bizjak, Lemmon, and Naveen also consider labor market effects through proxies such as firm age and the unemployment rate, but the authors do not consider direct evidence from CEO talent pools as we do in this article.

CEO talent pools could have a significant effect on benchmarking. In industries with a large percentage of outsider CEOs, the CEO's outside option should be determined by the compensation of CEOs in other firms, most likely in the same industry. In a competitive labor market, firms would adjust the compensation of the CEO to that of others in the industry (Oyer, 2004). If, however, there are very few outsider CEOs in the industry and the relevant talent pool of CEO candidates comprises top executives from inside the firm, then CEO compensation in other firms should not be an important determinant of the firm's compensation to its chief executive. In those industries, any evidence of benchmarking might be interpreted as evidence of opportunistic pay-setting practices or CEOs being compensated with little regard to changes in their outside opportunities.

3.1 EMPIRICAL METHODOLOGY

A natural way to examine whether CEO compensation is benchmarked against peer groups is to test whether changes in CEO compensation between year $t-1$ and year t are explained by the relative position of the CEO's compensation in year $t-1$ vis-à-vis compensation among the peer group (the benchmark), after controlling for the relevant variables that determine compensation. In particular, we closely follow the procedure in Bizjak, Lemmon, and Naveen (2008), whose specification is as follows:

$$\begin{aligned}\Delta \text{Compensation}_{i,t} &= a_1 {}^{*}\text{Distance}(\text{Compensation}_{i,t-1}, \text{Benchmark Compensation}_{t-1}) \\ &\quad + a_2 {}^{*}\text{Controls}_{it} + \text{Error}_{it}.\end{aligned} \tag{1}$$

The function Distance (Compensation$_{i,t-1}$, Benchmark Compensation$_{t-1}$) is a measure of the distance between CEO compensation in year $t-1$ and the benchmark compensation in the same year. Like Bizjak, Lemmon, and Naveen (2008), we consider the benchmark compensation as the median compensation in the peer group in the previous year and employ two different proxies for such distance. First, we set a Low Compensation Dummy equal to one if compensation$_{i\ t-1}$ is less than benchmark median compensation$_{t-1}$, and zero otherwise. Second, we employ the cumulative distribution function of the difference between the last year's benchmark median compensation minus the firm's compensation last year (CDF Distance). CDF Distance is positive if last year's CEO pay was below the peer-group median and is negative if last year's pay was above the peer-group median.

The benchmark group formation also closely follows Bizjak, Lemmon, and Naveen (2008) and is based on industry and size. Each year and within each of the forty-eight industry groups, we classify firms as being in one of two industry-size groups: either the large-firm or small-firm group, depending on whether they have market capitalization above or below the industry median. Thus, there are ninety-six industry-size groups. Each firm's benchmark group is then determined by all firms in its same industry-size group. Throughout the article, robust standard errors clustered by firm are used. Furthermore, all samples only include CEOs with at least 2 years of tenure to make sure that all compensation changes are for the same CEO.

In recent years firms have started to disclose the names of the peer firms for which the CEO compensation is tied to. As a result, an alternative to using industry-size groups would be to use the firm's self-declared peer firms to determine each firm's benchmark group. However, firms were required to disclose these data only recently, and so it is not available for the time frame of our data.[8] In general, studies that have considered these self-declared peer group find that firms typically choose other peer firms from the same industry

[8] Potentially, we could have extended the sample beyond 2005, but, in fact, in 2006 firms have also changed the way they disclose compensation (as a result of the same changes in disclosure rules). These changes have also significantly affected compensation policies (See, for example, Lemmon *et al.*). Therefore, examining firms after 2006 along with firms before 2006 is likely to lead to wrong inferences.

(Faulkender and Yang, 2010; Bizjak, Lemmon, and Nguyen, 2011) and so our benchmark groups should be closely related to these measures. We also think that examining talent pools at the industry level has some advantages over self-reported groups. First, firms often report a relatively small number of peer firms, such that this measure may be noisy. Second, boards may have incentives to choose peers that make it easier to justify their relatively high executive pay (Faulkender and Yang, 2010). Third, actual peer flow across these firms is quite low, suggesting that the talent pool from which firms pick other CEOs is a much larger set than the reported peers.[9]

The control variables include performance measures (return on equity in the previous year, change in log shareholder value from the previous year, and growth in log sales) as well as CEO tenure. Because GL suggests that changes in the distribution of firm size in the economy affect CEO compensation, we also include as control variables the market capitalization of the 250th largest firm in the current and the previous year. We further add the Herfindahl concentration index based on sales to control for the product market structure. Finally, we add the firm's stock price volatility and its market beta (both based on the previous 5 years) to control for differences in risk, which may be particularly important for the valuation of the option packages (see also Aggarwal and Samwick, 1999). However, these additional controls, which are not included in Bizjak, Lemmon, and Naveen (2008), do not significantly affect our results.

We propose two methodological changes compared to Bizjak, Lemmon, and Naveen (2008). First, as our dependent variable we use changes in log compensation rather than changes in compensation, a relatively innocuous revision to Bizjak *et al.*'s methodology. Although results are largely similar across these specifications, results using log compensation are less sensitive to outliers and small sample problems. Furthermore, by using log compensation rather than compensation, we can no longer reject the normality of the regression residual errors using a standard skewness test.

The second methodological change we propose is more critical. Specification (1) assumes that, after controlling for the performance, tenure, and economy-wide variables, changes in compensation follow a random walk. However, this assumption ignores the very significant positive autocorrelation of firms' CEO compensation across time. For example, a pooled panel regression of log CEO compensation on a constant and its 1-year lag gives an R^2 of 56% and an AR(1) coefficient of 0.76, which is significantly smaller than 1. Because of this, the first

[9] Faulkender and Yong (2010) report that 1.5% of the CEOs in their 2006 sample moved between firms in the previous 13 years (Table 1, Panel B in their study).

difference of (log) compensation has very significantly *negative* autocorrelation. For negatively autocorrelated variables, a relatively low (high) value tends to be followed by a subsequent increase (decrease). Therefore without adjusting changes in (log) compensation for strong negative autocorrelation, there is, by construction, a large positive association between changes in compensation and both benchmarking proxies described above. In particular, negatively autocorrelated changes in (log) compensation mean that firms with previous compensation decreases tend to increase their compensation the subsequent year. However, firms with previous compensation decreases are also more likely to have low compensation relative to their benchmark, such that this negative autocorrelation, if not corrected for, could significantly increase evidence for benchmarking.

Fortunately, such effects are relatively easy to correct for by controlling for the lagged level of CEO compensation. Note that controlling for this should not affect the evidence for benchmarking in a well-specified regression. Benchmarking specifically links the change in CEO compensation to its distance to the compensation of *other* firms, not the firm's distance to its *own* lagged compensation.

Table V shows the importance of controlling for the lagged level of CEO compensation in the benchmarking regressions, both when using the Low Compensation Dummy (in Panel A) and CDF Distance (in Panel B) as the benchmarking proxies. In the 1st two columns of each panel, the specifications do not control for lagged compensation. The lagged compensation is then added in the last two columns.

