'Til death do us part: The relative merits of founder CEOs

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ABSTRACT

This paper addresses a question faced by every firm in the economy, namely is it optimal for a firm's founder to lead the company as CEO? To identify the treatment effect of founder CEOs on corporate policy and firm value, I exploit a natural experiment involving exogenous founder-to-professional CEO turnovers that arise from a founder's death or illness. I find that, relative to comparable firms that retain their founder CEO, firms that must switch to a professional CEO experience a 10% reduction in their internally generated innovation. However, professional CEOs counteract this reduced internal R&D productivity by undertaking other firm value enhancing activities, namely acquiring external technologies through greater M&A activity, increasing firm leverage and nurturing larger, more stable top management teams. These combined policy changes have offsetting effects on total firm value, implying that founder and professional CEOs have distinct yet valuable skill sets.

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I. INTRODUCTION

A fundamental question encountered by every organization is what skills and characteristics should an organization's top executive possess? In the context of for-profit corporations, the most salient manifestation of this issue is whether a firm should install a firm founder or a non-firm founder ("professional") as Chief Executive Officer (CEO). The vast economic implications of this choice between a founder and a professional CEO can be seen in the celebrated successes of founder CEO-led firms such as Amazon (Jeff Bezos), Apple (Steve Jobs), Microsoft (Bill Gates) and Facebook (Mark Zuckerberg) juxtaposed against the infamous corporate failures of other founder CEO-led firms such as Enron (Kenneth Lay), Worldcom (Bernard Ebbers), WeWork (Adam Neumann), Jawbone (Hosain Rahman), Inphonic (David Steinberg) and Theranos (Elizabeth Holmes). This ongoing debate about the merits of founder CEOs versus professional CEOs is illustrated in the divergent views held about the advantages of a founder CEO's entrepreneurial mindset and firm-specific technical skills (Schumpter, 1934) compared with the benefits derived from the more general managerial skills of professional CEOs (Rajan, 2012; Hellmann & Puri, 2002). For example,

> "We prefer to fund companies whose founder will run the company as CEO [because] founders have the moral authority to make hard choices, they know the detail of the business and have better instincts, and they have a long-term perspective on investments and building a company that lasts."
>
> - *Ben Horowitz, Co-Founder and General Venture Capital Partner of Andreesen Horowitz*

> "[The typical founder-CEO] is the inventor, the believer, the dreamer – passionate to a fault, dismissive and intolerant of "lesser" mortals. But such people generally do not do well at more mundane tasks, like actually running a successful operation."
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> - *Bob Lutz, Former Vice Chairman of General Motors Company*

Despite the fact that over 10% of U.S. public firms are run by founder CEOs (Fahlenbrach, 2009), there remains considerable disagreement in the existing literature about the role of founder CEOs in driving firm policy and ultimately firm value. On the one hand, some researchers argue that founder CEOs have a *negative* impact on firm performance (Bennett, Lawrence & Sadun, 2017; Carver, Cline & Hoag, 2013; Abebe & Alvarado, 2013; Anderson, Duru & Reeb, 2009; Johnson, Magee, Nagarajan & Newman, 1985). The claimed underperformance of founder CEOs relative to professional CEOs is attributed to founder CEOs exhibiting poorer management skills

(Bennett et al., 2017) and extracting excess rents from managerial entrenchment (Brockman, Megginson, Lee & Salas, 2017; Anderson et al., 2009; Carver et al., 2013). On the other hand, many papers document a *positive* relationship between founder CEO firms and future firm performance (Kim & Koo, 2018; Lee, Kim and Bae, 2016; Olsen, Sisodiya & Swisher, 2016; Fahlenbrach, 2009; Adams, Almeida & Ferreira, 2009; Palia, Ravid & Wang, 2008; Villalonga & Amit, 2006; Nelson, 2003), asserting that this represents the treatment effect of founder CEOs in promoting technological innovation (Lee et al, 2019; Kim & Koo, 2018; Lee et al., 2016) and adopting a more focused M&A strategy (Fahlenbrach, 2009).

These widely divergent views about the relative merits of founder CEOs versus professional CEOs likely stem from the formidable challenge in disentangling the *treatment* effect (i.e. causal impact) of founder CEOs on future firm performance and the *selection* effects that arise from endogenous firm-CEO matching (whereby any positive correlation between founder CEOs and future firm performance may be due to the firm founder only choosing to remain as CEO when their company is poised to innovate and succeed, even absent their involvement) (Miller, Breton-Miller, Lester & Cannella Jr., 2007; Jayaraman, Khorana, Nelling & Covin, 2000 c.f. Adams et al., 2009; Anderson & Reeb, 2003).

In this paper, I exploit a novel natural experiment involving exogenous founder CEO departures to identify the treatment effect of founder CEOs on interrelated dimensions of corporate policy and ultimately firm value. Specifically, I compare the change in the policies and performance of firms that are forced to switch from a founder CEO to a professional CEO due to the firm founder's death or serious illness (i.e., treated firms) with contemporaneous changes in the policies and performance of comparable peer firms that are able to retain their founder CEO in both the pre- and post-treatment period (i.e., control firms). Given the extensive evidence that I present supporting the identifying assumption that an individual firm founder's death or serious illness is an idiosyncratic shock that is exogenous to the firm's current and future prospects, my experimental setting is akin to some (treated) firms being randomly assigned a professional CEO while other (control) firms are randomly assigned one of the firm's founders as CEO.

There are several advantages of my empirical approach compared to traditional matching and instrumental variable estimators used in the prior literature. First, by comparing pairs of similar firms who are initially led by founder CEOs, I can credibly probe the validity of my identifying assumption by comparing the characteristics and behavior of both treated and control firms in the

years *prior* to the exogenous departure of only the founder CEOs of treated firms. Unlike prior studies that try to infer causality from pre-existing founder CEO and professional CEO firms that exhibit quite divergent pre-test characteristics and behavior, I provide extensive evidence that the treated and control firms in my natural experiment are very similar on a wide range of industry-, firm- and CEO-level observables in the pre-treatment period. Second, another unique advantage of my experimental setting is that when a founder CEO relinquishes his executive position due to death or illness, the treated firms in my sample must choose a non-firm founder/professional CEO replacement. This arises due to the simple fact that it is impossible for a firm to select another founder CEO if the company's only founder is dead or incapacitated. Thus, not only are the CEO turnovers in my study driven by credibly exogenous circumstances, the CEO characteristic that I am interested in examining (namely whether the company's CEO is a firm founder or not) cannot be directly replaced by another CEO at the treated firm Board's discretion. Third, since my sample covers a wide range of industries (39 out of 48 Fama-French industry classifications) across many different economic cycles (sample period of 40 years), I am better able to isolate the causal effect of founder CEOs on firm outcomes independent of various time, macroeconomic, industry, firm and CEO-level effects (c.f. Fahlenbrach, 2009; Adams et al., 2009).

Using a difference-in-differences specification that exploits over 200 exogenous departures of founder CEOs at publicly listed U.S. firms, I initially document a number of interesting and important differences in the behavior of professional CEO-led firms vis-à-vis founder CEO-led firms. First, I find that treated firms suffer a significant decline (approximately 10%) in their internally generated innovative output after switching from a founder CEO to a professional CEO. Since the intensity of R&D investment is similar for both the treated and the control firms in pre- and post-treatment periods, this decline in internal innovation is attributable to a reduction in internal R&D productivity. Second, I find that professional CEO firms are 50% more likely than founder CEO firms to acquire companies in the years following the CEO turnover event. This increased M&A activity is primarily driven by treated firms seeking to acquire new externally developed technologies (as measured by the number of target firm patents acquired). Importantly, the acquisitions undertaken by the professional CEOs in my sample appear to generate significantly greater shareholder value (as measured by acquirer cumulative abnormal announcement returns) than the M&A deals undertaken by their founder CEO counterparts. Third, I find that, compared to founder CEO-led firms, professional CEO-led firms adopt 12%

higher corporate leverage ratios and also implement less hierarchical management structures that attract and retain a deeper pool of executive talent.

The next natural question that I examine is what are the overall firm value implications of these combined changes in corporate policy? I find that the value created by founder CEOs through increased internal R&D productivity is offset by the value created by professional CEOs through greater M&A activity, less conservative capital structure policies and more decentralized governance structures. This results in overall firm value not being significantly different between founder CEO-led control firms and professional CEO-led treated firms in the post-treatment period. Therefore, consistent with the observed executive labor market equilibrium whereby both types of CEO co-exist, my results imply that neither type of CEO is uniformly superior and that the optimal choice between a founder CEO and a professional CEO will depend on the relative importance of internally generated innovation, external investment, capital structure and corporate governance in driving overall firm value.

I attempt to rule out several alternative explanations for my results. First, it is plausible that the observed decision-making of founder CEOs vis-à-vis professional CEOs is simply a reflection of their educational or employment backgrounds. However, the inclusion of indicators for whether the firm's CEO has a PhD, MBA and/or Technical education (i.e. CEO has an undergraduate or graduate degree in Science, Technology, Engineering or Mathematics (STEM) related fields per Jung, 2018) or whether the firm's CEO has finance related job experience (Custodio & Metzger, 2014) does not alter my paper's findings. Second, it is possible that many of the founder CEOs in my sample are also inventors such that my results (at least with respect to innovation) are being driven by an "Inventor CEO" effect rather than a "founder effect" (Islam & Zein, 2018). However, even after including measures capturing the patenting activity of firm CEOs, I find that my results continue to hold. Finally, I find that my results are robust to the inclusion of an extensive list of other firm and CEO characteristics that have been studied in the prior literature, including CEO tenure, CEO ownership, CEO overconfidence (Hirshleifer, Low & Teoh, 2012) and CEO early life experiences (Malmendier, Tate & Yan, 2011).

This paper contributes to several strands of the existing literature. First, my unique empirical strategy helps to shed light on the highly contested debate about the role of observable managerial traits in affecting corporate policy decisions (e.g. Dittmar & Duchin, 2016 c.f. Fee et al., 2013). By centering my difference-in-differences analysis on exogenous founder-to-professional CEO

turnovers while controlling for a broad range of both firm and CEO characteristics, I am able to more clearly identify that founder CEOs and professional CEOs adopt widely divergent strategies with respect to corporate innovation, M&A, capital structure and firm governance but that both types of CEO seem to generate similar growth in overall firm value. Thus, by highlighting that both founder and professional CEOs can add value to their firms through different channels (consistent with the observed CEO market equilibrium), my study's findings help to reconcile the vast disagreement amongst both academic researchers and corporate investors about the net causal impact of founder CEOs on firm performance.

