ESSAYS IN EMPIRICAL CORPORATE FINANCE

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ABSTRACT

My dissertation consists of two chapters exploring several aspects of empirical corporate finance with a special focus on founder CEOs and family firms.

Chapter 1 focuses on the impact of founder CEO leadership on firm value in publicly listed U.S. firms. Previous research on how founder CEOs affect firm value shows mixed results. Using a natural experiment whereby I measure the impact of the sudden deaths of CEOs during the period 1964–2018, I document that stock prices increase by 1.56% upon founder CEOs' deaths and decrease by 2.89% upon professional CEOs' deaths. Next, I develop a novel measure of managerial private benefits and discuss several new insights. First, I document that the positive stock price reactions to the sudden deaths of founder CEOs are mainly driven by the fact that founder CEOs extract two times greater private benefits relative to professional CEOs. Second, segregating private benefits into two parts – nepotism and non-nepotism – I find that investors react to both types of private benefits. Third, investor reactions are more pronounced for tunneling-related disclosed private benefits than for investment-related non-disclosed private benefits. Fourth, investors reactions are more pronounced for private benefits related to underinvestment than for private benefits related to overinvestment. Overall, my paper highlights the impact of CEO leadership styles on shareholder wealth.

Chapter 2 examines significant family ownership in publicly listed U.S. firms. Instead of holding a diversified portfolio, family owners, such as the Waltons of Walmart, hold large fractions of their wealth in a single stock. To explain this decision, we build a unique model of ambiguity aversion wherein the family's information advantage in their firm allows them to more accurately estimate value-at-risk in tail events relative to the diversified portfolio. Using an index of macroeconomic uncertainty, we find a strong, negative relation between the uncertainty beta and both family ownership and involvement. Also consistent with our predictions, we document that families with high absolute wealth or risk aversion are unlikely to exit the firm. Our analysis provides an explanation for a family owner's decision to hold a concentrated stake in a single firm in countries with well-developed financial markets and legal regimes.

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CHAPTER 1

FOUNDER CEO AND FIRM VALUE: A TALE OF MANAGERIAL PRIVATE BENEFITS

Introduction

Whether a founder CEO who continues heading a firm after its early entrepreneurial stages generates as much investor wealth as a professional CEO could have remains unclear despite much scholarly attention across different fields.[1] Specifically, the empirical results of such investigations are mixed mainly because these investigations encounter challenges arising from causality concerns. First, an endogenous relationship between firm value and CEO type makes it hard to establish causality. As powerful and influential managers, founder CEOs may decide to remain in their roles because of strong (or weak) firm performance, suggesting that reverse causality could play a role. Unobservable or latent firm and managerial characteristics also likely play a role in both CEO status and firm performance. For example, managerial intelligence and firm culture – both difficult traits to measure – likely influence the relationship between managerial selection and firm value, again suggesting omitted variable bias. Second, sample selection bias is another serious concern. For example, earlier studies on founder CEOs in publicly listed U.S. firms mostly use data from large firms e.g., Fortune 500 firms and S&P 1500 firms; thus, results from

[1] Several studies document a positive relationship between founder-CEO leadership and accounting and market-based measures of firm performance in U.S. publicly traded firms (Villalonga & Amit, 2006; Adams et al., 2009; Fahlenbrach, 2009; Fitzgerald, 2020). However, other studies using international data document poor financial performance, managerial practices, and governance policies in family and founder-led firms (Lemmons & Lins, 2003; Bloom, Genakos, et al., 2012; Bloom, Sadun, & Reenen, 2012; Lins et al., 2013; Mullins & Schoar, 2016; Bandiera et al., 2018).

these studies are likely to be influenced by highly successful founder CEOs such as Bill Gates, Larry Ellison, and Steve Jobs to name a few.

To investigate the potential effect of founder CEO leadership on firm value and to address causality concerns, I exploit a natural experiment using random CEO terminations: specifically, I examine stock price reactions to the sudden and unexpected deaths of founder and professional CEOs. The sudden death of a firm's CEO is an exogenous shock to CEO status because the CEO does not self-select to remain or leave the firm, and firm and CEO characteristics are unlikely to affect sudden death. Moreover, because such deaths are unexpected and unpredictable by investors, stock price reactions around these deaths reflect whether investors perceive the service of the CEO as valuable to the firm or not. Upon the public release of the CEO's death, investors react by revising their expectations based on the change in top management and factor the change into stock prices (Johnson et al., 1985; Faccio & Parsley, 2009; Salas, 2010; Nguyen & Nielsen, 2010; Nguyen & Nielsen, 2014; Quigley et al., 2017; Jenter et al., 2018).