In Panel A, the coefficient on the Low Compensation Dummy equals 0.458 and is highly significant in Column 1, and it is hardly affected by adding industry dummies in Column 2. However, controlling for lagged compensation in Column 3 lowers the coefficient on the benchmarking dummy to 0.017, which is insignificant (p-value of 30%). Once industry dummies are added in Column 4, the coefficient on the Low Compensation Dummy equals −0.006 (thus with the opposite sign) and is insignificant. In contrast, the lagged compensation variable is highly significant and its addition almost doubles the R^2. Likewise, the results in Panel B using CDF Distance as the proxy for benchmarking show a very strong reduction in benchmarking once lagged compensation is controlled for: the coefficient on CDF Distance drops by about 90%, from 1.019 (Column 2) to 0.093 (Column 4), where it is only statistically significant at the 5% level.

Without taking logs, the results are even stronger (results not reported but available upon request). For example, the coefficient on the Low Compensation Dummy equals $1,743 without controlling for lagged compensation (similar to the results found by Bizjak, Lemmon, and Naveen,

Table V. Benchmarking

The table shows regression results of changes in log compensation on two benchmarking proxies and controls. In Panel A, the benchmark proxy is a dummy variable for whether the CEO compensation last year was lower than the median compensation of its forty-eight industry, two-size group in the previous year. In Panel B, the benchmark proxy is the cumulative distribution function of the median compensation of its industry-size group minus the CEO compensation during the previous year (CDF Distance). TDC1 is the total CEO compensation and is taken from ExecuComp. Market Cap_250 is the equity market capitalization of the 250th largest firm in Compustat. Tenure is the number of years since the CEO took over that position. The numbers in parentheses are robust standard errors clustered at the firm level. ***, **, and * represent significance at the 1, 5, and 10 levels, respectively.

Dependent variable: $\text{Log}(\text{tdc1}_{it}) - \text{Log}(\text{tdc1}_{it-1})$				
Independent variable	(1)	(2)	(3)	(4)
Panel A: benchmarking—Low Compensation Dummy				
Low Compensation Dummy_{t-1}	0.458 ***	0.461***	0.017	−0.006
	(0.016)	(0.016)	(0.016)	(0.016)
$\text{Log}(\text{tdc1}_{t-1})$			−0.441***	−0.464***
			(0.020)	(0.021)
Herfindahl concentration	−0.453*	−1.699***	1.403***	−0.426
	(0.257)	(0.562)	(0.340)	(0.600)
Stock price volatility	0.028	0.041	0.209***	0.217***
	(0.042)	(0.044)	(0.044)	(0.047)
Market beta	0.000	0.007	−0.007	−0.005
	(0.014)	(0.015)	(0.014)	(0.015)
$\text{Log}(\text{sales}_t) - \text{Log}(\text{sales}_{t-1})$	0.150***	0.154***	0.100***	0.099***
	(0.035)	(0.036)	(0.033)	(0.033)
ROE	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.002)	(0.002)
$\text{Log}(\text{MrketCap}_t) - \text{Log}(\text{MarketCap}_{t-1})$	0.314***	0.319***	0.335***	0.336***
	(0.019)	(0.019)	(0.018)	(0.018)
$\text{Log}(\text{MarketCap}_{t-1})$	0.042***	0.047***	0.210***	0.218***
	(0.004)	(0.004)	(0.011)	(0.011)
$\text{Log}(\text{MarketCap\_250}_t)$	−0.169***	−0.176***	−0.113**	−0.120***
	(0.050)	(0.051)	(0.045)	(0.045)
$\text{Log}(\text{MarketCap\_250}_{t-1})$	0.153**	0.149**	0.314***	0.316***
	(0.047)	(0.047)	(0.044)	(0.044)
Tenure	−0.002**	−0.002**	−0.002***	−0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	−0.322*	−0.220	0.011	0.255***
	(0.187)	(0.191)	(0.187)	(0.191)
Industry dummies	No	Yes	No	Yes
R^2	0.138	0.139	0.268	0.275
Observations	11,699	11,699	11,699	11,699

(continued)

Table V. (Continued)

Dependent variable: $\text{Log}(\text{tdc1}_{it}) - \text{Log}(\text{tdc1}_{it-1})$				
Independent variable	(1)	(2)	(3)	(4)
Panel B: benchmarking—cumulative distribution function of distance				
CDF Distance_{t-1}	1.010***	1.019***	0.151***	0.093**
	(0.036)	(0.036)	(0.035)	(0.036)
$\text{Log}(\text{tdc1}_{t-1})$			−0.408***	−0.436***
			(0.021)	(0.022)
Herfindahl concentration	−0.304	−1.569***	1.293***	−0.481
	(0.288)	(0.573)	(0.339)	(0.600)
Stock Price Volatility	0.097**	0.119***	0.209***	0.218***
	(0.041)	(0.044)	(0.044)	(0.047)
Market Beta	−0.013	−0.005	−0.008	−0.005
	(0.014)	(0.015)	(0.014)	(0.015)
$\text{Log}(\text{Sales}_t) - \text{Log}(\text{Sales}_{t-1})$	0.134***	0.139***	0.100***	0.100***
	(0.034)	(0.035)	(0.033)	(0.033)
ROE	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.002)	(0.002)
$\text{Log}(\text{MarketCap}_t) - \text{Log}(\text{MarketCap}_{t-1})$	0.321***	0.326***	0.335***	0.337***
	(0.018)	(0.019)	(0.018)	(0.018)
$\text{Log}(\text{MarketCap}_{t-1})$	0.057***	0.064***	0.201***	0.211***
	(0.005)	(0.005)	(0.011)	(0.011)
$\text{Log}(\text{MarketCap\_250}_t)$	−0.159***	−0.165***	−0.115**	−0.122***
	(0.048)	(0.048)	(0.045)	(0.045)
$\text{Log}(\text{MarketCap\_250}_{t-1})$	0.119*	0.113**	0.294***	0.300***
	(0.045)	(0.045)	(0.044)	(0.044)
Tenure	−0.002**	−0.002**	−0.002**	−0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	−0.517***	−0.414**	−0.050	0.202
	(0.186)	(0.190)	(0.187)	(0.191)
Industry dummies	No	Yes	No	Yes
R^2	0.189	0.191	0.269	0.276
Observations	11,699	11,699	11,699	11,699

2008), but changes to −$342 with the control. The same sign reversal occurs when the CDF Distance is used as the proxy for benchmarking.

Overall, once lagged compensation is controlled for, we find much weaker or no evidence of benchmarking. In the next subsection we explore whether benchmarking depends on the CEO talent pool structure.