Second, my research relates to the theoretical literature on the organization of R&D (e.g. Aghion & Tirole, 1994) as well as prior empirical work on the boundaries of the firm (e.g. Beshears, 2013). In particular, I find that, compared to founder CEOs, professional CEOs have a greater propensity to shift the location of some R&D activity outside firm boundaries through the acquisition of patents and innovative target companies. This highlights how managerial characteristics and preferences can significantly impact the type of research activity conducted inside a firm's boundaries, separate from previously documented influencing factors such as the structure of internal capital markets (Seru, 2014) and asset complementarity (Robinson, 2008).

The remainder of this paper is organized as follows. Section II presents my empirical method and data. Section III analyses the relationship between founder CEOs and firm behavior with respect to innovation, mergers and acquisitions, capital structure and corporate governance. Section IV considers the impact that differences in firm behavior under founder CEOs versus professional CEOs may have on overall firm value. Section V discusses the key conclusions.

II. EMPIRICAL METHOD AND DATA

2.1 Empirical design

In order to credibly assess the relative merits of founder CEOs vis-à-vis professional CEOs, empirical tests need to isolate the causal effect of founder CEOs on various dimensions of firm policy such as innovation, M&A strategy, capital structure and corporate governance. The object of interest, the average treatment effect (ATE), can be represented as:

$$ATE = E[y_i(F = 1) - y_i(F = 0)] \tag{1}$$

where $y_i(F = j)$ is the observed behavior of firm i when it either has a founder CEO $(j = 1)$ or a professional CEO $(j = 0)$. The complication of making causal inferences in this setting is that we do not observe the same firm at the same point in time under two different leadership regimes. Instead, we only observe $E[y_i(1)|F = 1] - E[y_i(0)|F = 0]$ in the data, namely the difference in observed outcomes of firms led by founder CEOs relative to firms led by professional CEOs. It is important to note that:

$$\begin{aligned} E[y_i(1)|F = 1] - E[y_i(0)|F = 0] = {} & E[y_i(1)|F = 1] - E[y_i(0)|F = 1] \\ & + \underbrace{E[y_i(0)|F = 1] - E[y_i(0)|F = 0]} \end{aligned} \tag{2}$$

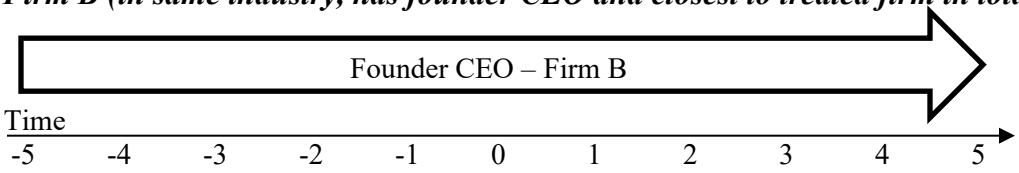
This second bracketed term is the "selection bias" that plagues any estimates based on a simple comparison in observed outcomes between founder CEO firms and professional CEO firms. This is because the difference in observed outcomes may be due to inherent differences between firms led by founder CEOs and firms led by professional CEO firms - both in terms of observable and unobservable characteristics - that are distinct from the firm's choice of CEO. This selection bias is highly unlikely to be adequately addressed using matching estimators (since companies cannot be matched on key unobservable characteristics like future innovation potential: Bernstein et al., 2016) or instrumental variable approaches (due to the difficulty in finding a robust instrument that credibly satisfies the exclusion restriction: Roberts & Whited, 2013).

However, if one could randomly assign firms with similar fundamental characteristics into either having a founder CEO or a professional CEO, one can remove this selection bias because $E[y_i(0)|F = 1] = E[y_i(0)|F = 0]$ under the condition of random assignment. Therefore, the empirical method of this paper is to exploit credibly exogenous CEO turnovers that are akin to some firms being randomly assigned a professional CEO while the remaining firms are randomly assigned one of the firm's founders as CEO.

Specifically, this paper utilizes a natural experiment involving founder CEO departures due to death or illness to help generate exogenous variation in the type of CEO (i.e. founder CEO versus professional CEO) leading otherwise similar firms. In particular, I find all firms who lose their current founder CEO at time $t = 0$ as a result of the founder's death or illness (i.e. the 'treatment' group). For each treated firm, I then find another firm that: (a) is in the same industry (3-digit SIC), (b) has a founder CEO in both the pre-treatment and post-treatment periods and (c) is closest to the treated firm in terms of total assets at year $t - 1$ (i.e. the 'control' group). These two groups combined form a sample where I claim that the assignment of a firm into the treatment group (i.e. having a professional CEO in the post-treatment period due to the founder CEO's exogenous departure) or control group (i.e. the firm retains its founder CEO in the post-treatment period) is essentially random. Under this assumption of random assignment, I can then difference out any selection bias by comparing the outcomes of firms in the treatment group pre- and post-CEO turnover with those of the control group. This identification strategy can be graphically illustrated as follows:

Treated Firm A*:** ***Founder CEO dies

***Control Firm B (in same industry, has founder CEO and closest to treated firm in total assets)*:**



One very attractive feature of my unique experimental research setting is that when a founder CEO relinquishes his executive position due to death or illness, the treated firms in my sample are forced to choose a non-founder/professional CEO replacement (c.f. Islam & Zein, 2018; Custodio & Metzger, 2014; Bernile, Bhagwat & Rau, 2017). While some prior papers have used 'exogenous' CEO turnovers to study the importance of other CEO characteristics such as inventor experience, financial expertise and risk-taking preferences on firm performance, the issue with this approach is that even though the turnover may occur for exogenous reasons, the choice of whether the new CEO should also possess the same given characteristic as their predecessor CEO (i.e. should the new CEO also be a financial expert, inventor etc.) is not random and likely related to the unobserved future investment/innovation prospects of the firm.

Conversely, in my typical case where a firm with only one founder loses their founder CEO due to death or illness, it is impossible for the firm to select another founder CEO to lead the company, irrespective of the firm's future outlook or optimal strategy.[1] Combined with the fact that the death or serious illness of a founder CEO occurs randomly over time, the difference in post-turnover firm behavior between treated firms (under new professional CEO leadership) and control firms (who remain under founder CEO leadership) should provide a credible estimate of the treatment effect of founder CEOs on various corporate outcomes.[2] In other words, my identification of the causal impact of a founder CEO on firm outcomes is derived from control firms (who maintain their founder CEO in both the pre- and post-treatment sample period) acting as a counterfactual for how the treated firms would have performed in the post-treatment period, had their founder CEO not passed away.

2.2 Sample formation

2.2.1 Sample of treatment firms

Following Quigley, Crossland & Campbell (2017) and Jenter, Matveyev & Roth (2016), Table 1 details the full sample of U.S. public company CEOs who were (a) one of the founders of the firm and (b) forced to permanently relinquish their CEO position due to death or illness.

First, I collect a comprehensive sample of CEO departures due to death or well-specified health issues through an extensive search of news sources, press releases, company reports, SEC company filings and various other sources. I start by searching all news articles contained in the *Factiva* database for the years 1981 to 2011 using keywords to identify the firm's CEO/top

[1] Over four-fifths of my entire sample is comprised of firms whose sole surviving founder relinquishes the CEO position due to death or illness, necessitating a mandatory switch to a non-founder/professional CEO. For all remaining cases, I do not find any treatment firms that replace a deceased co-founder CEO with another co-founder.

[2] There are several reasons why it is unlikely that my results are primarily driven by the firm's *Board* making sudden and large revisions to the company's strategy after the founder CEO's death. First, there is extensive evidence that CEOs, as opposed to corporate Boards, are the primary decision-makers when it comes to operational issues such as innovation strategy, capital structure policy and management of executive officers (e.g. Graham, Harvey & Puri, 2013; Bertrand & Schoar, 2003). Second, most of the effects that I document in Section 3 only occur many years after the new professional CEO is appointed. This seems to be inconsistent with a story that the Board of Directors of treated firms suddenly decides that the firm's optimal strategy must change after the founder CEO departure and then merely hires a professional CEO to immediately execute this change in strategy. Finally, the mere fact that the dying founder CEO could prevent the Board from thinking about or implementing new strategic plans is itself evidence of a significant "founder CEO effect" in corporate decision-making.

executive[3] and keywords related to death or ill-health.[4] I also search all electronically available 8-K, 10-K and proxy statement filings by firms in the *SEC EDGAR* database between 1994 and 2011. Since these keyword searches result in a large number of hits that are usually false positives, I manually screen all search results and keep only those events where I can verify that the person in question was the firm's top executive and was still in office at the date of departure. Furthermore, to ensure that no CEO departures are correlated with a firm's future prospects, I also remove any turnovers due to suicide or otherwise accompanied by any discussion that the CEO was forced to relinquish their position for any reason other than a well-defined health condition (Fee et al., 2013). This results in an initial sample of 882 CEO turnover events.

Second, consistent with the prior literature on this topic, I match all firms that experienced a CEO departure to the Compustat and CRSP databases for financial and stock price information respectively.[5] I also drop all financial firms (SIC codes 6000-6999) from my analysis. These two filters result in the loss of 305 and 40 firm observations respectively.

Third, I determine whether the departed CEO is a founder of the firm following Fahlenbach (2009). Founder status is usually given in press releases announcing the CEO's departure and/or noted in the key executive personnel section of the proxy filing. When the proxy filing does not provide information about the CEO's employment history from which I can infer whether the CEO founded the firm or not, I read both *Hoovers* and *Funding Universe* Company profiles that detail the company's history. In the rare case where these company profiles do not clearly identify the firm's founders, I use *Factiva* news searches to verify the founder status of the CEO.[6] This procedure results in a final sample of 212 exogenous founder CEO turnover events that I use for my main empirical tests.[7]

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[3] Since a firm's top executive is not always referred to as the Chief Executive Officer or CEO, I follow Jenter et al. (2016) and Quigley et al. (2017) by using the following keywords to identify potential top executives: "CEO", "Chief Executive", "President" and "Chairman".

[4] In particular, I use various connotations of keywords such as "died", "death", "passed away", "health reasons", "medical reasons", "ill health" and "illness."

[5] While restricting my sample to publicly traded firms excludes direct comparison of founder and professional CEOs in the interesting subpopulation of private firms, my focus on public firms allows for greater comparability of my results with those of the prior literature, permits consideration of a much richer set of input and outcome variables and still identifies the key dimensions on which founder and professional CEOs are likely to differ across all firms.

[6] For any ambiguous cases, I conservatively classify the CEO as a non-founder or professional CEO.

