

A note on assessing the relation between CEO characteristics and stock performance: Alpha Above Replacement

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Abstract

Many studies examine the relation between stock performance and CEO characteristics. We approach the topic in a different way, using the alphas generated by the Fama-French three-factor model as the dependent variable in a CEO characteristic model. We find several traits are significantly related to alpha. CEOs who are younger, own a larger fraction of firm equity and hold a graduate degree provide greater alphas. CEOs who are also the founder of the firm deliver larger alphas. Our results provide useful information for boards assessing the performance of CEOs and considering CEO succession.

Key words: Chief executive officer; Stock performance; Abnormal returns; Alpha

JEL classification: G34, L22, L25, M51

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1. Introduction

The primary objective of the CEO is to maximise the wealth of the shareholders. Many factors influence the performance of a firm's stock, including the overall performance of the market, the performance of the firm's

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industry, and external shocks. In addition to these exogenous factors, the individual characteristics of the chief executive could be significant determinants of stock performance. While industry performance and similar factors are easier to measure and evaluate, shareholders may have difficulty assessing the contribution of the CEO characteristics to firm performance. This paper applies a well-known method in a novel way to revisit the question regarding the link between stock performance and CEO characteristics. The process can help firms better assess the contributions provided by the decisions of the current CEO, help investors better understand and evaluate managerial performance and provide a new evaluation approach to be used in CEO searches.

We examine the performance of the current CEO using the concept of *Alpha Above Replacement (AAR)*, which estimates the abnormal returns differential generated by the firm's current CEO compared to an average CEO. We borrow this concept from the statistics of baseball, which uses *Wins Above Replacement* to measure the value of a major league player versus a potential minor league replacement.¹ The term 'alpha' is also widely used in portfolio management, where it measures the abnormal returns generated by managers after controlling for risk. A rich body of research studies the alphas generated by portfolio managers.² Our focus is on the characteristics related to the alpha performance of CEOs. The abnormal returns in our research are the alphas from the Fama-French (1993) three-factor model produced during a CEO's tenure at the firm. Using a hand-collected data set of CEO characteristics for firms from 1997 through 2007, we construct CEO characteristic models with the alphas from the three-factor pricing model as our dependent variable. After controlling for other characteristics, we find that younger CEOs provide higher abnormal returns than do older chief executives, consistent with previous findings that suggest younger CEOs are more likely to take risks that deliver higher returns. CEOs with graduate degrees deliver larger alphas than their lesser educated counterparts. Also, consistent with studies that support greater equity ownership as a way to align the incentives between managers and shareholders, we find that CEOs with larger equity stakes in the firm provide larger abnormal returns. Founding CEOs provide better performance as do CEOs with a background in research and development or engineering. These results hold for the Fama-French alpha measure as well as our *AAR* metric. Measured in basis points, the *AAR* provides an economic, risk-

¹ A review of existing research indicates that a majority of applications of the *Wins Above Replacement* measure are in baseball contexts, with some research extending to other sports (e.g., Shea and Baker, 2012; Pasteur, 2014), but we found no research applications outside of sports environments.

² See, for example, Broussard and Vaihekoski (2012), Comerton-Forde *et al.* (2011), Fong *et al.* (2008) and Kolm *et al.* (2014).

adjusted metric of CEO performance, relative to an average CEO, which is used to assess the effects of CEO characteristics on stock performance.

Considering that we control for market risk, firm size and firm value through the three Fama-French factors, the economic significance of our findings is compelling. With the *AAR* measure, we can assess the value a CEO provides the shareholders and determine whether the primary objective of creating shareholder value is being met. Assigning an *AAR* metric could be useful in various settings, including the assessment of CEO performance by the compensation committee of the board of directors as they review the current and future remuneration of the firm's top management team; the selection committee of the board of directors as they review the current CEO and potential replacements for that CEO; executive recruiters, now armed with an additional quantifiable metric as they shop for firms and for executives; and active investors seeking to push for firm value growth. Several studies examine the use of relative performance evaluation, or RPE, in CEO compensation (Gibbons and Murphy, 1990; Albuquerque, 2009) and turnover (e.g., DeFond and Park, 1999). *AAR* analysis differs from RPE as its measure is based on the characteristics of all CEOs rather than the performance of peer executives. For this reason, *AAR* could be particularly useful to boards of directors and executive recruiters, who often hire replacement CEOs from other industries. Thus the *AAR* metric is a complement measure to RPE rather than a substitute. This study contributes to the extensive literature questioning the value of the CEO by using the novel application of sports valuation to identify characteristics that could enhance performance. Also benefiting are the extant finance literatures on CEO turnover, the relation between the executive office and shareholder wealth, and CEO compensation.