3.2 BENCHMARKING

Our main goal is to explore how important peer groups are to CEO compensation. We previously documented that CEO talent comes from different pools, with significant differences across industries in the number of insiders who rise to become CEOs. For the analysis in this section, we first divide industries into quartile groups based on the percentage of new CEOs who come from inside the firm.[10] We define the High-Insider (percentage) group dummy as a dummy variable that equals one if the firm belongs to an industry that is in the highest quartile of insider CEOs and zero otherwise, and the Low-Insider group dummy as a dummy variable that equals one if the firm belongs to an industry that is in the lowest quartile and zero otherwise.

Second, we also divide industries into quartile groups based on the percentage of new outsider CEOs who come from firms outside the industry. The dummy for firms in the 25% of industries where the CEO talent pool is most industry-specific is denoted as the "High Outsider Outs. Industry" group dummy, and the dummy for firms in the 25% of industries with the fewest new outsider CEOs from within the industry is the "Low Outsider Outs. Industry" group dummy.[11] The high-insider and the low-outsider-outside-the-industry dummies are naturally correlated (35%), and likewise the low-insider and the high-outsider-outside-the-industry dummies (32%). If both sets of dummies are incorporated simultaneously, one would expect the high/low-insider dummies to have 1st-order effects, whereas the high/low-outsider-outside-the-industry dummies would capture the importance of having outsiders from within the industry or from outside the industry.

One would expect the CEO compensation of firms in the Low Insider group to be most affected by benchmarking against other firms of similar size in their industry. For this group, there are significant outside opportunities for the CEOs, meaning firms must remain competitive in CEO compensation in order to attract top talent from other firms. The same applies for firms in industries with many outside CEOs who come from outside the industry.

We examine the differences in benchmarking across the various industry groups by interacting the two benchmark proxies with the High-Insider and Low-Insider dummies and present the results in Table VI. Panel A of Table VI shows the regressions using the benchmarking proxy of the Low Compensation Dummy, whereas Panel B uses CDF Distance.

The 1st specification shows that the coefficient of the Low Compensation Dummy is 0.109 and is statistically significant from zero (at the 1% level). The

[10] We use the whole sample to reduce noise and because there is little time variation in the percentage of insiders across industries in our sample.

[11] We again use the Fama-French forty-eight industries, and use CEO replacements from the whole sample. Dividing the time-series into three subperiods and calculating the percentage of insiders and of outsiders-from-the-same-industry gives similar results. Also, because we create industry quartile groups, the number of firm years in each group is slightly different from 25%, but all four groups have between 23% and 25% of firms.

Table VI. Benchmarking and talent pools

The table shows regression results of changes in log compensation on two benchmarking proxies interacted with CEO talent pool structure and controls. In Panel A, the benchmark is a dummy variable for whether the CEO compensation in the current year is lower than the median compensation of its industry-size group in the previous year. Industry grouping is determined according to Kenneth French's 48-industry classification. Within each industry and each year, we further classify firms as either large- or small-size, based on whether they are above or below the median equity market capitalization for all Compustat firms within the industry in the particular year. In Panel B, the benchmark proxy is the cumulative distribution function of the median compensation of its industry-size group minus the CEO compensation during the previous year (CDF Distance). Low (High) Insider is a dummy variable for whether the industry to which the firm belongs is at the bottom (top) 25% in terms of the percentage of CEOs that are coming from within the firm. Similarly, Low (High) Outsider Outs. Industry is a dummy variable for whether the industry to which the firm belongs is at the bottom (top) 25% in terms of the percentage of outsider CEOs that are coming from within the same industry. Low (High) forced turnover dummy equals one if the industry is in the lowest quartile (highest quartile) in terms of percentage of forced turnovers across all industries in our sample. Data on forced turnover are from Jenter and Kanaan (2010). The rest of the variables are defined in Table IV. The numbers in parentheses are robust standard errors clustered at the firm level. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively.

Dependent variable: $\text{Log}(\text{tdc1}_{it}) - \text{Log}(\text{tdc1}_{it-1})$

Independent variable	(1)	(2)	(3)	(4)
Panel A: benchmarking measure—Low Compensation Dummy				
Low Compensation Dummy_{t-1}	0.109***	0.096***	−0.023	0.072*
	(0.031)	(0.038)	(0.026)	(0.039)
Low Compensation Dummy_{t-1} * Low Insider	0.030	−0.019	0.114***	0.050
	(0.019)	(0.021)	(0.037)	(0.034)
Low Compensation Dummy_{t-1} * High Insider	−0.144***	−0.088***	−0.054	−0.042
	(0.028)	(0.033)	(0.034)	(0.036)
Low Compensation Dummy_{t-1} * Low Outsider Outs. Industry			0.012	
			(0.037)	
Low Compensation Dummy_{t-1} * High Outsider Outs. Industry			−0.039	
			(0.038)	
Low Compensation Dummy_{t-1} * High Forced Turn. Ind.				−0.113***
				(0.038)
Low Compensation Dummy_{t-1} * Low Forced Turn. Ind.				−0.060
				(0.052)
Outside CEO Dummy		0.023	0.024	0.022
		(0.021)	(0.021)	(0.021)
Percentage of Insiders in Industry	0.387***			
	(0.110)			
$\text{Log}(\text{tdc1}_{t-1})$	−0.434***	−0.453***	−0.492***	−0.489***
	(0.020)	(0.021)	(0.021)	(0.021)
Stock price volatility	0.201***	0.319***	0.320***	0.312***
	(0.044)	(0.058)	(0.059)	(0.058)
Market Beta	−0.005	0.018	0.019	0.019

(continued)

Table VI. (Continued)

Dependent variable: Log(tdc1$_{it}$) – Log(tdc1$_{it-1}$)				
Independent variable	(1)	(2)	(3)	(4)
	(0.014)	(0.017)	(0.017)	(0.017)
Log(Sales$_t$) – Log(Sales$_{t-1}$)	0.100***	0.104***	0.104***	0.104***
	(0.033)	(0.033)	(0.034)	(0.033)
ROE	0.006***	0.005***	0.006	0.005
	(0.002)	(0.004)	(0.004)	(0.004)
Log(MarketCap$_t$) – Log(Market-Cap$_{t-1}$)	0.334***	0.319***	0.319***	0.318***
	(0.018)	(0.018)	(0.018)	(0.018)
Log(MarketCap$_{t-1}$)	0.205***	0.238***	0.238***	0.237***
	(0.011)	(0.011)	(0.012)	(0.012)
Log(MarketCap_250$_t$)	–0.121*	–0.090*	–0.090**	–0.090**
	(0.045)	(0.044)	(0.044)	(0.044)
Log(MarketCap_250$_{t-1}$)	0.318***	0.347***	0.349***	0.347***
	(0.044)	(0.044)	(0.044)	(0.044)
Tenure	–0.003***	–0.003***	–0.003***	–0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	–0.193	–0.277	–0.286	–0.295
	(0.203)	(0.204)	(0.214)	(0.205)
R^2	0.2705	0.2951	0.2954	0.296
Industry dummies	No	Yes	Yes	Yes
Observations	11,699	10,385	10,385	10,385
Panel B: benchmarking measure—CDF Distance				
CDF Distance$_{t-1}$	0.188***	0.186***	0.085	0.137*
	(0.046)	(0.074)	(0.056)	(0.076)
CDF Distance$_{t-1}$ * Low Insider	0.172***	0.066	0.194***	0.195***
	(0.036)	(0.045)	(0.066)	(0.069)
CDF Distance$_{t-1}$ * High Insider	–0.259***	–0.168***	–0.131***	–0.090
	(0.045)	(0.065)	(0.062)	(0.068)
Low Compensation Dummy$_{t-1}$ * Low Outsider Outs. Industry			–0.038	
			(0.075)	
Low Compensation Dummy$_{t-1}$ * High Outsider Outs. Industry			–0.050	
			(0.075)	
CDF Distance$_{t-1}$ * High Forced Turn. Ind.				–0.208***
				(0.073)
CDF Distance$_{t-1}$ * Low Forced Turn. Ind.				–0.114
				(0.097)
Outside CEO Dummy		0.024	0.025	0.024
		(0.021)	(0.021)	(0.021)
Percentage of Insiders in Industry	0.731***			
	(0.145)			
Log(tdc1$_{t-1}$)	–0.402***	–0.465***	–0.463***	–0.460***
	(0.021)	(0.022)	(0.022)	(0.022)
Stock price volatility	0.195***	0.320***	0.321***	0.312***
	(0.044)	(0.058)	(0.059)	(0.059)
Market Beta	–0.006	0.017	0.020	0.018
	(0.014)	(0.017)	(0.017)	(0.017)
Log(Sales$_t$) – Log(Sales$_{t-1}$)	0.097***	0.103***	0.103***	0.103***