[7] The number of treated exogenous firm CEO turnover observations in this paper compares favorably to recent studies such as Islam & Zein (2018) (15 treated inventor CEO turnovers) and Bernile et al. (2017) (41 exogenous CEO turnovers involving changes in CEO risk attitude type).

2.3.2 Sample of control firms

The control group in my natural experimental setting consists of those firms who are also run by founder CEOs in the pre-treatment period but do *not* experience the exogenous shock of losing their founder CEO. To form this control group, I start with all firms listed in Compustat in the relevant event year that are in the same 3-digit Standard Industry Classification (SIC) category as the treated firm. For each of these firms, I then identify whether the then current CEO was one of the founders of the company (i.e. a founder CEO) and continued to serve as the company's top executive for at least three years after the associated treatment firm turnover date.[8] As a final step, I use the founder CEO firm whose total book value of assets in the year prior to the turnover is closest to the total assets of the treated firm as the control firm in my difference-in-difference specifications.[9] As a result, my control sample also comprises 212 firms.

2.3 Difference-in-difference estimates

I utilize a difference-in-differences specification to identify the treatment effect of founder CEOs on various firm outcomes. Since the exogenous CEO turnovers that I analyze impact only some firms and occur in different years during the sample period, I examine the before-after effect of an exogenous switch from a founder to a professional CEO (treatment group) compared to the before-after effect for firms with founder CEOs that were not affected by the turnover event (control group). This is a difference-in-differences test in multiple treatment groups and multiple time periods as considered in Atanassov (2013), Acharya, Baghai & Subramanian (2014) and Imbens & Wooldridge (2009). I implement this test via the following regression:

$$Y_{i,t+1} = \alpha + \beta_1 Post_{i,t} + \beta_2 Post_{i,t} \times Treated_i + \gamma Firm\ Characteristics_{i,t} + \delta CEO\ Characteristics_{i,t} + Firm\ FE_i + Year\ FE_t + \varepsilon_{i,t} \quad (3)$$

where i indexes the firm and t indexes the year. The dependent variable Y denotes various innovation, M&A, governance, and financial outcome variables of interest described in Section 2.4. The dummy variable $Post_{i,t}$ is equal to one for the years after the founder CEO turnover event, and zero otherwise. It is important to note that $Post_{i,t}$ is defined at the matched treated-

[8] My results are qualitatively unchanged if I alternatively use a two year or a five year minimum time frame that the control firm's founder CEO must remain in office in the post-treatment period.

[9] There are 11 cases where I cannot find any founder CEO firms in the same 3-digit SIC category as the treated firm. I thus repeat the search process discussed above but consider all firms in the same 2-digit SIC category as the treated firm. My results are qualitatively unchanged if I exclude these firms from my empirical analysis.

control pair level such that $Post_{i,t}$ equals one for the treated firm and its matched control firm in the years after the health-related founder CEO turnover event. The indicator variable $Treated_i$ is equal to one for treated firms that experience the exogenous loss of their founder CEO due to death or illness, and zero otherwise. I also include an extensive set of $Firm\ Characteristics$ and $CEO\ Characteristics$ that have been identified by the prior literature as affecting a firm's subsequent output/strategy. The inclusion of firm fixed effects $(Firm\ FE)$ allows me to control for any time-invariant differences in patenting, investment, and other financial practices across firms while the inclusion of calendar year fixed effects $(Year\ FE)$ allows me to control for intertemporal technology and economic shocks.[10] Given that the treatment is assigned at the individual firm level, I cluster standard errors by firm.

In this econometric specification, β_2 is the key coefficient of interest. By employing both firm and year fixed effects, β_2 is identified as the *within-firm* differences before and after treated firms exogenously switch from a founder CEO to a professional CEO as compared to the before and after differences for comparable control firms that did not experience the loss of their founder CEO during the same time period (Gao & Zhang, 2017; Imbens & Wooldridge, 2009).[11]

2.4 Variable construction

In my empirical analysis, I first consider in Section 3 how founder and professional CEOs directly affect future firm behaviour and/or strategy ("intermediate firm outcomes"). In particular, I examine how an exogenous change from a founder CEO to a professional CEO affects a firm's internal innovation output, external investment activity, financing decisions and corporate governance policies. I then analyse in Section 4 how these changes in firm behavior affect overall firm value.

[10] $Post_{i,t}$ is not collinear with the calendar year fixed effects; for instance, if treated firm A experiences its founder CEO turnover in 2005 and treated firm B loses its founder CEO in 2006, $Post_{i,t}$ will equal one in 2006 for treated firm A (and its matched control firm) but $Post_{i,t}$ will equal zero in 2006 for treated firm B (and its matched control).

[11] For clarity, following Jaravel, Petkova & Bell (2018) and Jung (2018), the indicator variable $Post_{i,t}$ is included along with $Post_{i,t} \times Treated_i$ in all regression specifications because the firm and year fixed effects may not fully account for trends in firm outcomes around the health-related departures of founder CEOs in our sample.

2.4.1 Innovation-related variables

Given that innovation is one of the key drivers of firm growth in the modern economy (Fitzgerald, Balsmeier, Fleming & Manso, 2019; Atanassov & Liu, 2018; Hall & Lerner, 2010) and that CEOs play a critical role in spurring firm innovation (Schein, 1992; Yukl, 2002), I study the relationship between founder CEOs and internally generated corporate innovation. To gauge the success of long-term internal investment in firm innovation, I employ two measures of innovation based on patents.

My first measure of internally generated innovation is $Number\ of\ Internal\ Patents$ which represents the number of patents filed (and subsequently granted) by a firm in a given year (Gao & Zhang, 2017). I collect information on firm patenting from three sources, the United States Patent & Trademark Office (USPTO), PatentsView and the Berkeley-Fung patent database.[12] As discussed further below, I identify whether a patent was internally generated by the firm or was acquired from another entity using the *Plainsite* database of patent assignment transfers.

In addition to studying the quantity of patents produced, I also measure the *quality* or impact of a patent by counting the number of citations that it receives. Scaled internal citations equals the number of citations that a patent receives divided by the average number of citations made to patents applied for in the same year and technology class. I scale the raw citation count to account for potential variation in citation rates over time and across technologies (Bernstein, 2015) as well as to address truncation bias that results in patents granted towards the end of the sample having less time to accumulate citations (Hall, Jaffe & Trajtenberg, 2005). I then form the firm-year level measure $Average\ Firm\ Patent\ Quality$ by calculating the average scaled citations across all the firm's internally generated patents applied for in that year.

2.4.2 External investment activity

Since a firm's external investment activities through modes such as M&A often has profound value consequences (both positive and negative) for firm shareholders (Moeller, Schlingemann & Stulz, 2005), I develop three measures of the intensity of a firm's acquisition activity.

[12] PatentsView contains detailed USPTO patent data since 1976 and includes a patent's application and grant year, technology class, patent assignee names and the number of citations by and to a patent. I use the Berkeley-Fung patent database, which extends the Compustat gvkey-pdpass bridge in the NBER Patent Database, in conjunction with PatentsView assignee ID numbers to identify all patents assigned to the publicly listed firms in my sample.

First, I use the *SDC Platinum* database to identify all completed acquisitions by sample firms of private, public and subsidiary targets from 1976 to 2016. Following Gompers, Ishii & Metrick (2003), I count the number of acquisitions per firm-year $(Acquisition\ Count)$.

Second, to capture the economic importance of M&A activity to the sample firm, I compute the variable $Acquisition\ Ratio$ as the sum of the prices paid for all acquisitions made during the year, divided by the firm's market capitalization (Fahlenbrach, 2009).

Third, I use the *Plainsite* database to develop a novel measure that identifies the number of patents a firm acquires from external entities during the year ($Number\ of\ Acquired\ Patents$). Since *Plainsite* records all transfers of title to granted patents and pending patent applications, I am able to observe patents that were originally developed by other externally owned entities and subsequently acquired by the focal firm (even if the patent is ultimately granted in the name of the acquirer). I supplement the information in the *Plainsite* database by searching the USPTO, PatentsView and Berkeley-Fung patent databases for all patents assigned to the target firm in both the pre- and post-merger period.

2.4.3 Financing decisions and corporate governance

Given that a firm's financing strategy has the potential to be significantly affected by a CEO's experiences and preferences (see Fee et al., 2013; Wasserman, 2012), I consider how a firm's leverage ratio changes after exogenous switches from a founder CEO to a professional CEO. Following Seru (2014), I measure $Leverage$ as total debt divided by total book value of assets.

Another dimension on which founder CEOs and professional CEOs may differ is the size and composition of the top management team (TMT) that they decide to establish as part of the firm's decision-making infrastructure (Peterson, Smith, Martorana & Owens, 2003). As such, I define $TMT\ Size$ as a count of the number of executive officers listed in a firm's annual proxy filings. To capture the possibility that certain types of CEOs may be more susceptible to losses of executive talent, I separately define $TMT\ Turnover$ as a count of the number of executive officers who left the firm during the year.[13]

[13] In computing $TMT\ Turnover$, I do not count any executive officer departures due to death or serious illness.

2.4.4 Operational performance and value creation

Given that the ultimate success or failure of a CEO's chosen policies is likely to be reflected in the operational performance of the firm (Fee et al., 2013), I consider return on assets (ROA), defined as operating income after depreciation divided by total assets, as a general measure of firm profitability (Bertrand & Schoar, 2003).

To test whether founder CEOs or professional CEOs systematically create more value for their shareholders, I examine changes in firm valuation, as measured by $Tobin's\ Q$, surrounding exogenous founder-to-professional CEO switches for the treated and control firms in my sample. I calculate $Tobin's\ Q$ as the ratio of the market value of assets to the book value of assets, where the market value of assets is defined as the book value of assets plus the market value of common stock less the book value of common stock and deferred taxes (Fahlenbrach, 2009).

2.4.5 Firm characteristics

I include a broad set of firm-level characteristics that have been identified by the prior literature as impacting firm behavior and strategy. These include $Firm\ Age$, $Firm\ Size$, $Cash$ holdings, ROA, spending on $R\&D$, capital expenditures $(Capex)$ and $Tobin's\ Q$ (see e.g. Seru, 2014; Gao & Zhang, 2017; Adams et al., 2009). All explanatory variables are lagged by one year. Please refer to Appendix 1 for the method used to construct these firm-level variables.