2. Do CEOs characteristics matter?

If individual managers influence the economic outcomes of the firm, then the characteristics of managers may explain, in part, the variance of economic performance across all firms. Many finance and management articles attempt to tie specific CEO characteristics to firm performance. Datta and Rajagopalan (1998) contend that CEO characteristics such as tenure, age, education level and functional background are components of a knowledge base for the chief executive. These cognitive attributes provide a method for matching CEOs to firms that require specific functional knowledge. Their study, however, examines managerial efficiency from an operational perspective (return on assets) rather than stock performance.

Several studies examine the age and education level of the firm's top manager. In a summary of the turnover literature, Brickley (2003) laments that little is still known about the predictability of CEO turnover and suggests that analysing CEO's characteristics such as age may be fruitful.

Brickley finds that older CEOs are more likely to be replaced than younger CEOs, especially in larger firms, where age is a stronger predictor of turnover than prior firm performance. Murphy (1999) also finds that the age of the CEO is a strong predictor of CEO turnover. Chevalier and Ellison (1999) examine mutual fund managers, finding some support for younger mutual fund managers outperforming their older counterparts. Their strongest results show that managers from higher quality universities, measured by SAT scores, significantly outperform managers from lower quality schools. Gottesman and Morey (2010), on the other hand, find that higher quality schooling by CEOs does not provide positive abnormal returns. Bhagat *et al.* (2010) examine the varying levels of educational attainment and its influence on CEO turnover, finding that the hiring of a new CEO depends on the candidate's education. After a disciplinary firing, firms are more likely to hire a new CEO with educational attainment similar to the outgoing CEO. Following poor performance, CEOs with a law degree are less likely to be replaced by someone with similar educational qualifications than are CEOs with only an undergraduate degree. CEOs with an MBA degree are more likely to leave on their own accord. The authors also find that CEOs with an MBA degree provide a short-term boost in performance while non-MBA managers do not. Research of the characteristics of CEOs of international firms outside the US is quite limited. Ou-Yan and Shuang-shii (2007) show a negative relation between CEO age and the probability of turnover in Taiwan firms, while no relation between CEO age and firm performance is found in firms on the Bucharest Stock Exchange (Moscu, 2013). Examining Chinese firms, Lin *et al.* (2011) find that CEOs with a college education are more likely to invest in R&D and to invest more than are CEOs without such educational attainment.

Several articles (e.g., Roth, 1995; Wood and Vilkinas, 2005) make a survey of executives' traits. Roth finds that CEOs with an internal locus of control, where outcomes are a result of personal initiatives rather than exogenously determined, positively affect firm performance. The small sample size of the Wood and Vilkinas study limits its power, but it provides useful qualitative information about CEO characteristics. Notably, successful CEOs feel their success can largely be attributed to three characteristics: an achievement orientation, a humanistic approach and positivism.

These surveys suggest that individual managerial characteristics are important for the success of the firms as well as the managers. CEO traits likely influence the decision-making process within the firm. Kaplan *et al.* (2012) analyse a unique data set containing personality characteristics of CEO candidates for companies involved in buyout and venture capital transactions. Using factor analysis, they find that general talent or ability has the greatest effect on firm performance. They also find that CEOs who are resolute and have good execution skills perform better than those with good interpersonal skills. Adams *et al.* (2005) show that powerful CEOs influence the variation in

firm performance.³ If managers wield more power and influence in decision making within the firm, as opposed to sharing these duties, the risks associated with the decisions are not well diversified, leading to greater volatility in stock returns, return on assets and Tobin's Q. Fahlenbrach (2009) also finds that the managerial style of founding CEOs is notably different than of non-founders. Founders invest more in research and development, exhibit higher capital expenditures, and make more focused mergers and acquisitions. Narcissistic CEOs may share traits with the powerful CEOs of Adams *et al.* (2005). Chatterjee and Hambrick (2007) find that narcissistic managers are more likely to pursue bold, impressive decisions that attract more attention to the firm. Overconfidence of the firm manager may also lead to overestimation of the profitability of corporate investment (Malmendier and Tate, 2005).