(continued)

Table VI. (Continued)

Dependent variable: $\text{Log}(\text{tdc1}_{it}) - \text{Log}(\text{tdc1}_{it-1})$

Independent variable	(1)	(2)	(3)	(4)
	(0.032)	(0.033)	(0.034)	(0.033)
ROE	0.006***	0.005	0.006	0.005
	(0.002)	(0.004)	(0.004)	(0.004)
$\text{Log}(\text{MarketCap}_t) - \text{Log}(\text{MarketCap}_{t-1})$	0.334***	0.320***	0.320***	0.319***
	(0.018)	(0.018)	(0.018)	(0.018)
$\text{Log}(\text{MarketCap}_{t-1})$	0.196***	0.231***	0.230***	0.229***
	(0.011)	(0.012)	(0.012)	(0.012)
$\text{Log}(\text{MarketCap\_250}_t)$	−0.122***	−0.090**	−0.089**	−0.090**
	(0.045)	(0.044)	(0.044)	(0.044)
$\text{Log}(\text{MarketCap\_250}_{t-1})$	0.306***	0.337***	0.340***	0.337***
	(0.044)	(0.045)	(0.045)	(0.045)
Tenure	−0.003**	−0.003***	−0.003***	−0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	−0.562	−0.388	−0.432	−0.410
	(0.218)	(0.206)	(0.217)	(0.206)
R^2	0.2734	0.2957	0.2960	0.2969
Industry Dummies	No	Yes	Yes	Yes
Observations	11,699	10,385	10,385	10,385

coefficient of the interaction of the Low Compensation Dummy with the Low-Insider Dummy is 0.030 and is not statistically significant from zero. The coefficient of the interaction of the Low Compensation Dummy with the High-Insider Dummy is −0.144, and it is statistically significant from zero. Results using the CDF Distance proxy are even stronger, with its interaction with the Low-Insider Dummy having a coefficient of 0.172 and with the High-Insider Dummy a coefficient of −0.259 (both coefficients are significant at 1%). These results suggest that benchmarking exists in industries where CEOs tend to come from outside the firm, but there is no evidence for benchmarking in industries where CEOs tend to come from inside the firm.

One potential driver of our results is that different industries tend to have different conversions to the median peer group compensation that are not related to whether CEOs tend to come from inside or outside the firm. To control for this possibility, we add industry dummies to the original specification and obtain similar results (2nd specification). The coefficient of the Low Compensation Dummy is 0.117 and is statistically significant from zero. However, the coefficient of Low Compensation Dummy interacted with High-Insider equals −0.095 and is statistically significant from zero, consistent with no benchmarking in industries where outsider CEOs are rare. Results using the CDF Distance proxy in Panel B of Table VI are similar.

The High- and Low-Insider dummies are based on within-sample averages across firms that replaced their CEOs. It is possible that our results are driven by those particular firm-year observations when the new CEOs entered their jobs. To control for this possibility, we also include an Outside CEO Dummy variable in Specification 2, which equals one if in the previous year a new CEO entered the firm and that new CEO is an outsider. The results are not affected by the inclusion of this dummy variable. In Specification 3, we find no significant differences based on whether outside CEOs tend to come from within or outside the industry, leaving the main result unaffected.

Finally, it is interesting to explore the circumstances that affect insider and outsider hires. Parrino (1997) shows that forced turnovers are often followed by outside hires. The interpretation of this finding is that when the board is not happy with its CEO's strategy and performance, it will often look for an outsider to bring a new strategy and a new vision to the firm. An industry with many forced turnovers would therefore be an industry with high demand for CEOs who have new views and visions, and it would be an industry in which multiple firms are more likely to look in new or different directions. Thus, even though such an industry is more likely to bring in outside hires, it is probably less likely to benchmark their compensation to other firms in the industry because the talent the new CEOs bring with them may be less likely to be similar to the talent of other CEOs in the industry.

To examine the effect of industries with high numbers of forced turnovers on the likelihood of benchmarking, we add to our 3rd specification two interaction variables: the Low Compensation Dummy interacted with a dummy for High Forced-Turnover industries and the Low Compensation Dummy interacted with a dummy for Low Forced-Turnover industries. Our definition of a forced turnover is similar to that used by Parrino (1997).[12] We

[12] We thank Dirk Jenter for providing us with the forced-turnover data as used in Jenter and Kanaan (2010) and updated subsequently. Following Parrino (1997), Jenter searches the Factiva news database for the exact turnover announcement date and classifies each CEO turnover according to whether the turnover was forced or voluntary. A departure is defined as a forced departure if the CEO is fired, forced out, or retires or resigns due to policy differences or pressure. All other departures for CEOs above and including age 60 are classified as not forced. All departures of CEOs below age 60 are reviewed further and classified as forced if either the article does not report the reason as death, poor health, or the acceptance of another position (including the chairmanship of the board), or the article reports that the CEO is retiring but does not announce the retirement at least 6 months before the succession. Finally, the cases classified as forced are reclassified as voluntary if the press reports convincingly explain the departure as due to previously undisclosed personal or business reasons that are unrelated to the firm's activities. For further details, see Jenter and Kanaan (2010).

classify an industry as a Low Forced-Turnover (High Forced-Turnover) industry if it is in the lowest quartile (highest quartile) in terms of percentage of forced turnovers across all industries in our sample.