2.4.6 CEO characteristics

Given this paper's focus on comparing the actions of founder CEOs and professional CEOs, I include an extensive set of CEO-level characteristics that may attenuate the relationship between founder CEOs and firm behavior, namely: $CEO\ Age$, $CEO\ Duality$, $CEO\ Tenure$ (Islam & Zein, 2018) and $CEO\ Ownership$ (Kim & Lu, 2011). In addition, I also control for whether the CEO is an $Inventor\ CEO$ (Islam & Zein, 2018), is a $Female$, exhibits $Overconfidence$ (Malmendier & Tate, 2008), grew up during the $Great\ Depression$ (Malmendier, Tate & Yan, 2011), has $Military$ experience (Malmendier et al. 2011), is a $Financial\ Expert$ (Custodio & Metzger, 2014), has a PhD, has a MBA and/or has a STEM degree (i.e. $Technical\ education$) (Jung, 2018). Please refer to Appendix 1 for the method used to construct these CEO-level variables.

2.5 Evidence supporting validity of experimental design

To make causal inferences about changes in firm outcome measures (for example innovation) for the treatment and control groups after the exogenous CEO turnover event, it is crucial that the parallel trends assumption holds in my research design. In other words, my natural experiment assumes that, in the absence of treatment (i.e. both the treatment and the control firms were able to retain their founder CEO throughout the sample period), the difference in firm outcomes between the treatment and control groups would be constant over time.

While the parallel trends assumption cannot be directly tested, one important way in which to assess the validity of the parallel trends assumption in my research setting is to examine whether the output/policies of the treatment and control firms were similar *prior* to the turnover event when both sets of firms were under founder CEO leadership (Seru, 2014).[14]

Panel A of Table 1 presents descriptive statistics on the innovativeness, acquisitiveness, and financial position of firms in the treatment and control group before the exogenous CEO turnover event. Column 3 shows the statistical significance of the mean difference in various firm and CEO characteristics for the treatment and control group in the pre-treatment period. This univariate analysis indicates that the two groups are insignificantly different from one another on virtually all key pre-treatment characteristics.[15] The similarity of the treated and control firms in terms of observable characteristics pre-turnover is a first indication that the sample of founder CEO control firms are a valid counterfactual for the treated professional CEO firms. However, in order to more rigorously test the similarity of the two groups in the pre-treatment period, I now turn to a multivariate setting.

In this multivariate test, I pool all founder-led firms together and examine whether the innovative output, acquisition activity or the financial position of firms in the pre-treatment period can predict whether a firm experiences the departure of its founder CEO at time t. The logit specification is:

$$Prob(Founder\ CEO\ Departs_{i,t} = 1) = \Phi(\beta_1 Innovation_{i,t-1} + \beta_2 Acquisitiveness_{i,t-1} \quad (4)$$

[14] As discussed earlier, an advantage of my experimental setting is that I do not attempt to infer causality from firms that have already endogenously chosen whether to install a founder CEO or a professional CEO. As observed in both Fahlenbrach (2009) and Adams et al. (2009) respectively, founder CEO-led firms are often smaller, have higher Tobin's Q and invest more in R&D and capital growth compared to professional CEO-led firms.

[15] Indeed, the only substantive difference between the two groups is that the founder CEOs of treated firms tend to be approximately 6 years older at the CEO turnover event date compared to the founder CEOs of control firms, an unsurprising observation given that my treated sample involves CEOs that eventually die or suffer serious illnesses.

$$+ \gamma Firm\ Characteristics_{i,t-1} + \delta CEO\ Characteristics + Year\ FE)$$

where $Innovation$ includes three-year average measures of internal innovation described in Section 2.4.1, $Acquisitiveness$ includes three-year average measures of firm acquisition activity described in Section 2.4.2, $Firm\ Characteristics$ represents firm-level financial and other information while $CEO\ Characteristics$ comprises CEO-level explanatory variables. The dependent variable $Founder\ CEO\ Departs$ takes a value of one for the treatment group in the event year and zero otherwise. The logit regression is estimated with year fixed effects and robust standard errors.

Panel B of Table 1 reports the results of this multivariate test. Consistent with the univariate results documented in Panel A, the pre-treatment characteristics of the treated and control firms are quite similar on the dimensions of innovative output, acquisition activity and financial position/performance and thus do not systematically predict which firms will be assigned to the treatment and control samples. This analysis supports my claim that the firms in my sample are as good as randomly assigned into the treatment and control groups and that the control firms who retain their founder CEO are a valid counterfactual for the treated firms who must switch to a professional CEO. I further discuss the reasonableness of the parallel trends assumption in Sections 3 and 4 when discussing the multivariate difference-in-difference test results.

III. FOUNDER CEOS AND CORPORATE POLICY

As outlined in Section 2, I use a difference-in-differences specification to examine changes in firms' internally generated innovation, external investment activity, capital structure and management team composition around exogenous founder-to-professional CEO turnovers.

3.1 Effect of founder CEOs on internally generated innovation

There are two competing theories concerning the relative ability of founder CEOs vis-à-vis professional CEOs to promote innovation, particularly in larger corporations. On the one hand, 'entrepreneurship theory' posits that founder CEOs are better innovators than professional CEOs because founder CEOs tend to have a longer-term investment horizon (Miller, Breton-Miller & Lester, 2011) and are likely to have a greater tolerance to risk and failure (Fahlenbrach, 2009). In addition, founder CEOs with strong beliefs in entrepreneurial risk-taking may attract like-minded and talented employees who can increase a firm's innovative performance (Lee et al., 2016). On the other hand, 'corporate life cycle' theory suggests that founder CEOs may exhibit similar or even worse innovation performance than professional CEOs. This is because founder CEOs may not possess the right leadership skills to manage lower-level employees/inventors who are critical to driving the innovation process at larger, more established firms (Boeker & Wiltbank, 2005). In particular, as the scale and complexity of a firm's operations increases, the strong preference of founder CEOs to retain centralized decision making authority may stifle the development of creative solutions to the firm's widening range of problems and challenges (Campbell, Epstein & Martinez-Jerez, 2011; Wasserman, 2003).

3.1.1 Main results

Table 2 presents the regression results based on the diff-in-diff specification outlined in equation (3). Using $Ln(1 + Number\ of\ Internal\ Patents)$ as the dependent variable in column (1), I find that the coefficient estimate on the indicator $Post\ Founder\ CEO$ is negative (-0.10) and significant at the 5% level. This finding suggests that treated firms that are forced to switch from a founder CEO to a professional CEO suffer a large decline in the *quantity* of their internally generated innovation output relative to control firms that continue to be led by their founder CEOs. To examine whether there are also changes in the quality of patents produced, I examine the impact/quality of each internally generated patent using the scaled number of

forward citations received per patent ($Average\ Firm\ Patent\ Quality$). As shown in column (2) of Table 3, I find that there is no significant difference in the average *quality* of patents produced in the post-treatment period for founder CEO firms and professional CEO firms. Combining this result with the earlier findings documenting the decline in the quantity of internally generated patents implies that *total* internally generated innovation output declines significantly in the years after a founder CEO's exogenous departure. The economic magnitude of this overall decline in internal innovation is sizeable: changing from a founder CEO to a professional CEO leads to a decrease in the number of internally developed patents of approximately 10% (i.e. $e^{[-0.10]} - 1$).

One potential explanation for the reduction in the innovative output of treated firms (led by a professional CEO) relative to control firms (led by their founder CEO) is that professional CEOs may have deliberately curtailed R&D expenditure as part of a strategic shift away from focusing on internal innovative developments. Under this hypothesis, the R&D productivity (i.e. the amount of innovative output generated per dollar of R&D spending) of treated firms may be unchanged or even improve after a change to a professional CEO (see Custodio & Metzger (2014) in the context of financial expert CEOs). As such, in Column 3 of Table 2, I examine whether there are any significant differences in the intensity of R&D spending (defined as R&D expenditure divided by total assets following Fahlenbrach, 2009) by founder CEO firms vis-a-vis professional CEO firms. Interestingly, in contrast to the results in Fahlenbrach (2009), I find that, in my natural experimental setting involving exogenous CEO turnovers, there are no significant differences in the R&D outlays of professional CEO firms and comparable founder CEO firms in the post-treatment period.[16] As such, my empirical results imply that the relative decline in the innovative output of treated firms is more likely due to an unanticipated drop in treated firms' internal R&D productivity post the founder CEO's departure rather than a deliberate curtailment of internal innovative activities by professional CEOs.

3.1.2 Pre-treatment trends

Before continuing, I expand on the discussion in Section 2.5 by providing further evidence that supports the parallel trends assumption underlying my empirical study. In particular, I define

[16] As Fahlenbrach (2009) concedes in his paper, it is an open empirical question as to whether "the excess stock market performance of founder-CEO firms is a particularity of the sample period [1992–2002] of overall exceptional stock market performance" and "to what extent is the excess performance related to the investment behavior of founder-CEOs, and does it differ in different economic scenarios?"

seven dummy variables ($Year-2$, $Year-1$, $Year\ 0$, $Year+1$, $Year+2$, $Year+3$ and $Year+4\ and\ afterward$), to indicate the year relative to the exogenous founder-to-professional CEO turnover event. For example, $Year\ 0$ indicates the year in which the founder CEO turnover event occurred, $Year-2$ denotes that it is two years prior to the CEO turnover event and $Year+2$ indicates that it is two years after the turnover event. I then re-estimate equation (3) by replacing the $Post$ indicator variable with the seven indicators described above.

Table 3 investigates the pre-and post-treatment trend in internally generated innovation between the treatment and control group (noting that all patent-related outcome variables are computed based on patent application year). The first important result to note in Table 3 is that the coefficients on $Year-2\times Treated$ and $Year-1\times Treated$ are both close to zero and not statistically significant across all innovation measures and sub-samples. This suggests that there are no significant differences in innovation in the treatment and control groups *prior* to the exogenous shock of founder CEO departure due to death or illness, suggesting that the parallel trend assumption of the difference-in-differences approach is not violated in my study.

Moreover, Table 3 suggests that most of the impact of an exogenous switch to a professional CEO occurs three or more years after the turnover event. In particular, the coefficients on $Year\ 0 \times Treated$ and $Year+1\times Treated$ are insignificant across all innovation measures while the effects of professional CEO leadership are concentrated in the three to five years after treatment. This is consistent with the view that innovation is a relatively long-term process (Hirschleifer, Hsu & Li, 2013) and thus we would not expect to see an immediate change in the innovation trajectory of the firm post-CEO turnover, especially when that turnover is not part of a planned change in corporate strategy (see generally Gao & Zhang, 2017).