The management style of CEOs is the subject of Bertrand and Schoar (2003), who develop a manager fixed-effects model that measures managerial style based on four key firm areas: investment policy, financial policy, organisational strategy and performance. Their model follows managers from firm to firm, examining the effects these managers have on strategic policies and performance. Younger CEOs and CEOs with an MBA degree tend to follow more aggressive strategies compared to their counterparts. Similarly, Herrmann (2002) finds that certain traits determine the degree of international diversification of the firm. CEOs with higher education levels and younger CEOs are likely to lead firms that are more globally diversified.

3. Data

Using the ExecuComp database, we identify all firms from 1997–2007 and match each firm with financial data from Compustat and stock price data from CRSP. ExecuComp provides CEO age, gender, tenure and equity ownership data. Only firms present in all three databases remain in the sample. For each of the CEOs in this initial sample, we hand collect education and functional backgrounds using several resources, including proxy filings, Marquis Who's Who and LexisNexis Academic. Our final sample size includes 9,591 CEO-years and 2,715 individual CEO–firm combinations. Reviewing details of the CEO's career, we identify the dominant area of education and/or work experience across the executive's career and place the CEO within one of six functional background categories – accounting/finance, manufacturing, marketing/sales, R&D/engineering, law and medicine. The functional background data is particularly challenging to obtain due to vague career descriptions, either not being clearly identified or more than one background dominating the

³ These authors define a powerful CEO as a manager who is the founder of the firm, presides as the only insider on the board of directors and owns the additional titles of president and board chairman.

information. We retain these CEO observations, categorising this group as ‘unidentified.’

CEO characteristics for the sample are summarised in Table 1. The average CEO is about 56 years old with nearly 10 years at the firm. Most of the CEOs are male (98.4 per cent), most are also the chairman of the board (64.2 per cent) and 8.8 per cent founded the firm. Our CEOs own a mean of 2.8 per cent of their firm’s outstanding equity. The average CEO holds at least a bachelor’s degree. Figure 1 provides further details on the educational attainment of our CEO sample. Over 97 per cent of the CEOs have at least a 4-year college degree, with over one-third of the sample obtaining only a bachelor’s degree (38.3 per cent), a slightly higher percentage receiving a master’s degree (43.5 per cent) and 15.6 per cent earning a doctoral or professional degree. Figure 2 provides details on the functional backgrounds of the CEOs in our sample. Functional backgrounds for nearly two-thirds of the CEOs in the sample are accounting/finance, R&D/engineering or marketing/sales (in that order). Lawyers lead 8.7 per cent, CEOs with manufacturing experience head 3.1 per cent and CEOs with medical backgrounds head 1.7 per cent of the sample firms. About one-fifth of our sample includes CEOs with specialisation unidentified. Both Figures 1 and 2 include only unique CEOs.

Viewing the change in CEO characteristics over time and per industry (untabulated), we note several gradual, persistent downward trends with the average CEO age (from 57.1 in 1997 to 55.2 in 2007), average tenure (11.2–8.4 years), the percentage of male CEOs (99.6–97.2 per cent), the percentage of

Table 1
CEO characteristics

	Mean	Min.	Median	Max.
<i>Age</i>	56.2	32	56	92
<i>Tenure</i>	9.6	<1	7.7	57
<i>Equity owned (%)</i>	2.8	0.0	0.4	87.6
<i>Male</i>	0.984	0.0	1.0	1.0
<i>Founder</i>	0.088	0.0	0.0	1.0
<i>Duality</i>	0.642	0.0	1.0	1.0
<i>Education level</i>	4.7	1.0	5.0	6.0

This table presents the descriptive statistics for the 9,591 CEO-years in our sample. *Tenure* represents the CEO’s time as the chief executive of his/her current firm. *Equity owned* indicates the percentage of the firm’s equity owned by the CEO. The mean for *Male* indicates the portion of the sample CEOs who are male. The mean for *Founder* indicates the portion of the sample CEOs who founded their current firm. The mean for *Duality* indicates the portion of the sample CEOs who are also the chairman of the board of directors. *Education level* is based on the hierarchy of educational attainment: No high school diploma = 1, High school diploma/GED = 2, Associate’s degree = 3, Bachelor’s degree = 4, Master’s degree = 5, Doctoral/Professional degree = 6.