The results, shown in the 4th specification of Table VI, suggest that when the industry has a high percentage of forced turnovers, there is indeed less tendency to benchmark CEO compensation (i.e., a negative coefficient that is strongly statistically significant). When the firm has more inside hires, there is a weaker tendency to benchmark, but the coefficient is not statistically different from zero and is much smaller in magnitude.

Adding the interactions of the benchmarking proxy to the forced-turnover dummies does not change the previous result that benchmarking also depends on the CEO talent pool structure. Although the interactions of the Low Compensation Dummy with Low- and High Insider in Panel A no longer have statistically significant coefficients (equal to 0.050 and −0.042), their differences are still economically and statistically significant (*p*-value of 6%).

We get similar results when we use the CDF Distance as the measure of benchmarking rather than the low CEO compensation dummy. The results are stronger, likely because the CDF Distance measure may be a more accurate measure than the Low Compensation Dummy of the relative ranking of CEO compensation compared to other firms in the industry. For example, in Specification 4 of Panel B the coefficient on the interaction of CDF Distance and Low Insider equals 0.195 and is strongly statistically significant.

Our results contribute to the findings of Bizjak, Lemmon, and Naveen (2008) in two ways. First, controlling for lagged compensation essentially takes away the average effect of benchmarking on the dynamics of executive compensation. Second, in the subset of firms in industries with a high percentage of outsider CEOs, there is still very strong evidence for benchmarking. In contrast, there is no evidence for benchmarking in industries with few outsider CEOs, which is consistent with competitive benchmarking and CEO labor market considerations.[13]

4. Pay for Luck

CEO compensation may change not only with firm-specific performance but also with industry or even economy-wide performance. This finding stands in seeming contrast to Holmstrom's (1979) result that CEOs should only be

[13] Our results also do not change if we do not control for lagged compensation. The evidence for benchmarking is still much stronger in industries with many outsider CEOs.

paid for the part of performance that they can influence (denoted by "Skill"), and not for the performance that is due to other factors such as industry-wide shocks (denoted by "Luck").[14] Bertrand and Mullainathan (2001) argue that "pay for luck" is a manifestation of an agency conflict. In contrast, Himmelberg and Hubbard (2000) and Hubbard (2005) argue that pay for luck can be due to the correlation between the value of CEO skill and market conditions. When the industry is booming, the value of CEO skill increases and therefore the CEO should receive higher compensation.

In this section, we explore the relation between pay for luck and the structure of CEO talent pools. To the extent that pay for luck is the result of changes in the value of CEO skills, shocks within pools, rather than outside pools, should explain CEO compensation. Specifically, in an industry with many outsider CEOs and where the overall supply of CEOs will be relatively inelastic, boards may be forced to raise their CEOs' compensation if there is a positive industry-wide shock. An industry-wide boom clearly improves each CEO's next best alternative in those industries. However, in industries with very few outsider CEOs, such a competitive labor market argument would be less compelling because CEOs and top executives are beholden to the firm and their talent is less likely to be used by other firms in the industry.

4.1 METHODOLOGY FOR MEASURING PAY FOR LUCK

Our measure of performance is the firms' annual excess stock return (dividends reinvested, above the risk-free rate). This measure has a large explanatory power for cross-sectional variations in CEO compensation (Jensen and Murphy, 1990) and is commonly used. To separate the component of performance that is due to luck from the component that is due to skill, our two-stage regression closely follows Garvey and Milbourn (2006) and Bizjak, Lemmon, and Naveen (2008). In the 1st stage, we conduct a pooled panel regression of annual firm excess stock returns on value- and equally weighted industry excess stock returns, industry dummies, and year dummies, using the forty-eight Fama-French industry groups.[15] Next, the

[14] DeMarzo *et al.* (2012) show in a dynamic agency problem that luck could optimally enter compensation contracts.

[15] We use both equally weighted industry returns and value-weighted industry returns in the regression to ensure that our results are not biased because of the size distribution within industries. We tried both the Fama-French forty-eight industry classification of industries and the ten industry classification in the 1st stage, and results using either are very similar.

estimated coefficients are used to calculate the component of the return that is explained by the industry returns and the industry and year dummies. As in Garvey and Milbourn (2006) and Bizjak *et al.*, we define this fitted component as the "luck" component of the return that is not explained by the firm-specific CEO skills. The regression residual—the difference between the annual return and the luck component—is denoted as the "skill" component. We then scale these two components of the return by the log of the market capitalization of the firm at the beginning of the year. We define these two components as Skill and Luck.

In the 2nd stage, we regress changes in log compensation on Skill and Luck plus controls, year dummies, and firm fixed effects. We further interact the proxies of Skill and Luck with the high/low-insider, the high/low-outsider industry dummies, and the high/low-outsiders-from-outside-the-industry dummies. The controls are similar to those used in the benchmarking test.

4.2 RESULTS

Table VII shows the results of the 2nd stage. The 1st column contains Skill, Luck, and the cumulative distribution function of the stock volatility, plus the other control variables from Table V, including lagged CEO compensation. Both Skill and Luck have statistically significant and economically large effects on CEO compensation. In Column 1, a 1% increase in the Skill component of stock market performance is associated with a 0.243% increase in compensation, and a 1% increase in the Luck component is associated with an about 0.165% increase in compensation.

Next, we consider the effect of the CEO talent pool structure. In Column 2, we interact Skill and Luck with dummies for whether the industry has a high or low percentage of insider CEOs. We find that Skill remains significantly different from zero, but there is no significant difference in the elasticity of compensation changes to the firm-specific component of performance (i.e., Skill) across industries with high and low percentages of insiders. In contrast, while Luck by itself remains significant, Luck—which could also be called the industry-wide performance component—is statistically significantly (*p*-value of 7%) larger in industries that have a low percentage of insider CEOs, whereas Luck interacted with the High-Insider Dummy is insignificant. Economically, the coefficient on Luck is almost twice as large for firms in industries with many outsiders compared to the average. This result is consistent with the argument that pay for luck is at least partly driven by outside opportunities available to the CEO. When the

Table VII. Pay for luck

The table shows the regression results where the dependent variable is the change in Log compensation between the current year and the previous year, including year- and firm-fixed effects. The variable Luck is the fitted return from a pooled regression of annual firm returns on value—and equally weighted industry returns plus year- and industry-fixed effects (using forty-eight industry groups). The variable Skill is the difference between the annual firm return and Luck. Low Insider is a dummy variable for whether the industry to which the firm belongs is at the bottom 25% in terms of the percentage of CEOs that are coming from within their own firm. High Insider is a dummy variable for whether the industry to which the firm belongs is at the top 25% in terms of the percentage of CEOs that are coming from within the firm. Similarly, Low (High) Outsider Outs. Industry is a dummy variable for whether the industry to which the firm belongs is at the bottom (top) 25% in terms of the percentage of outsider CEOs that are coming from within the same industry. CDF BS Volat is the cumulative distribution of the stock return volatility of the firm relative to all firms in ExecuComp, where the volatility is from ExecuComp. The rest of the variables are defined in Table V. The numbers in parentheses are robust standard errors clustered at the firm level. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively.