3.2 Impact of founder CEOs on external investment policy

While the results in the previous section suggest that a firm's *internal* innovative productivity declines after the exogenous departure of a founder CEO, this observation alone provides an incomplete perspective on the development of a firm's innovative growth options. This is because a company can expand its overall investment opportunity set by increasing its reliance on external technologies acquired through mergers and acquisitions (Bernstein, 2015) or strategic alliances (Seru, 2014). For example, in the context of firms that IPO versus those that withdraw their IPO filing and remain privately held entities, Bernstein (2015) finds that IPO firms offset a decline in

the novelty of their internally generated innovation by substantially increasing their acquisition of externally developed patents. In fact, Hitt, Hoskisson & Ireland (1990) note that acquiring later stage innovative companies may be a cheaper (risk-adjusted) growth strategy than developing all new innovation through internal R&D investment. Therefore, it is important to consider the possibility that professional CEOs may offset a decline in internal R&D productivity with a greater reliance on acquiring innovative growth options through external investments like M&A.

3.2.1 Main results

As shown in the first two columns of Table 4, the treatment firms led by professional CEOs are significantly more acquisitive in the post-turnover period than comparable control firms led by founder CEOs after accounting for firm and CEO characteristics. In particular, firms headed by professional CEOs are 50% more likely than their founder CEO counterparts to engage in an M&A transaction in any given year.

However, given that corporate acquisitions can be conducted for a variety of reasons, it is not necessarily the case that this increase in M&A activity at treatment firms is motivated by the desire to purchase externally generated technologies (Bernstein, 2015). Therefore, I utilize my novel measure $Number\ of\ Acquired\ Patents$ which counts the number of patents that a firm acquires from external entities each year. Importantly, I find that while treated and control firms acquire external patents at a similar rate in the pre-treatment period, there is a 9% increase in the number of externally developed patents in a treated firm's patent portfolio in the post-turnover period. This implies that firms led by professional CEOs make markedly greater use of M&A transactions as a means to broaden the firm's pipeline of innovative opportunities.

3.2.2 Value impact of M&A activity

Given the increased acquisition intensity of treatment firms in the post-period relative to control firms documented in the previous section, a reasonable question to ask is whether the greater volume of M&A deals undertaken by professional CEOs tends to create or destroy value for firm shareholders. The theoretical and empirical evidence to date on this question provides mixed conclusions. On the one hand, founder CEOs may be more susceptible to an over-investment problem due to less Board resistance to investing in poor projects or overconfidence in their ability to select and integrate undervalued M&A targets (Hayward, Shepherd & Griffin, 2006). For example, Lee, Kim & Reuer (2016) document that acquisitions led by overconfident

founder CEOs at recently listed firms experience lower abnormal announcement returns than acquisitions conducted by professional CEOs. On the other hand, Fahlenbrach (2009) argues that founder CEOs are less prone to empire building and that, in his sample of publicly listed firms between 1993 and 2002, the increased M&A activity of founder CEO firms does not appear to be value-destroying (nor value creating) relative to professional CEOs.

In order to assess whether the increased M&A activity of professional CEOs is value enhancing for treated firm shareholders, I examine the stock market announcement returns for completed M&A deals undertaken by acquirer firms in my sample, where deals are partitioned by founder CEO status (see Lee, Mauer & Xu, 2018; Ishii & Xuan, 2014; Cai & Sevilir, 2012). I calculate cumulative market model adjusted abnormal returns around the initial acquisition announcement following the standard event study methodology established in Brown & Warner (1985) using daily stock returns. Specifically, I use trading days −200 through to −45 relative to the announcement date as the estimation period for the market model parameters, further requiring that a stock have at least 30 non-missing daily returns during this time period in order to be included in the final sample (Betton et al., 2013). Over this estimation period, firm daily returns are regressed on the value-weighted returns of the market portfolio. The difference between the actual daily return and the market model predicted daily return using the estimated factor loadings represents the daily abnormal return. Following Masulis, Wang & Xie (2007), Cai & Sevilir (2012) and Golubov et al. (2012), I sum the daily abnormal return over the 5-day event window around the announcement date ([–2, +2]) and use the cumulative abnormal return as the measure of acquirer abnormal performance upon deal announcement (ACAR).

In univariate analysis, both the mean and the median ACAR is significantly positive for professional CEO-led acquirer firms (2.1% and 1.8% respectively). Furthermore, the ACARs for deals executed by the professional CEOs in my sample are significantly higher than for those deals undertaken by founder CEOs (mean and median of –0.3% and 0.1% respectively). These univariate results suggest that acquisitions conducted by professional CEOs are associated with higher expected value creation relative to acquisitions undertaken by the founder CEOs in my sample, consistent with professional CEOs having superior skill in identifying and closing value-added M&A deals.

To further probe the relationship between founder CEO status and acquirer announcement returns, I utilize a multivariate ordinary least squares (OLS) regression framework following

Moeller, Schlingemann & Stulz (2004). This setting allows me to control for other deal and firm characteristics aside from founder CEO status that could impact the stock market's reaction to an acquisition. The dependent variable in all of these regressions is the 5-day ACAR.[17] The key independent variable of interest is *Founder CEO* which is a dummy variable equal to one if an acquisition is undertaken by a founder CEO and zero otherwise. All regression specifications include standard control variables identified by the prior literature (see Appendix 1 for all variable definitions). In relation to acquirer firm characteristics, I control for *Acquirer size*, *Acquirer Tobin's Q*, *Acquirer leverage*, Acquirer return on assets (*Acquirer ROA*) and pre-announcement stock price run-up (*Acquirer price run-up*). In relation to deal characteristics, I control for whether the target firm is publicly listed (*Target public status*), whether the acquirer held a pre-bid equity stake in the target firm (*Toehold*), whether the deal is 100% financed with equity (*Pure stock deal*), the deal involves a foreign domiciled target company (*Cross border*), whether the acquirer and the target share the same 3-digit SIC code (*Diversifying acquisition*), the size of the deal relative to the size of the acquirer (*Relative Deal Size*), whether the transaction is a tender offer (*Tender Offer*), whether the acquisition approach is hostile or not (*Hostile*) and whether the transaction is a merger of equals (*Merger of Equals*). All regressions include year and industry fixed effects (based on the Fama & French (1997) 48 industry classification scheme) while t-statistics are calculated using robust standard errors that adjust for heteroskedasticity and acquirer clustering.

Utilizing this multivariate regression approach, I find that the market reaction to acquisitions undertaken by professional CEOs is significantly higher than for those acquisitions completed by founder CEOs. Overall, the ACAR analysis indicates that the increased M&A activity of professional CEO-led firms in my sample creates significant shareholder value by expanding the firm's pipeline of innovative growth options. Furthermore, this analysis also suggests that professional CEOs have superior skill in identifying more promising M&A opportunities relative to founder CEOs.

3.3 Founder CEOs and firm financing strategy

An important but understudied facet of the behavior of founder CEOs relative to professional CEOs is their decision-making tendencies with respect to firm financing strategy. For example,

[17] All subsequent results are qualitatively similar using 3-day ACAR as the dependent variable.

there is substantial survey evidence to suggest that many firm founders lack the financial knowledge and/or financial market connections to optimize the growth of the businesses they manage, particularly in the earlier stages of the company's development (see e.g. Wasserman, 2012; Bennett et al., 2017).

As a manifestation of the relative expertise of founder CEOs and professional CEOs in managing more complex firm financing activities, two related strands of literature suggest that founder CEOs may be more likely to make more conservative leverage choices. First, Strebulaev & Yang (2013) argue that the puzzling observation that over 10% of public non-financial U.S. firms forego the tax benefits of debt equal to 7% of the market capitalization of their firm can be explained in part by agency costs arising through the private benefits of control (Bertrand & Schoar, 2006). Given that founder CEOs are likely to care more about the private benefits of control and their voting rights than professional CEOs (Strebulaev & Yang, 2013), it is plausible that founder CEOs may be more averse to using debt to finance their business. Second, using a survey of 800 CEOs in 22 emerging countries, Mullins & Schoar (2016) find that founder CEOs are four times more likely than professional CEOs to feel accountable to the firm's lenders and involve lenders before making any major investment decisions while professional CEOs place much greater emphasis on the importance of shareholder value maximization when setting the firm's financial policies. As a result, separate from a founder CEO's personal preferences, it is possible that founder CEOs may choose to systematically adopt lower corporate leverage ratios in order to facilitate a more harmonious relationship with the firm's debtholders (Cronqvist, Makhija & Yonker, 2012).

To test these predictions, I examine how a firm's leverage ratio changes around exogenous founder-to-professional CEO turnovers using the method described in Section 2. The first column of Table 5 presents the results of this analysis. I find that professional CEO-led treated firms adopt 12% higher leverage ratios relative to the average founder CEO control firm. This evidence is consistent with the survey findings in Mullins & Schoar (2016) whereby founder CEOs may be willing to adopt more conservative leverage policies relative to their professional CEO counterparts in order to balance the competing interests of debtholders and equityholders. Furthermore, my empirical evidence builds on the work by Frank & Goyal (2009) by robustly identifying a readily observable managerial trait, namely whether a firm's CEO is also one of the firm's founders, that has a large economic impact on corporate leverage decisions.

3.4 Founder CEOs and management of executive human capital

Despite the well accepted positive relationship between top management team (TMT) quality and firm performance (e.g. Kroll, Walters & Le, 2007; Fischer & Pollock, 2004), an open empirical question with respect to founder CEOs is how their deep psychological attachment and commitment to the success of the firm (Nelson, 2003) impacts both the size of the firm's TMT and the retention of executive talent. While a founder CEO's entrepreneurial mindset and extensive firm-specific knowledge will often be a key source of competitive advantage for the firm (Peterson et al., 2003), it is possible that a founder's great trust and confidence in their business judgment (see Lee, Hwang & Chen, 2017; Wasserman, 2012) may lead to heightened tension between the founder CEO and his executive managers as well as reduce the number of executive officers to whom the founder CEO is willing to delegate decision-making authority. For example, Mullins & Schoar (2016) present survey evidence that finds that founder CEOs view their main task as supervising and monitoring the decisions of lower level management in contrast to professional CEOs that prioritize the selection and appraising of managers. This tendency of founder CEOs to maintain a more hierarchical management structure and to somewhat "micro-manage" the work of employees (Catella, 2018) may lead to more friction and disagreement between a founder CEO and their subordinates.[18] This in turn may result in founder CEOs choosing to maintain smaller executive management teams relative to professional CEOs and may also precipitate a higher number of costly TMT departures (Zak, 2017).

In Column 2 of Table 5, I use a difference-in-differences estimation to first test whether treated firms led by professional CEOs are more likely to establish a larger team of executive officers relative to control firms that continue to be led by their founder CEO. I find that professional CEOs establish 15% larger executive management teams than their founder CEO counterparts. This equates to the top management teams (TMT) of professional CEO-led firms having an additional executive officer compared to founder CEOs' average TMT size of five executives. This general result is consistent with the survey evidence in Mullins & Schoar (2016) who find that founder CEOs tend to centralize control of their firm and have the fewest number of managers reporting directly to them.