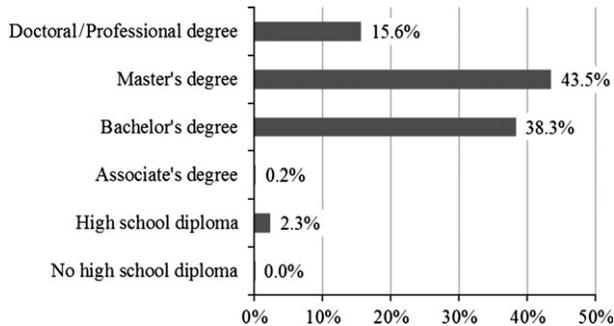


Figure 1 Educational attainment distribution for CEOs in sample.

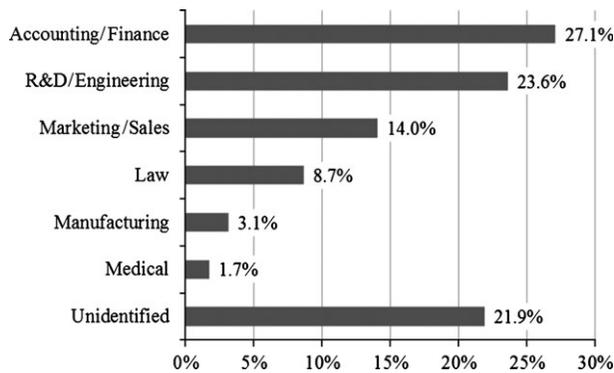


Figure 2 Functional background distribution for CEOs in sample.

equity owned (3.2–2.3 per cent), and the percentage of CEOs who also hold the board chair position (75.1–50.9 per cent). These trends suggest an increase in CEO turnover and a decrease in CEO power across our sample period, which occurs during a period of increased scrutiny of the chief executive office. High profile scandals at several firms (e.g., Enron, Worldcom) and the passage of Sarbanes-Oxley during this period may help explain the sharp decline in duality as firms separate the offices of the CEO and board chairman. Despite an improving trend, our data also show the difficulty facing women seeking to break into the firm's top office.

4. CEO characteristics and abnormal returns

Our research question revolves around the characteristics of the CEO. If CEO characteristics matter, we should find a significant difference in stock performance between the CEOs with differing traits such as age and tenure. We quantify stock performance using the annual alphas from the three-factor

model (Fama-French, 1993). The alphas measure the abnormal returns after controlling for market risk ($R_M - R_{RF}$), firm size (SMB) and firm value (HML). Returns in the model (RAR) are monthly realised risk-adjusted returns, defined as the realised return minus the risk-free return.⁴ We obtain the monthly risk factors from Kenneth French's website.⁵ The model is:

$$RAR_{i,t} = \alpha_{i,t} + b1_{i,t}(R_M - R_{RF})_t + b2_{i,t}(SMB)_t + b3_{i,t}(HML)_t + \varepsilon_{i,t}. \quad (1)$$

Several researchers posit that the traits of the CEO affect firm performance (Bertrand and Schoar, 2003, and others). A relation may exist, therefore, between CEO characteristics and the alphas found above. We quantify this relation with the model in Equation (2) below. We estimate the theta coefficients by regressing the alpha for fiscal year $t + 1$ from Equation (1) on the n CEO characteristics identified for firm i in fiscal year t (vector $CEO_{i,t}$).

$$\alpha_{i,t+1} = \theta 0_t + \begin{bmatrix} \theta 1_t \\ \vdots \\ \theta n_t \end{bmatrix} \begin{bmatrix} CEO1_{i,t} \\ \vdots \\ CEOn_{i,t} \end{bmatrix} + v_{i,t}. \quad (2)$$

The theta estimates found in Equation (2) provide a measure of the effects each CEO characteristic has on the abnormal return for all firms per year. The characteristics we examine include the CEO's age, tenure, educational attainment and functional background. We ignore CEO gender due to the limited variation in our sample. Datta and Rajagopalan (1998) examine CEO successions and argue that the cognitive attributes firms desire in CEO successors are captured within these characteristics. We also include the fraction of the firm's equity owned by the CEO. While Jensen and Meckling (1976) argue that agency costs decline as equity ownership increases, Morck *et al.* (1988) show that a nonlinear relation exists between equity ownership and firm value. The CEO also sitting as chairman of the board weakens the governance structure of the firm, thus reducing firm value (Jensen, 1993; Beatty and Zajac, 1994). Therefore, we include the duality position of the CEO (i.e., whether the CEO is also the board chairman). Founding CEOs may work harder to obtain improved firm performance because of their personal attachment to the firm, or they may have a more thorough understanding of the business. Fahlenbrach (2009) shows that founding CEOs offer higher valuation, provide better stock returns and make more effective investment decisions. We include a founding indicator variable in our models.