Dependent variable: $\text{Log}(\text{tdc1}_{it}) - \text{Log}(\text{tdc1}_{it-1})$			
Independent variable	(1)	(2)	(3)
Skill	0.243***	0.246***	0.258***
	(0.020)	(0.025)	(0.032)
Luck	0.165***	0.123***	0.114***
	(0.031)	(0.041)	(0.044)
Skill * Low Insider		−0.007	0.003
		(0.042)	(0.043)
Skill * High Insider		0.010	−0.016
		(0.040)	(0.044)
Luck * Low Insider		0.096*	0.098*
		(0.053)	(0.056)
Luck * High Insider		0.013	−0.015
		(0.056)	(0.064)
Skill * Low Outsider Outs. Industry			0.023
			(0.040)
Skill * High Outsider Outs. Industry			−0.052
			(0.039)
Luck * Low Outsider Outs. Industry			0.064
			(0.064)
Luck * High Outsider Outs. Industry			0.016
			(0.053)
CDF BS Volat	0.183	0.180	0.184
	(0.133)	(0.133)	(0.133)
Outside CEO Dummy	0.091*	0.091*	0.094*
	(0.053)	(0.053)	(0.053)
Log (tdc1 (t−1))	−0.962***	−0.961***	−0.962***
	(0.019)	(0.020)	(0.020)

(continued)

Table VII. (Continued)

Dependent variable: $\text{Log}(\text{tdc1}_{it}) - \text{Log}(\text{tdc1}_{it-1})$			
Independent variable	(1)	(2)	(3)
Herfindahl Concentration	1.529*	1.501*	1.567*
	(0.819)	(0.823)	(0.829)
Stock Price Volatility	−0.005	0.003	−0.006
	(0.215)	(0.215)	(0.215)
Market Beta	0.024	0.022	0.023
	(0.022)	(0.022)	(0.022)
Log_sales_ch	0.154***	0.155***	0.155***
	(0.037)	(0.037)	(0.037)
ROE	0.007	0.007	0.007
	(0.003)*	(0.003)**	(0.003)*
Log(market cap (t−1))	0.407***	0.408***	0.407***
	(0.020)	(0.020)	(0.020)
Tenure	−0.002	−0.002	−0.002
	(0.002)	(0.002)	(0.002)
R^2	0.574	0.574	0.575
Observations	10,376	10,376	10,376

pool for CEOs is largely other executives from outside the firm, CEO compensation responds more to the luck component of compensation.[16]

Column 3 shows variation in the relation between Skill and Luck across industries with high and low levels of outside CEOs from outside the firm's industry. We do not find a variation in the two components across this classification of industries. Our interpretation for this result is that what matters is whether the CEO skill is firm-specific. Whether outside CEOs are coming from the same industry or from other industries still leaves them with outside opportunities that are affected by industry shocks. These results are also consistent with the benchmarking results in Section 3.

5. Robustness Using an Alternative Proxy Based on Geographical Distance

This section describes our robustness check using an alternative measure of CEO talent pools based on the number of local peer firms. As explained in Section 2, we define local peer firms as publicly traded firms in the same industry whose headquarter is within 100 miles of the firm's headquarter (i.e., the main geographical measure from Coval and Moskowitz, 1999,

[16] Similar to the previous section, we have confirmed that these results are robust by also adding the interactions of Skill and Luck with dummies for high and low percentage of forced turnovers in the industry.

2001). Having more local peer firms means that the outside CEO talent pool for firms is likely to be larger, and this also makes exiting the firm more convenient for the firm's top executives.

Table VIII shows the benchmark results using this alternative proxy. We create a dummy variable "Low (High) # of Local Peer Firms" that is equal to one of the firm is at the bottom (top) 25% in terms of the number of local peer firms. We define local peer firms as firms that are in the same industry that the firm belongs to, and whose headquarter is located within a 100-mile distance from the firm's headquarters. We interact these dummies with the Low Compensation Dummy in log change in total compensation regressions, also including the control variables in Panel A of Table VI and the dummies themselves. In the 1st specification, we find that benchmarking is only prevalent at firms where there are better outside options in the industry. The Low Compensation Dummy by itself has a coefficient of −0.006 and is insignificant, while its interaction with the High number of Local Peer Firms has a coefficient of 0.109 and is highly statistically significant. This result is robust to adding industry dummies and also to adding interactions of the Low Compensation Dummy and the Low (High) Insider dummies. The results in Panel B of Table VIII interact the "Low (High) # of Local Peer Firms" dummies with the CDF Distance, and likewise find that there is more benchmarking for firms with a larger number of local peer firms.

Table IX presents results for "pay for luck" regressions using the alternative proxy. Here, the results are statistically quite weak, with all interactions of the Skill and Luck components of the firm's stock return with the "Low (High) # of Local Peer Firms" dummies having the predicted signs but being statistically insignificant. In the 1st specification with both firm- and year fixed effects, the *p*-value of the test that the coefficient on Luck is the same across firms in the top versus bottom of the number of local peer firms equals 16%. In the 2nd specification with only firm, but no year fixed effects, this *p*-value is marginally significant at 10%. We thus conclude that our alternative proxy based on geography gives corroborating evidence that pay for luck and especially benchmarking are more likely at firms with larger CEO talent pools outside of the firm.

6. CEO Pay Levels and Firm Size

Our last test examines whether the talent pool structure in the industry explains the relation between size and compensation. Gabaix and Landier (2008) analyze the relation between managerial talent and CEO compensation. In their general equilibrium setting, all firms choose managers from the

Table VIII. Benchmarking and the number of local peer firms

The table shows regression results of changes in log compensation on two benchmarking proxies interacted with different proxies for the CEO talent pool structure and controls. In Panel A, the benchmark is a dummy variable for whether the CEO compensation in the current year is lower than the median compensation of its industry-size group in the previous year. Industry grouping is determined according to Kenneth French's forty-eight industry classification. Within each industry and each year, we further classify firms as either large- or small size based on whether they are above or below the median equity market capitalization for all Compustat firms within the industry in the particular year. In Panel B, the benchmark proxy is the cumulative distribution function of the median compensation of its industry-size group minus the CEO compensation during the previous year (CDF Distance). Low (High) Insider is a dummy variable for whether the industry to which the firm belongs is at the bottom (top) 25% in terms of the percentage of CEOs that are coming from within the firm. Similarly, Low (High) number of Local Peer Firms is a dummy variable for whether the firm is at the bottom (top) 25% in terms of the number of firms in the same industry to which the firm belongs and whose headquarters are located within a 100 miles distance from the firm's headquarters. All the controls in Table VI are included as well, see Table IV for descriptions. The numbers in parentheses are robust standard errors clustered at the firm level. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively.