[18] For example, co-founder and CEO of Tesla Motors Inc, Elon Musk, has described himself as a "nano-manager" and is widely reported as having a "domineering presence" in the company. As a result, "some high-level managers quit or were fired after clashing with the Chief Executive over Mr Musk's insistence on doing things his way, according to interviews with dozens of current and former Tesla executives" per the Wall Street Journal, "Electric Car Pioneer Elon Musk Charges Head-On at Detroit" (11 January 2015).

While professional CEOs prefer to *add* a wider range of executive talent compared to founder CEOs, it is unclear whether the differing management styles of founder CEOs and professional CEOs systematically leads to more *losses* of executive talent. Thus, in Column 3 of Table 5, I test whether founder CEO-led firms experience a higher number of executive officer departures relative to professional CEO-led firms in the post-treatment period. I find that founder CEO firms are almost twice as likely to experience an executive departure in a given year compared to similar professional CEO firms. This finding is consistent with the theory that the authoritative management style of founder CEOs can cause greater TMT instability and turnover. This in turn may negatively impact the performance of founder CEO firms relative to professional CEO firms who are better able to acquire and keep executive human capital (see Le, Kroll & Walters, 2017).

IV. CEO CHOICE AND FIRM VALUE

As documented in the previous section, the contrasting growth and managerial strategies of founder CEOs versus professional CEOs may (or may not) generate value for their respective shareholders. In particular, founder CEOs seem to foster superior internal R&D productivity at their firms relative to their professional CEO counterparts while professional CEOs exhibit an increased willingness to acquire externally developed technologies, take greater advantage of the tax benefits of debt financing (through increased corporate leverage) and demonstrate a greater ability to both attract and retain managerial talent. Given the stark differences in the skills and behavior of founder CEOs relative to professional CEOs, combined with the unclear value implications of each difference in firm policy considered in Section 3, a natural question for company stakeholders to ask is whether either type of CEO has a greater positive impact on *overall* firm value and operating performance.

4.1 Firm operational performance

Following the prior literature, I use an accounting measure of profitability, namely return on assets (ROA), to evaluate any changes in a firm's operating performance around the exogenous founder CEO turnover event (Bertrand & Schoar, 2003; Seru, 2014). I implement the difference-in-differences specification described in equation (3) and report the results in the first column of Table 6. Interestingly, I find that there is *no* significant difference in the operating performance of treated and control firms in the post-treatment period. This implies that the beneficial impact of higher internal R&D productivity at founder CEO control firms can be offset by the superior ability of professional CEOs to acquire and integrate new external technologies into the firm's operations and fully utilize the knowledge and experience of their larger, more stable executive management teams. Nevertheless, given the potential issues in using ROA as a proxy for true economic profitability (see Fee et al., 2013), I also consider how an alternative market based measure of firm value changes around the exogenous CEO turnover events in my sample.

4.2 Firm valuation

To make stronger causal claims about the relationship between founder CEOs and overall firm value, I use my difference-in-differences specification detailed in Section 2 to examine how firm value evolves for treated and control companies around exogenous shocks generated by the

departure of founder CEOs for health-related reasons. Following papers such as Fahlenbrach (2009) and Adams et al. (2009), I use $Tobin's\ Q$, defined as the ratio of the market value of assets to the book value of assets, as my measure of firm value (see Appendix 1 for further details). Notably, consistent with the ROA results reported in the previous section, I find that there are *no* significant differences in overall firm value generated by treated and control firms in the post-treatment period despite these firms being run by professional CEOs and founder CEOs respectively (see last column of Table 6).

The neutral total value impact of an exogenous switch from a founder CEO to a professional CEO has numerous implications for practitioners and academics. Given that novel innovations have been shown to generate significant value (see Hall, Jaffe & Trajtenberg, 2005; Kogan, Papanikolaou, Seru & Stoffman, 2017), observing no change in overall firm value implies that firms in the treatment group were able to implement strategies that mitigated the value loss resulting from a decline in treated firms' internal R&D productivity. Thus, while it seems that professional CEOs are unable to replicate the "creative genius" of the firm's founder in terms of nurturing internally driven innovative activities, my research shows that it is insufficient to only consider internal innovation performance when evaluating the relative merits of founder CEOs and professional CEOs (c.f. Kim et al., 2018; Lee et al., 2019).

In particular, my findings indicate that professional CEO-led firms are better able to generate firm value through a combination of: (a) moving R&D activity outside the boundaries of the firm via the acquisition of external technologies, (b) implementing more sophisticated firm financing strategies by increasing corporate leverage to take advantage of the tax and other benefits of debt finance and (c) establishing more decentralized management structures that attract and retain a deeper pool of executive talent. While it is not feasible in my empirical setting to separately identify the individual value generated by each of these three strategic actions, my empirical results support the notion that a company CEO possessing a broad range of skills across M&A, firm financing and employee management activities is valuable in and of itself and is at least as important for firm growth as the promotion of internally generated innovation.

V. CONCLUSION

A firm's choice of CEO is one of the most important determinants of a firm's future growth and development. In this paper, I examine a question that faces every firm at least once in its lifetime, namely whether one of the firm's founders should act as the company's top executive. In order to overcome the formidable identification challenges that arise from the endogenous matching of founder CEOs and professional CEOs with the firms they manage, I exploit a natural experiment involving exogenous founder-to-professional CEO turnovers that arise from a firm founder's death or illness. By isolating pairs of comparable founder CEO-led firms that only differ in whether they are exposed to the exogenous shock of losing their founder CEO due to health-related issues, I am able to present credibly causal estimates of the relative impact of founder CEOs on corporate policy and firm performance vis-à-vis professional CEOs.

Using my experimental setting, I first document that treated firms led by professional CEOs exhibit significantly different behavior compared to control firms that continue to be led by their founder CEOs. First, I find that professional CEO firms have 10% lower internally generated innovative output compared to founder CEO firms. Given that the amount spent on R&D is similar for both sets of firms, this decline in internal innovative output at treated firms is primarily driven by a reduction in R&D productivity. Second, I find that professional CEO firms are 50% more likely than their founder CEO counterparts to engage in M&A transactions and that one of the primary motivations for this increased M&A activity is to gain access to externally generated technologies. Third, I find that, compared to founder CEO-led firms, professional CEO-led firms adopt 12% higher corporate leverage ratios and also implement management structures that attract and retain a deeper pool of executive talent.

Given the conflicting firm value implications of these changes in corporate policy, I then examine whether these combined changes in firm policy or behavior by professional CEO firms has a clear positive or negative impact on overall firm value. I find that the observed changes in innovation, M&A, capital structure and governance policies appear to have offsetting effects such that overall firm value is not significantly different between founder CEO firms and professional CEO firms in the post-treatment period.

Overall, my results imply that founder CEOs are not uniformly superior to professional CEOs and vice-versa. Instead, it seems that each CEO type possesses particular skills that are important for driving firm value, namely founder CEOs are better able to nurture internally generated

innovation while professional CEOs are more adept at managing external investment, firm financing and corporate governance activities. These findings are consistent with the observed executive labor market equilibrium where we see that: (a) there exist a significant percentage of both founder CEO-led firms and professional CEO-led firms in the economy (Fahlenbrach, 2009; Adams et al., 2009) and (b) a firm's founder is relatively more likely to be the CEO of the firm in its early growth stages (when promoting internal innovation is likely to be relatively more important) and that professional CEOs are relatively more common among more mature publicly traded firms (when capital structure, team management skills and growth through external investments are likely to be relatively more important drivers of firm value) (Hellmann & Puri, 2002; Mullins & Schoar, 2016). As a result, my study's findings support a "horses for courses" approach to firm CEO selection whereby the optimal choice between a founder CEO and a professional CEO will largely depend on the relative importance of internal innovation, external investment, capital structure and human capital management in driving changes in overall firm value.

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Table 1: Summary statistics and evidence supporting validity of experimental design

This table reports tests regarding the validity of the construction of the control group in my natural experiment. In Panel A, I provide summary statistics (mean value with standard deviations below in parentheses) as well as univariate comparisons of various firm and CEO characteristics for firms in the treatment sample (i.e. firms that are forced to switch from a founder CEO to a professional CEO due to the death or illness of the firm founder) and firms in my control sample (i.e. firms that remain under founder CEO leadership in both the pre- and post-treatment periods). Panel B presents the results of a logit regression concerning the probability that a firm will lose its founder CEO due to death or serious illness as a function of pre-treatment firm and CEO characteristics. The variables $Number\ of\ Pre\ Internal\ Patents\_3year$ and $Average\ Pre\ Firm\ Patent\ Quality\_3year$ as well as the variables $Acquisition\ Count\ Pre\_3year$ and $Number\ of\ Pre\ Acquired\ Patents\_3year$ are three year average internal innovation and firm acquisitiveness measures, respectively, calculated over the three year period that ends one year prior to the exogenous founder CEO turnover event (i.e. Year $t-3$ to Year $t-1$). All other explanatory variables are expressed as at one year prior to the founder CEO turnover event (i.e. Year $t-1$). All variable definitions are contained in Appendix 1. Robust standard errors are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level respectively.