⁴ We winsorise returns at the 1 per cent level. Our results are similar if we do not winsorise returns.

⁵ http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Our null hypothesis is that CEO characteristics do not matter. In other words, as the various characteristics differ over time or through turnover, the risk-adjusted abnormal returns of the firm will not be significantly affected by the changes. Thus the null hypothesis implies that the theta coefficients from (2) will be insignificant. Table 2 provides the theta coefficient estimates from the abnormal returns model in Equation (2), which describes the relation between the characteristics of the CEO and the abnormal returns provided by the CEO. Model 1 characteristics include the CEO's age, tenure with the firm, the portion of the firm's outstanding equity owned by the CEO, an indicator identifying the CEO as the firm's founder, and an indicator identifying the CEO as also the board chairman or holding only the chief executive seat. We transform the tenure variable (measured as the natural log of *Tenure* +1) and the equity ownership variable (measured as the natural log of *Equity*

Table 2
CEO characteristic models

	Model 1	Model 2	Model 3
Constant	0.0355 ***	0.0342 ***	0.0331 ***
<i>Age</i>	-0.0005 ***	-0.0005 ***	-0.0005 ***
<i>Tenure</i>	0.0000	0.0000	0.0000
<i>Equity owned</i>	0.0007 **	0.0007 ***	0.0008 ***
<i>Founder</i>	0.0092 ***	0.0094 ***	0.0085 ***
<i>Duality</i>	0.0013	0.0013	0.0015
<i>Graduate degree</i>		0.0021 *	0.0021 *
<i>Accounting/Finance</i>			-0.0014
<i>Manufacturing</i>			0.0044
<i>Marketing/Sales</i>			0.0014
<i>R&D/Engineering</i>			0.0055 ***
<i>Medicine</i>			0.0056
<i>Law</i>			-0.0032
<i>F-value</i>	17.46 ***	15.11 ***	9.77 ***

This table presents coefficient estimates for three models with abnormal returns (α) from the Fama-French three-factor model as the dependent variable and various CEO characteristics as the explanatory variables. *Tenure* represents the natural log of the CEO's time as the chief executive of his/her current firm, calculated as $\ln(\textit{Tenure}+1)$. *Equity owned* represents the natural log of the fraction of the firm's outstanding equity owned by the CEO, calculated as $\ln(\textit{Equity owned} + 0.01 \text{ per cent})$. *Founder* is an indicator variable that equals 1 if the CEO is also the firm's founder, 0 if not. *Duality* is an indicator variable that equals 1 if the CEO is also the board chairman, 0 if not. *Graduate degree* is an indicator variable that equals 1 if the CEO has a master's degree or higher, 0 otherwise. The functional background variables in Model 3 include indicator variables that equal 1 if the CEO has the corresponding background of *Accounting/Finance*, *Manufacturing*, *Marketing/Sales*, *R&D/Engineering*, *Medicine* or *Law*, and 0 otherwise. The sample includes 9,591 observations. ***, **, * indicate statistical significance at the 1, 5 and 10 per cent levels.

Owned + 0.01 per cent) for improved normality characteristics.⁶ Model 2 adds an indicator variable identifying whether the CEO holds at least a master's degree. Model 3 adds indicator variables for each functional background: Accounting/Finance, Manufacturing, Marketing/Sales, R&D/Engineering, Medicine and Law. We exclude gender as a descriptive variable due to the limited variability in the data. Only 1.6 per cent of our sample CEOs are female, as described earlier.