Dependent variable: $\text{Log}(\text{tdc1}_{it}) - \text{Log}(\text{tdc1}_{it-1})$				
Independent variable	(1)	(2)	(3)	(4)
Panel A: benchmarking measure—Low Compensation Dummy				
Low Compensation Dummy$_{t-1}$	−0.006	−0.032	−0.027	−0.038
	(−0.28)	(−1.52)	(−1.16)	(−1.62)
Low Compensation Dummy$_{t-1}$ * Low number of Local Peer Firms	−0.041	−0.046*	−0.038	−0.048*
	(−1.52)	(−1.70)	(−1.44)	(−1.80)
Low Compensation Dummy$_{t-1}$ * High number of Local Peer Firms	0.109***	0.105***	0.096***	0.121***
	(3.14)	(3.01)	(2.73)	(3.59)
Low Compensation Dummy$_{t-1}$ * Low Insider			0.100***	0.059*
			(3.20)	(1.78)
Low Compensation Dummy$_{t-1}$ * High Insider			0.003	−0.039
			(0.10)	(−1.25)
R^2	0.289	0.301	0.290	0.301
Control variables Table VI Included	YES	YES	YES	YES
Industry dummies	NO	YES	YES	YES
Observations	9,066	9,066	9,066	9,066
Panel B: benchmarking measure—CDF Distance				
CDF Distance$_{t-1}$	0.116***	0.047	0.090**	0.0573
	(2.80)	(1.09)	(2.07)	(1.36)
CDF Distance$_{t-1}$ * Low number of local peer firms	−0.086**	−0.092***	−0.082**	−0.086**
	(−2.55)	(−2.64)	(−2.46)	(−2.56)

(continued)

Table VIII. (Continued)

Dependent variable: Log($tdc1_{it}$) – Log($tdc1_{it-1}$)				
Independent variable	(1)	(2)	(3)	(4)
CDF Distance$_{t-1}$ * High number of local peer firms	0.159***	0.159***	0.142***	0.088**
	(2.98)	(2.91)	(2.64)	(2.43)
CDF Distance$_{t-1}$ * Low Insider			0.148***	0.092*
			(3.38)	(1.86)
CDF Distance$_{t-1}$ * High Insider			−0.006	−0.091**
			(−0.18)	(−2.12)
R^2	0.289	0.301	0.290	0.301
Control variables Table VI included	Yes	Yes	Yes	Yes
Industry dummies	No	Yes	Yes	Yes
Observations	9,066	9,066	9,066	9,066

Table IX. Pay for luck and the number of local peer firms

The table shows the regression results where the dependent variable is the change in Log compensation between the current year and the previous year, including year- and firm-fixed effects. The variable Luck is the fitted return from a pooled regression of annual firm returns on value- and equally weighted industry returns plus year- and industry-fixed effects (using forty-eight industry groups). The variable Skill is the difference between the annual firm return and Luck. Low (High) number of Local Peer Firms is a dummy variable for whether the firm is at the bottom (top) 25% in terms of the number of firms in the same industry to which the firm belongs is and whose headquarters are located within a 100 miles distance from the firm's headquarters. All the controls in Table VII are included as well, see Table IV for descriptions. The numbers in parentheses are robust standard errors clustered at the firm level. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively.

Dependent variable: Log($tdc1_{it}$) – Log($tdc1_{it-1}$)		
Independent variable	(1)	(2)
Skill	0.270***	0.279***
	0.026	0.026
Luck	0.191***	0.227***
	0.038	0.037
Skill * Low number of Local Peer Firms	−0.056	−0.061
	0.042	0.043
Skill * High number of Local Peer Firms	0.008	0.008
	0.041	0.041
Luck * Low number of Local Peer Firms	−0.036	−0.048
	0.051	0.051
Luck * High number of Local Peer Firms	0.060	0.062
	0.065	0.065
R^2	0.4687	0.4665
P-value (Luck * Low number) = (Luck * High number)	16%	10%
Fixed effects	Firm + Year	Firm
Control variables Table VII Included	Yes	YES
Observations	10,376	10,376

same pool of talent. Following Rosen's (1992) insight that productivity of talent increases with firm size, Gabaix and Landier's matching model implies a relation between CEO compensation and the size distribution across large public companies. Empirically, their results rely on the assumption that firm size is a reasonable proxy for CEO talent.

Under some mild distributional assumptions of firm size in the economy, GL show that the compensation to the CEO should be related both to the size of the firm in which the CEO operates and the size of the nth largest firm in the economy, where n is a constant. They then test this prediction using the following specification on a panel of large public US firms:

$$\text{Log(CEO compensation}_{it}) = a_0 + a_1\text{Log(Size}_{it}) + a_2\text{Log(Size\_Reference\_Market}_t) + e_{it}$$

The variable Size_Reference_Market$_t$ is the size of the mth largest firm in the economy. Theoretically, m could be any size ranking as long as it captures the tail of the size distribution. In their empirical specification, Gabaix and Landier (2008) use $m = 250$ (the 250th largest firm is the reference firm). The authors acknowledge that if talent pools are segmented, then "...the reference firm size should be industry-specific which will lead to an attenuation bias in the coefficient on the reference firm size" (p. 35).

In this section, we explore the extent to which firm- and industry-specific variations in CEO talent pools help explain variations in CEO compensation. Previously, we documented large differences in CEO talent pools across industries. In pools of CEO candidates that are highly segmented, the GL model would predict that what matters is not the size distribution of firms across the whole economy, but the size distribution of firms within the particular talent pool.

To test the effect of industry-specific talent, we introduce the following regression specification over the entire ExecuComp data between the years 1993 and 2005 that closely follows the specification in GL:

$$\text{Log(CEO compensation}_{it}) = a_0 + a_1\text{Log(Size}_{it}) + a_2\text{Log(Size\_Reference\_Market}_t) + a_3\text{Log(Size\_Reference\_Industry}_t) + e_{it},$$

where Size_Reference_Industry$_t$ is the size of the 20th largest firm in Compustat that belongs to the same industry as the CEO's firm (using the Fama-French forty-eight industry specification and using all firms in the Compustat database, not just those firms in the ExecuComp sample). The size of the 20th largest firm is used as an additional explanatory variable to help determine whether distribution of talent within the industry explains changes in compensation. Other than our addition of an industry reference firm (i.e., a reference firm that is industry specific), this specification is similar to GL. We further define firm size as the market value of the equity of the firm rather than the total value of the firm, as using market value of equity gives a clearly higher R^2 than using a total cap that includes the book value of debt (as used in GL), though results are very similar when using total cap. Finally, like GL, we adjust compensation and market capitalizations for inflation (as we cannot use year fixed effects).

6.1 MARKET AND INDUSTRY REFERENCE FIRM SIZE

Table X presents the results. Column 1 shows the results of the GL specification with the addition of the industry reference firm and the interaction of the firm's market cap variable with High- and Low-Insider dummy variables. As expected, the coefficients of both market size and the size of the market-wide reference firm are significant both statistically and economically. However, variations in the size of the industry reference firms explain very little of the variation in CEO compensation. The coefficient of the industry reference firm's market cap is statistically different than zero, but is much smaller than that of the market reference firm (0.03 compared to 0.48). Column 1 also shows that firms in industries in which CEOs are typically replaced by talent inside the firm tie CEO compensation to firm size almost in the same way as firms in industries with many outsider CEOs. Industries with many insider CEOs have an elasticity of compensation to size that is only 0.018 smaller than that of other firms—about 4% smaller than the coefficient of 0.417 of Log(Market Cap).