Panel A: Characteristics of treatment and control firms before the founder CEO turnover event

	Treatment (Professional CEO)	*Control* (Founder CEO)	(1)-(2)
Number of Firms	212	212	
Ln(1 + Number of Pre Internal Patents_3year)	1.04	0.97	0.07
	(1.26)	(1.16)	
Average Pre Firm Patent Quality_3year	0.96	0.87	0.09
	(0.50)	(0.52)	
Acquisition Count Pre_3year	0.46	0.52	-0.06
	(0.60)	(0.63)	
Ln(1 + Number of Pre Acquired Patents_3year)	0.19	0.18	0.01
	(0.52)	(0.67)	
Ln(Firm Age)	2.89	2.79	0.10
	(0.82)	(0.63)	
Ln(Firm Size)	4.72	4.64	0.08
	(2.33)	(2.04)	
Scaled Cash	0.17	0.20	-0.03
	(0.20)	(0.22)	
ROA	0.04	0.06	-0.02
	(0.36)	(0.31)	
Tobin's Q	2.89	2.41	0.48
	(3.69)	(2.39)	
Leverage	0.18	0.21	-0.03
	(0.19)	(0.27)	
TMT Size	5.63	5.67	-0.05
	(2.61)	(2.25)	
Scaled R&D	0.07	0.08	-0.01
	(0.10)	(0.17)	

	Treatment (Professional CEO)	*Control* (Founder CEO)	(1)-(2)
Scaled Capex	0.06	0.05	0.00
	(0.61)	(0.50)	
CEO Duality	0.83	0.75	0.08
	(0.38)	(0.44)	
Ln(CEO Age)	4.14	4.03	0.12**
	(0.21)	(0.19)	
CEO Female	0.01	0.03	-0.02
	(0.12)	(0.17)	
CEO Tenure	18.06	14.80	3.26
	(11.90)	(9.88)	
CEO Ownership	0.20	0.18	0.02
	(0.16)	(0.17)	
CEO PhD	0.10	0.13	-0.03
	(0.34)	(0.29)	
CEO MBA	0.20	0.21	-0.01
	(0.40)	(0.45)	
CEO Technical Education	0.33	0.34	-0.02
	(0.48)	(0.47)	
CEO Great Depression	0.28	0.16	0.12*
	(0.45)	(0.24)	
CEO Military	0.17	0.11	0.06
	(0.42)	(0.31)	
CEO Financial Expert	0.09	0.14	-0.05
	(0.24)	(0.36)	
Inventor CEO	0.33	0.31	0.02
	(0.47)	(0.47)	
CEO Overconfidence	0.05	0.06	-0.01
	(0.04)	(0.04)	

Panel B: Probability of departure of a firm's founder CEO due to health-related reasons (Treatment = 1)

	(1) Prob(Treatment = 1)	(2) Prob(Treatment = 1)
Log(1 + Number of Pre Internal Patents_3year)	0.03	-0.05
	(0.27)	(0.31)
Average Pre Firm Patent Quality_3year	0.23	0.91
	(0.67)	(0.92)
Acquisition Count Pre_3year	0.08	-0.23
	(0.47)	(0.53)
Log(1 + Number of Pre Acquired Patents_3year)	-0.18	0.14
	(0.45)	(0.51)

Firm Age	-0.65	-1.08
	(0.77)	(0.92)
Firm Size	0.03	0.04
	(0.27)	(0.24)
Scaled Cash	0.92	0.85
	(1.15)	(1.38)
ROA	-1.70	-1.66
	(1.49)	(1.46)
Tobin's Q	0.01	0.09
	(0.08)	(0.08)
Leverage	-1.39	-1.02
	(1.18)	(1.29)
TMT Size	-0.11	-0.12
	(0.13)	(0.14)
Scaled R&D	-3.12	-3.38
	(2.84)	(2.94)
Scaled Capex	2.81	0.63
	(4.61)	(5.12)
CEO Duality	0.32	0.26
	(0.59)	(0.63)
CEO Age	3.36**	3.19**
	(1.69)	(1.62)
CEO Female	0.16	0.09
	(0.38)	(0.22)
CEO Tenure	0.07	0.09
	(0.04)	(0.07)
CEO Ownership	-0.77	-1.52
	(1.63)	(1.80)
CEO PhD		-1.38
		(1.07)
CEO MBA		-1.83
		(1.71)
CEO Technical Education		-0.12
		(0.74)
CEO Great Depression		0.72
		(0.90)
CEO Military		-1.04
		(0.75)
CEO Financial Expert		-0.90
		(0.83)
Inventor CEO		-0.58
		(0.67)
CEO Overconfidence		0.04
		(0.09)
Observations	424	424
Year FEs	Yes	Yes
Pseudo R^2	0.13	0.14

Table 2: Effect of exogenous founder-to-professional CEO turnovers on internal innovation

This table reports the difference-in-differences tests that examine the impact of founder CEOs on internally generated innovative output vis-à-vis professional CEOs. The dependent variables in column (1), (2) and (3) are the log of one plus the number of internally generated patents, the average scaled quality of a firm's internally developed patents and R&D expenses scaled by the book value of assets respectively. The unit of observation is a firm-year observation (with patent-related variables based on patent application year). The indicator variable *Post* takes a value of one for all years after the exogenous founder CEO turnover event, and zero otherwise. The indicator variable *Treated* equals one for treated firms that experience the exogenous loss of their founder CEO due to death or illness, and zero otherwise. *Other Firm characteristics* and *Other CEO characteristics* outlined in Table 1 are included in the estimation but unreported for brevity. Other Firm Characteristics included as control variables are *Firm Age*, *Firm Size*, *Scaled Cash*, *ROA*, *Tobin's Q*, *Scaled R&D* and *Scaled Capex* (see Appendix 1 for definitions). Other CEO Characteristics included as control variables are *CEO Duality*, *CEO Age*, *CEO Female*, *CEO Tenure*, *CEO Ownership*, *CEO PhD*, *CEO MBA*, *CEO Technical Education*, *CEO Great Depression*, *CEO Military*, *CEO Financial Expert*, *Inventor CEO* and *CEO Overconfidence* (see Appendix 1 for definitions). Founder CEO turnover event dates in the sample correspond to the period 1981–2011. The standard errors are clustered at the firm-year level. *, ** and *** denote statistical significance at the 10%, 5% and 1% level respectively.

	(1) Log(1 + Number of Internal Patents)	(2) Average Firm Patent Quality	(3) Scaled R&D
Post	0.05	0.04	0.01
	(0.03)	(0.03)	(0.01)
Post × Treated	-0.10**	0.03	-0.01
	(0.04)	(0.06)	(0.03)
Other Firm characteristics	Yes	Yes	Yes
Other CEO characteristics	Yes	Yes	Yes
Observations	3,903	3,903	3,849
Number of Firms	424	424	424
Firm FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Adjusted R^2	0.72	0.55	0.62

Table 3: Internal innovation - pre-treatment trends and reversals

This table investigates the pre-treatment trends and post-treatment reversals between the treated and control group. The dummy variables *Year -2*, *Year -1*, *Year 0*, *Year +1*, *Year +2*, *Year +3*, *Year +4 and afterward* indicate the year relative to the exogenous founder-to-professional CEO turnover event. For example, the *Year +2* dummy variable takes the value of one if it is two years after the founder CEO turnover event, and zero otherwise. The indicator variable *Treated* equals one for treated firms that experience the exogenous loss of their founder CEO due to death or illness, and zero otherwise. The dependent variables in column (1) and (2) are the log of one plus the number of internally generated patents and the average scaled quality of a firm's internally developed patents respectively. The unit of observation is a firm-year observation (with patent-related variables based on patent application year). *Other Firm characteristics* and *Other CEO characteristics* outlined in Table 1 are included in the estimation but unreported for brevity. Other Firm Characteristics included as control variables are *Firm Age*, *Firm Size*, *Scaled Cash*, *ROA*, *Tobin's Q*, *Scaled R&D* and *Scaled Capex* (see Appendix 1 for definitions). Other CEO Characteristics included as control variables are *CEO Duality*, *CEO Age*, *CEO Female*, *CEO Tenure*, *CEO Ownership*, *CEO PhD*, *CEO MBA*, *CEO Technical Education*, *CEO Great Depression*, *CEO Military*, *CEO Financial Expert*, *Inventor CEO* and *CEO Overconfidence* (see Appendix 1 for definitions). Founder CEO turnover event dates in the sample correspond to the period 1981-2011. The standard errors are clustered at the firm-year level. *, ** and *** denote statistical significance at the 10%, 5% and 1% level respectively.

	(1) Log(1 + Number of Internal Patents)	(2) Average Firm Patent Quality
Year -2 × Treated	-0.03	-0.04
	(0.04)	(0.06)
Year -1 × Treated	0.01	-0.03
	(0.03)	(0.05)
Year 0 (founder CEO turnover year) × Treated	-0.01	0.00
	(0.02)	(0.05)
Year +1 × Treated	-0.02	-0.01
	(0.05)	(0.06)
Year +2 × Treated	-0.05	0.02
	(0.04)	(0.07)
Year +3 × Treated	-0.11**	-0.01
	(0.05)	(0.07)
Year +4 and after × Treated	-0.15***	-0.03
	(0.05)	(0.08)
Other Firm characteristics	Yes	Yes
Other CEO characteristics	Yes	Yes
Observations	3,903	3,903
Number of Firms	424	424
Firm FEs	Yes	Yes
Year FEs	Yes	Yes
Adjusted R^2	0.72	0.55

Note: The standalone indicator variables *Year -2*, *Year -1*, *Year 0*, *Year +1*, *Year +2*, *Year +3* and *Year +4 and afterward* are included in this regression but their (insignificant) coefficients are not reported for brevity.

Table 4: Effect of exogenous founder-to-professional CEO turnovers on external investment policy

This table reports the difference-in-differences tests that examine the impact of founder CEOs on external investment policy vis-à-vis professional CEOs. The dependent variables in column (1), (2) and (3) are the count of the number of acquisitions per firm-year, the sum of acquisition prices paid scaled by firm market capitalization and the log of one plus the number of patents acquired from external entities in that year respectively. The unit of observation is a firm-year observation. The indicator variable *Post* takes a value of one for all years after the exogenous founder CEO turnover event, and zero otherwise. The indicator variable *Treated* equals one for treated firms that experience the exogenous loss of their founder CEO due to death or illness, and zero otherwise. *Other Firm characteristics* and *Other CEO characteristics* outlined in Table 1 are included in the estimation but unreported for brevity. Other Firm Characteristics included as control variables are *Firm Age*, *Firm Size*, *Scaled Cash*, *ROA*, *Tobin's Q*, *Scaled R&D* and *Scaled Capex* (see Appendix 1 for definitions). Other CEO Characteristics included as control variables are *CEO Duality*, *CEO Age*, *CEO Female*, *CEO Tenure*, *CEO Ownership*, *CEO PhD*, *CEO MBA*, *CEO Technical Education*, *CEO Great Depression*, *CEO Military*, *CEO Financial Expert*, *Inventor CEO* and *CEO Overconfidence* (see Appendix 1 for definitions). Founder CEO turnover event dates in the sample correspond to the period 1981-2011. The standard errors are clustered at the firm-year level. *, ** and *** denote statistical significance at the 10%, 5% and 1% level respectively.