The three models each show that CEO age is significantly and negatively related to the abnormal returns provided by the CEO. Younger CEOs provide higher abnormal returns, decreasing 0.05 per cent for each year older. This result is consistent with previous research showing that younger CEOs are more aggressive, taking higher risk in their decisions compared with their older counterparts (Chevalier and Ellison, 1999), while older CEOs are more conservative in their decision making (Bertrand and Schoar, 2003). CEOs who hold a larger fraction of the firm's equity provide higher abnormal returns, consistent with the literature that links incentives provided by equity ownership to CEO performance (e.g., Jensen and Meckling, 1976). Founding CEOs also provide higher abnormal returns, similar to the findings of Fahlenbrach (2009). Results of Models 2 and 3 show that having a graduate degree is positively related to abnormal returns, yielding 0.21 per cent. Of the various functional backgrounds, only the R&D/Engineering background is significantly related to abnormal returns. CEOs with this functional experience provide 0.55 per cent higher abnormal returns, on average. Individually, each significant characteristic has a nontrivial economic impact on the annual abnormal returns that could be attributed to the CEO, with the founding CEO variable producing the largest coefficient.

5. *Alpha Above Replacement*

To examine whether CEO characteristics matter, we estimate the difference between the stock performances of the firm's current CEO and the average CEO. In baseball, statisticians quantify the value of a major league player compared with a potential minor league replacement using the parameter called *Wins Above Replacement (WAR)*. The *WAR* measure describes the number of wins a team gains by playing the major league player rather than his minor league replacement. While CEOs and firms do not have statistics such as hits, batting average and RBIs, we can apply the *WAR* concept to quantify the performance provided by a firm's existing CEO compared with the average CEO. We use the significant theta estimates resulting from Equation (2), provided in Table 2 Model 3, and the average of each of the corresponding CEO characteristics to find the expected abnormal return, α_{REP} , of the

⁶ The results in Table 2 remain quantitatively and qualitatively similar if we do not transform the explanatory variables *Tenure* and *Equity owned*. All other variables exhibit traits of normal distributions.

‘average CEO’ (whom we define as the replacement CEO) for firm i in year $t + 1$. For the binary characteristics (e.g., *Founder*) with significant theta estimates, we use the median value of the characteristic.

$$\alpha REP_{i,t+1} = \widehat{\theta}_0 + \begin{bmatrix} \widehat{\theta}_1 \\ \vdots \\ \widehat{\theta}_n \end{bmatrix} \begin{bmatrix} \overline{CEO1} \\ \vdots \\ \overline{CEOn} \end{bmatrix}. \quad (3)$$

We subtract the expected abnormal return of the replacement (average) CEO ($\alpha REP_{i,t+1}$) from the abnormal return of the current CEO, found earlier, to find the *Alpha Above Replacement (AAR)* for firm i in year $t + 1$.

$$AAR_{i,t+1} = \alpha_{i,t+1} - \alpha REP_{i,t+1}. \quad (4)$$

We begin by examining the CEO’s characteristics and the economic sensitivity of the alpha to changes in these characteristics. In Table 3, we find

Table 3
Replacement CEO

CEO characteristic	Mean or median value	BP increase in alpha with one unit change in characteristic	Direction of characteristic change
<i>Age</i> (years)	56.2	5.46	Decrease
<i>Equity owned</i> (%)	2.78	2.58	Increase
<i>Founder</i>	0 (CEO is not Founder)	84.68	Increase
<i>Graduate degree</i>	1 (CEO has Graduate degree)	0.00	No change
<i>R&D/Engineering</i>	0 (CEO does not have R&D/Engg background)	54.54	Increase

Using the coefficients from the OLS regressions (see Table 2 Model 3), we estimate the sensitivities, in basis points (bp), of the Fama-French alphas produced by the mean or median CEO to changes in CEO characteristics. The sensitivities are quantified by the increase in alpha if the characteristic changes by one unit. The rightmost column indicates the direction of change in each characteristic that would increase the alpha. We use the mean values for *Age* and *Equity owned* and median values for the three indicator variables: *Founder*, *Graduate degree* and *R&D/Engineering*. The *Graduate degree* characteristic shows no change because the median CEO, our replacement CEO, possesses a graduate degree, and this indicator variable cannot increase further.

that the founder coefficient has the strongest effect on alpha and equity ownership the weakest. Changing the CEO's status from non-founder to founder (i.e., changing the indicator variable from its median value of 0 to 1) increases the alpha 84.68 basis points (bp). The functional background also provides a strong sensitivity. Identifying the replacement CEO with an R&D/Engineering background increases the alpha 54.54 bp. Age and abnormal returns are negatively related, and decreasing the CEO's age by 1 year increases alpha 5.46 bp. Finally, increasing the equity ownership of the CEO by 1 per cent, increases alpha only 2.58 bp.