One interpretation of these findings is that the markets for CEO talent are integrated and therefore the change in the size distribution of firms across the entire economy is the more relevant indicator for the change in the return to talent in our sample. However, this result seems inconsistent with our documentation that the labor market for CEOs has explanatory power when examining other features of compensation.

To further explore the result, we check whether the effect of the market reference firm or the industry reference firm will differ between industries with a low percentage of CEO insiders and industries with a high percentage of CEO insiders. We expect firms in industries with a high percentage of CEO insiders to be affected less by reference size variables because, to the extent that these reference size variables represent distribution of skill in top firms, they should be less relevant when the market for talent is firm specific.

The 2nd specification in Table X shows that industries with a high percentage of insider CEOs are less influenced by the distribution of talent in

Table X. Gabaix and Landier (2008) results and talent pools

The table shows the results of panel regressions where the dependent variable is the natural log of CEO compensation. The sample consists of all ExecuComp firms with CEO compensation information between the years 1993 and 2005. CEO compensation is the variable tdc1 from ExecuComp, and it consists of the sum of salary, bonus, value of restricted stock, and Black-Scholes value of option grants for the fiscal year. The independent variable log (Total cap) is the natural log of the market capitalization of the firm at the end of the fiscal year. Market Cap Ref. Firm_t is the equity market capitalization of the 250th largest firm in the Compustat database in each year. Market Cap Ind. Ref. Firm_t is the equity* market capitalization of the 20th largest firm in the Compustat database in each industry that year. Both compensation and market caps are inflation-adjusted. Low Insider is a dummy variable for whether the industry to which the firm belongs is at the bottom 25% in terms of the percentage of CEOs that are coming from within their own firm. High Insider is a dummy variable for whether the industry to which the firm belongs is at the top 25% in terms of the percentage of CEOs that are coming from within the firm. The industry classification is based on the forty-eight industries in Fama and French (1997). The numbers in parentheses are the standard deviations of the coefficients. All errors are clustered at the firm level. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively.

Dependent variable: Log(tdc1_{it})			
Independent variable	(1)	(2)	(3)
Log(Market Cap_{it})	0.417***	0.416***	0.415***
	(0.009)	(0.009)	(0.009)
Log(Market Cap Ref. Firm_{it})	0.480***	0.482***	0.482***
	(0.026)	(0.026)	(0.026)
Log(Market Cap Industry. Ref. Firm_{it})	0.030***	0.033***	0.032***
	(0.013)	(0.013)	(0.013)
Log(Market Cap_{it}) * High Insider	−0.018***		
	(0.004)		
Log(Market Cap_{it}) * Low Insider	0.007		
	(0.005)		
Log(Market Cap Ref. Firm_{it}) * High Insider		−0.018***	
		(0.004)	
Log(Market Cap Ref. Firm_{it}) * Low Insider		0.006**	
		(0.003)	
Log(Market Cap Ind. Ref. Firm_{it}) * High Insider			−0.021***
			(0.005)
Log(Market Cap Ind. Ref. Firm_{it}) * Low Insider			0.008**
			(0.005)
Constant	0.202	0.172	0.182
	(0.238)	(0.238)	(0.238)
R^2	0.4143	0.4154	0.4147
Observations	18,466	18,466	18,466

the economy (as captured by the market cap of the reference firm in the market) than industries with a low level of insider CEOs. The coefficients, however, are extremely small compared to the coefficient of the market cap of the market-wide reference firm. Interactions of the firm's market cap are likewise economically not meaningful (see the 1st specification). We obtain similar results when we interact the High/Low-Insider CEO dummies with the size of the industry reference firm (3rd specification).

These findings suggest that CEO compensation is related to the distribution of talent in the economy regardless of whether the talent measure is relevant to the CEO talent pool; instead, what matters is the distribution of talent in the whole economy rather than the firm's industry.

This result seems puzzling given the wide differences in CEO talent pools across industries as documented in Table III and our previous results on the relation between talent pool structure, benchmarking, and pay for luck. We suggest two possible explanations for this finding. First, it may be the case that executives make career decisions early on, knowing that once they enter certain industries they close-off other options outside that industry. In that case, more talented potential CEOs may enter industries where they expect higher rewards, and vice versa for less talented potential future CEOs. This could generate equilibrium compensation that is again driven by market-wide, not industry-specific, factors, even if CEO talent is not homogeneous across industries.[17]

Empirically however, we find that insider CEOs typically have very long tenures with their firms before becoming CEOs. For example, more than 90% of new inside CEOs in our sample have been with their firms 5 years or more. It seems likely that many of those CEOs made their career decisions many years before that. As a result, projections regarding the potential growth of different industries would arguably seem to be hard to make that far in advance by young executive talent deciding on their career path.

Second, the size of the market-wide reference firm may be a proxy for something else not directly related to the equilibrium model in GL. Recent papers challenging the interpretation of GL include Frydman and Saks (2010), who find a much smaller elasticity between CEO compensation and average firm size, using data starting in 1936, as well as Gordon and Dew-Becker (2007), who find widely varying elasticities for 1970–2005 compensation data using rolling 20-year regressions.

[17] We thank Xavier Gabaix for proposing and illustrating this possibility in his NBER discussion of our article.

7. Conclusion

Our results suggest that there are two important and different markets for CEO talent. The first market is external and is composed of managers and CEOs from other companies, largely within the same industry. The second is the internal market for CEOs. Compensation to CEOs whose market is internal does not respond to industry shocks and is less strongly tied to industry performance. Compensation to CEOs whose market is external responds to industry shocks and is tied to industry performance.

These findings stand in contrast to the widely held belief that CEO skills are relatively homogenous and mainly related to firm size (or complexity). They further suggest that the forces that determine executive compensation could be driven both by outside market pressure and by internal bargaining and also that the importance of each force differs depending on the talent pool structure that the firm faces.

In this article, we studied the effect of talent pool structure on executive compensation. By doing so, we extend the literature on talent pools, which to this point has concentrated mainly on their relation to CEO replacements (Parrino, 1997). We believe that the CEO talent pool structure could also affect monitoring decisions by boards and board structure itself. We plan to explore these issues in future research.

Finally, our results question the use of firm size as a proxy for the relative talent of different CEOs (Rosen, 1992) and the interpretation of the empirical results in Gabaix and Landier (2008). Their model and specification assume homogeneity in CEO skills across firms, while their empirical results rely on the assumption that firm size can serve as a proxy for CEO talent. Having documented the importance of heterogeneous firm- and industry-specific skills, we find that variations in firm size (used as a proxy for talent in GL) within industries explain only a very small portion of the variation in CEO compensation over time.

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