	(1) Acquisition Count	(2) Acquisition Ratio	(3) Log(1 + Number of Acquired Patents)
Post	-0.04	0.00	0.03
	(0.03)	(0.01)	(0.03)
Post × Treated	0.17***	0.03*	0.14**
	(0.06)	(0.02)	(0.06)
Other Firm characteristics	Yes	Yes	Yes
Other CEO characteristics	Yes	Yes	Yes
Observations	3,903	3,903	3,903
Number of Firms	424	424	424
Firm FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Adjusted R^2	0.38	0.21	0.26

Table 5: Effect of exogenous CEO turnovers on corporate leverage and management approach

This table reports the difference-in-differences tests that examine the impact of founder CEOs on corporate leverage and the structure of executive management teams compared to professional CEOs. The dependent variable in column (1) is the firm's leverage ratio. The dependent variables in columns (2) and (3) are the size of the firm's executive/top management team (TMT) and the number of executive officer departures in a given year respectively. The unit of observation is a firm-year observation. The indicator variable *Post* takes a value of one for all years after the exogenous founder CEO turnover event, and zero otherwise. The indicator variable *Treated* equals one for treated firms that experience the exogenous loss of their founder CEO due to death or illness, and zero otherwise. *Other Firm characteristics* and *Other CEO characteristics* outlined in Table 1 are included in the estimation but unreported for brevity. Other Firm Characteristics included as control variables are *Firm Age*, *Firm Size*, *Scaled Cash*, *ROA*, *Tobin's Q*, *Scaled R&D* and *Scaled Capex* (see Appendix 1 for definitions). Other CEO Characteristics included as control variables are *CEO Duality*, *CEO Age*, *CEO Female*, *CEO Tenure*, *CEO Ownership*, *CEO PhD*, *CEO MBA*, *CEO Technical Education*, *CEO Great Depression*, *CEO Military*, *CEO Financial Expert*, *Inventor CEO* and *CEO Overconfidence* (see Appendix 1 for definitions). Founder CEO turnover event dates in the sample correspond to the period 1981-2011. The standard errors are clustered at the firm-year level. *, ** and *** denote statistical significance at the 10%, 5% and 1% level respectively.

	(1) Leverage	(2) TMT Size	(3) TMT Turnover
Post	0.02	-0.11	0.18
	(0.04)	(0.15)	(0.12)
Post × Treated	0.12**	0.69**	-0.73***
	(0.06)	(0.27)	(0.17)
Other Firm characteristics	Yes	Yes	Yes
Other CEO characteristics	Yes	Yes	Yes
Observations	3,903	3,849	3,849
Number of Firms	424	424	424
Firm FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Adjusted R^2	0.65	0.75	0.58

Table 6: Effect of exogenous founder-to-professional CEO turnovers on firm value

This table reports the difference-in-differences tests that examine the impact of founder CEOs on firm operating performance and firm value vis-à-vis professional CEOs. The dependent variables in columns (1) and (2) are return on assets and Tobin's Q respectively. The unit of observation is a firm-year observation. The indicator variable *Post* takes a value of one for all years after the exogenous founder CEO turnover event, and zero otherwise. The indicator variable *Treated* equals one for treated firms that experience the exogenous loss of their founder CEO due to death or illness, and zero otherwise. *Other Firm characteristics* and *Other CEO characteristics* outlined in Table 1 are included in the estimation but unreported for brevity. Other Firm Characteristics included as control variables are *Firm Age*, *Firm Size*, *Scaled Cash*, *ROA*, *Tobin's Q*, *Scaled R&D* and *Scaled Capex* (see Appendix 1 for definitions). Other CEO Characteristics included as control variables are *CEO Duality*, *CEO Age*, *CEO Female*, *CEO Tenure*, *CEO Ownership*, *CEO PhD*, *CEO MBA*, *CEO Technical Education*, *CEO Great Depression*, *CEO Military*, *CEO Financial Expert*, *Inventor CEO* and *CEO Overconfidence* (see Appendix 1 for definitions). Founder CEO turnover event dates in the sample correspond to the period 1981-2011. The standard errors are clustered at the firm-year level. *, ** and *** denote statistical significance at the 10%, 5% and 1% level respectively.

	(1) ROA	(2) Tobin's Q
Post	-0.02	0.22
	(0.03)	(0.18)
Post × Treated	0.03	-0.39
	(0.05)	(0.59)
Other Firm characteristics	Yes	Yes
Other CEO characteristics	Yes	Yes
Observations	3,903	3,903
Number of Firms	424	424
Firm FEs	Yes	Yes
Year FEs	Yes	Yes
Adjusted R^2	0.71	0.67

Appendix 1: Variable definitions

Variable	Description
Panel A: Corporate policy and firm value outcome measures	
Number of Internal Patents	The total number of patents that are filed (and subsequently granted) by the firm in a given year. *Sources: USPTO, PatentsView and the Berkeley Fung Institute.*
Average Firm Patent Quality	Scaled internal citations is the number of citations a patent receives divided by the average number of citations received by all patents granted in the same year and technology class. Average firm patent quality is calculated as the mean of the scaled internal citation measures (i.e. a firm-year measure). *Sources: USPTO, PatentsView and the Berkeley Fung Institute*.
Acquisition Count	The number of acquisitions completed in a given firm-year. *Source: SDC*.
Acquisition Ratio	The sum of the available prices paid for all acquisitions made during the year, divided by the firm's market capitalization. *Sources: SDC, CRSP*.
Number of Acquired Patents	The number of patents that a firm acquires from external entities each year. *Sources: USPTO; PatentsView; Berkeley Fung Institute; Plainsite*.
ACAR	Cumulative abnormal percentage return for the acquirer over the 5-day window surrounding the deal announcement [–2, +2], using the market model and stock returns from 200 trading days prior to deal announcement to 45 days prior to deal announcement. *Source: CRSP*
Leverage	Total debt divided by the book value of total assets. *Source: Compustat*.
TMT Size	The total number of executive officers at the firm. *Source: Company annual and proxy filings.*
TMT Turnover	The number of executive officers who depart the firm for non-health related reasons during the year. *Source: Company annual and proxy filings.*
ROA	Return on assets, measured as operating income after depreciation normalized by the book value of total assets. *Source: Compustat*
Tobin's Q	Book value of assets plus market value of equity minus book value of equity minus deferred taxes, divided by the book value of total assets *Source: Compustat*.
Panel B: Firm characteristic control variables	
Firm Age	The number of years since the firm was incorporated. *Source: Company annual and proxy filings.*
Firm Size	Book value of total assets. *Source: Compustat*.
Scaled Cash	Cash and marketable securities divided by the book value of assets. *Source: Compustat.*
Scaled R&D	R&D expenditures normalized by the book value of total assets. If the R&D expenditures variable is missing, I set the missing value to zero. *Source: Compustat.*
Scaled Capex	Capital expenditures normalized by the book value of total assets. *Source: Compustat.*

Variable	Description
Panel C: CEO characteristic control variables	
CEO Duality	Dummy variable equal to one if the firm's CEO is also the Chairman of the Board of Directors, and zero otherwise. *Source: Company proxy filings.*
CEO Age	The age of the firm's CEO. *Sources: Company proxy filings; Factiva.*
CEO Female	An indicator variable equal to one if the firm's CEO is a female, and zero otherwise. *Sources: Company proxy filings; Factiva.*
CEO Tenure	CEO tenure in years. *Sources: Company proxy filings; Factiva.*
CEO Ownership	Percentage of common shares owned by CEO. *Source: Firm proxy filings.*
CEO PhD	Indicator variable equal to one if the CEO received a PhD degree and zero otherwise. *Sources: Company proxy filings, Factiva, web searches*.
CEO MBA	Indicator variable equal to one if the CEO received an MBA degree and zero otherwise. *Sources: Company proxy filings, Factiva, web searches*.
CEO Technical Education	Following *Jung (2018)*, this is an indicator variable that equals one if the CEO has an undergraduate or graduate degree in Science, Technology, Engineering or Mathematics (STEM), and zero otherwise. *Sources: Company proxy filings, Factiva, web searches*.
CEO Great Depression	Following *Malmendier et al. (2011)*, this is an indicator variable equal to one if the firm's CEO was born between 1920 and 1929, and zero otherwise. *Sources: Company proxy filings; Factiva.*
CEO Military	Following *Malmendier et al. (2011)*, this is a dummy variable equal to one if the firm's CEO has served in any country's military, and zero otherwise. *Sources: Company proxy filings, Dun & Bradstreet, Factiva, web searches.*
CEO Financial Expert	Following *Custodio et al. (2014)*, this is an indicator variable equal to one if a CEO has past experience in either banking or investment firms (two-digit SIC codes 60, 61, and 62), in a finance-related role (Accountant, CFO, Treasurer, or VP of Finance), or in a large auditing firm (current and former top-tier companies: Pricewaterhouse, Deloitte, Ernst & Young, KPMG, Arthur Andersen, Coopers, Peat Marwick, Touche Ross). *Sources: Company proxy filings, Factiva, web searches.*
Inventor CEO	Following *Islam & Zein (2019)*, this is an indicator variable equal to one if the CEO has at least one patent registered in their own name. *Sources: U.S. Patent Inventor Database, company filings, web searches.*
CEO Overconfidence	Following *Malmendier & Tate (2008)* and *Hirshleifer et al. (2012)*, I use a press based measure of CEO overconfidence. I search Factiva for all news articles using the available unique firm code and search keyword "CEO." I cumulate articles starting from the first year the CEO is in office or 1980, when I begin my Factiva article search. For each CEO and year, I record: the number of "Confident" terms, namely: (1) the number of articles that contain the words "confident", "confidence" or variants such as overconfidence or overconfident and (2) the number of articles containing the words "optimistic," "optimism" or variants such as overoptimistic and overoptimism versus the number of Cautious terms, namely: (1) the number of articles using "pessimistic", "pessimism" or variants such as over-pessimistic or not confident/optimistic and (2) the number of articles using "reliable", "steady", "practical", "conservative", "frugal", "cautious" or "gloomy". CEO overconfidence for each CEO i in year t is an indicator variable that equals one if the cumulative number of articles up until year $t-1$ using Overconfident terms exceeds the cumulative number of articles up until year $t-1$ using the Cautious terms, and zero otherwise.

Variable	Description
Panel D: Acquisition-related control variables	
Acquirer price run-up	Cumulative abnormal percentage return for the period –41 to –3 days pre-deal announcement, using the market model and stock returns from 200 trading days prior to deal announcement to 45 days prior to deal announcement. *Source: CRSP*
Target public status	Indicator variable equal to one if the target firm is publicly listed. *Source: CRSP*
Toehold	Indicator variable equal to one if the acquiring firm held an equity ownership stake in the target firm pre-bid. *Source: SDC*
Pure stock deal	Indicator variable equal to one if the deal is fully financed by stock. *Source: SDC*
Cross border	Indicator variable equal to one if the deal involves a foreign domiciled target company. *Source: SDC*
Diversifying acquisition	Indicator variable equal to one if the acquirer and the target firm have two different three-digit SIC codes. *Source: SDC*
Relative deal size	Deal size divided by acquirer market capitalization. *Source: SDC*
Tender offer	Indicator variable equal to one for tender offers. *Source: SDC*
Hostile	Indicator variable equal to one if the bid is hostile. *Source: SDC*
Merger of equals	Indicator variable equal to one if the deal is a merger of equals. *Source: SDC*