We continue with the null hypothesis that CEO characteristics do not matter and thus posit that changing the chief executive will not significantly alter the risk-adjusted returns of the firm. Indeed, as constructed, we expect *AAR* to be equal to or near zero. We are interested in the range of values of *AAR* to examine how firm stock performance and characteristics vary across this range. The distribution of *AAR* should vary over time and provide interesting relations between CEO characteristics and stock returns for closer inspection. The changing nature of *AAR* is depicted in Figure 3, a form of box plot that identifies the median *AAR* value and the interquartile range, with the detailed numbers provided in Table 4. The *AAR* interquartile distribution for our sample CEO-years ranges from -221.93 bp to +216.29 bp for the entire 11-year period. The median *AAR* begins below zero (-62.70 bp) in 1997, increasing to its highest point (+196.63 bp) in 2000, dropping again below zero through 2004, and then hovering near zero for the remaining years of our study. The lowest median *AAR* occurs in 2003 (-93.97 bp). Examining the volatility, pictorially in Figure 3 and numerically in Table 4, if we denote the

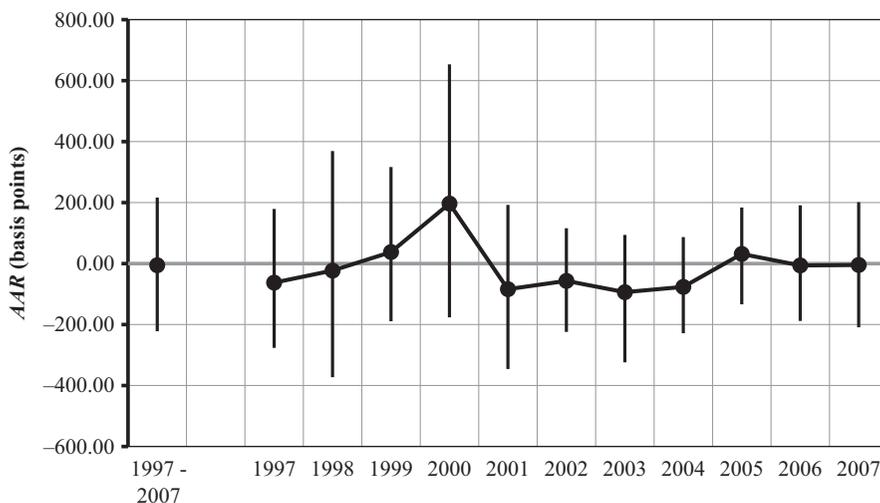


Figure 3 Median and interquartile distribution of *Alpha Above Replacement*.

Table 4
Distribution of *Alpha Above Replacement* by year

Period	Mean	25th Percentile	Median	75th percentile	Interquartile range
1997–2007	18.36	−221.93	−5.54	216.29	438.22
1997	−54.97	−276.74	−62.70	178.91	455.65
1998	8.61	−372.99	−23.20	368.98	741.97
1999	86.96	−189.55	37.72	316.75	506.30
2000	288.74	−176.32	196.63	653.49	829.81
2001	−58.85	−345.86	−84.13	192.22	538.08
2002	−56.73	−224.21	−57.04	115.81	340.02
2003	−107.41	−324.17	−93.97	93.89	418.06
2004	−90.35	−228.62	−76.67	86.73	315.35
2005	11.13	−133.80	31.52	183.75	317.55
2006	−16.26	−188.46	−6.20	191.04	379.50
2007	0.53	−209.06	−4.68	201.29	410.35

Alpha Above Replacement (AAR), in basis points, for the entire sample period and by year. The interquartile range is the difference between the 75th percentile and the 25th percentile, or the middle 50% of *AAR* values.

full period interquartile range (438.22 bp) as our baseline comparative, the first 5 years of the study have larger ranges than the final 6 years. This reduction in volatility of *AAR* is consistent with the increased difficulty for CEOs to distinguish their performance compared with their peers starting in 2002.

We then separate our sample into quartiles based on the *AAR* determined using the methods described above. Table 5 compares the mean characteristics

Table 5
Comparison of CEO characteristics based on *AAR* quartiles

	High <i>AAR</i> quartile	Low <i>AAR</i> quartile	Difference (high–low) <i>t</i> -stat
<i>Age</i> (years)	55.1	56.1	−4.50***
<i>Equity owned</i> (%)	3.12	2.78	1.78*
<i>Founder</i>	0.12	0.09	4.16***
<i>Graduate degree</i>	0.60	0.56	2.48***
<i>R&D/Engineering</i>	0.28	0.24	2.87***
<i>AAR</i> (bp)	607.11	−525.94	76.92***

This table presents a comparison of the mean CEO characteristics for the high and low quartiles of our sample sorted on *Alpha Above Replacement*, or *AAR*. The CEO characteristics (*Age*, *Equity owned*, *Founder*, *Graduate degree*, and *R&D-Engineering*) are defined in Table 2. *AAR* is measured in basis points (bp). The rightmost column provides the *t*-statistic for the difference-in-means test comparing the various CEO characteristics for each quartile. The high and low quartiles, respectively, have 2,394 and 2,409 observations. ***, **, * indicate statistical significance at the 1, 5 and 10% levels.

for CEOs in the highest *AAR* quartile to the characteristics for CEOs in the lowest *AAR* quartile. CEOs in the high *AAR* quartile are younger, own a larger fraction of the firm's equity, are more likely to be the founder of the firm, are more likely to hold a graduate degree and are more likely to have an R&D or Engineering background. The difference in the *AAR* measure is large and significant, with the highest *AAR* quartile producing 607 basis points and the lowest *AAR* quartile losing 526 basis points annually.

6. Conclusions

We revisit an important topic in the literature from a unique perspective: the relation between CEO characteristics and the alpha generated by the CEO. To test our null hypothesis that specific CEO traits do not influence the returns on firm stock, we investigate a sample covering the years 1997 through 2007, using a data set that includes 2,715 individual CEO–firm combinations. Our findings suggest that age, equity ownership and educational attainment are characteristics that significantly affect performance as measured by the alphas from the Fama-French three-factor model. Younger CEOs, CEOs who own a larger fraction of the firm's equity and CEOs with an advanced degree provide larger positive alphas. CEOs who also founded the firm, and CEOs with a background in research and development or engineering also deliver higher abnormal returns. CEO tenure and duality, in which the CEO also holds the board chair position, are not related to stock returns.

Adapting *Wins Above Replacement* to our study, we estimate the alpha produced by a CEO relative to the average CEO, using the coefficient estimates from the CEO characteristic models and the Fama-French three-factor alphas to arrive at a CEO's *Alpha Above Replacement (AAR)*. We use this novel approach to examine the effects of CEO characteristics on firm stock performance from a new perspective. With this measure, we are able to examine how *AAR* has varied over time, exhibiting a peak volatility around the turn of the century, which was an especially challenging period for firms and CEOs. The *AAR* difference between the highest and lowest quartiles, which also exhibit significant variations in CEO characteristics, is statistically and economically significant. The *AAR* metric, depicted in basis points, provides a new economic measure of CEO risk-adjusted performance and is complementary to existing measures of CEO performance such as RPE. The *AAR* metric could be particularly useful for boards of directors and recruiters searching for new CEOs, as it compares a CEO to the average CEO. Thus *AAR* allows comparisons of CEOs across a broad range of industries.

Our study contributes to the CEO literature that attempts to link CEO traits to performance. This area of research, which includes studies of CEO succession and turnover, provides a mixed view. We take a different approach, using the Fama-French model alphas to directly link CEO characteristics to abnormal returns. After controlling for market risk, firm size and firm value,

our results show that CEOs with specific traits provide larger positive and economically significant abnormal returns than CEOs who do not possess these traits. Thus, AAR provides an alpha similar to the measure used to assess the performance of portfolio managers.

We focus on large, publicly traded firms, suggesting potential selection bias in our study. An additional bias of survivorship may exist as poorly performing firms led by founders may fall out of the sample. There are, however, several important implications for firm management that arise from our results. Our findings suggest that the characteristics of the CEO matter. Age is significantly related to lower firm performance, especially as the chief executive approaches retirement age. Consistent with previous research, our results show firms should consider requiring greater equity ownership for CEOs as this parameter is significantly related to larger alphas. With respect to CEO turnover, boards would do well to prefer CEOs who hold advanced degrees. Boards should also recognise that it is difficult to replace CEOs who founded the firm, as founders significantly outperform other CEOs. The sensitivity related to the R&D/Engineering functional background may suggest that product-oriented CEOs are positive fits for the firm's top office. Overall, our research adds to the body of knowledge on how CEOs contribute to stock performance.

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