Using a sample of 165 CEOs' sudden deaths from 1964 to 2018, I document significant heterogeneity in investors' reactions around the deaths of CEOs with different backgrounds. Controlling for industry, firm, and CEO characteristics, the cumulative abnormal return (CAR) from one day before to two days after the sudden death of a professional CEO is -3.02% and 1.44% for founder CEOs. These results suggest that in publicly listed U.S. firms, investors perceive founder CEOs as less valuable than professional CEOs. In the analysis, I use a stringent definition of sudden death to ensure that firm performance and CEO traits do not influence the results. The sample excludes deaths from causes such as suicide or overdoses to eliminate the possibility of managerial self-selection (Nguyen & Nielsen, 2010).

One interpretation that emerges from my analysis is that relative to professional CEO led firms, investors bear greater managerial private benefit risk in founder CEO led firms, and the market upwardly adjusts a company's stock price to reflect the elimination of this value destroying risk. Based on theoretical foundations from existing literature on managerial private benefits (Demsetz, 1983; Fama & Jensen, 1983; Demsetz & Lehn, 1985; Shleifer & Vishny, 1997; Wasserman, 2008; Bloom, Genakos, et al., 2012; Carver et al., 2013; Lins et al., 2013; Mullins & Schoar, 2016; Bandiera et al., 2018), I develop CEO's private benefits index (PBI) composed of five dimensions: empire building, enjoying quiet life, tunneling, violation of fiduciary duties, and nepotism. Strikingly, I find that the sudden death of a CEO with one additional standard deviation of private benefits index (PBI) is associated with 6.08% (164.52 $million=$2706 million*6.08%) value gain for investors. Notably, once I control for PBI, the stock price reaction around the sudden death of a founder CEO is no longer different from that of a professional CEO. This is not surprising because founder CEOs in my sample, on average, extract two times greater private benefits than professional CEOs do. My novel measure of private benefits and sudden death methodology together enable me to explore several key questions related to managerial private benefits.

First, I try to understand whether the results of the PBI are mainly driven by nepotism (Perez-Gonzalez, 2006) related private benefits. I divide the PBI into two parts: (i) nepotism (which arises from family members in top management, committees, and board of directors) and (ii) non-nepotism (which arises from empire building, enjoying a quiet life, tunneling, and violating fiduciary duties). My results show that investors react to both nepotism and non-nepotism related private benefits, and both are important to explain the difference in stock price reactions around the sudden deaths of founder and professional CEOs.

Second, agency theory predicts that managers may enjoy investment-related private benefits (e.g., empire building and enjoying a quiet life); understandably, these private benefits have received much attention in the literature. However, there is no empirical evidence for whether these investment-related undisclosed private benefits receive greater backlash from investors compared to disclosed private benefits such as tunneling, which has received relatively less scholarly attention. I provide novel evidence that investors' reactions are more pronounced for disclosed private benefits (e.g., lawsuits against CEO for violation of fiduciary duties, related party transactions, and option backdating) than for non-disclosed private benefits related to investment. Moreover, investors' reactions are more pronounced for underinvestment problems than overinvestment problems.

The relative stock price increase around the sudden and unexpected deaths of founder CEOs might instead be explained by the death of entrenched CEOs rather than the influence of CEO private benefits. The managerial entrenchment literature argues that founders often cause the greatest firm damage when they maintain their position beyond the period their skills create value in large and mature publicly listed firms. (e.g., Morck et al., 1988; Classens et al., 2002; Wasserman, 2008; Salas, 2010; Lin et al., 2020). Consistent with Salas (2010), I find initial evidence in support of the managerial entrenchment argument; however, CEO entrenchment is not statistically significant once I control for CEO private benefit, and the result for CEO private benefit is significant at the 1% level.

These results suggest that investors are more worried about CEOs being engaged in value destroying activities rather than CEOs merely staying with the firm for too long. I also find that the results for CEO private benefit are robust when controlling for alternative explanations based on managerial ability (Johnson et al., 1985) and control premium arising from takeover fight (Demsetz, 1983; Demsetz & Lehn, 1985; Schwert, 1985; Shleifer & Vishny, 1997; La Porta et al., 1999).

My initial finding – founder CEOs are less valuable than professional CEOs – stands in stark contrast to extant research on U.S. public firms (Villalonga & Amit, 2006; Fahlenbrach, 2009; Adams et al., 2009; Fitzgerald, 2020). Thus, I subject my results to several robustness tests. *First*, my results are robust to the inclusion of an array of controls that have been shown in the literature to affect shareholders' wealth, such as CEO characteristics and firm characteristics. *Second*, I find consistent results using a large sample association study design. For example, using the ExecuComp sample for the period 2001–2017, results from a coarsened exact matched (CEM) sample show that on average a founder-CEO firm appears to suffer a 10% valuation discount compared to a professional-CEO firm. Finally, my results are robust to additional robustness tests using alternative specifications.

My research extends the work of earlier studies using the sudden death methodology along four dimensions (Johnson et al., 1985; Faccio & Parsley, 2009; Salas, 2010; Nguyen & Nielsen, 2010, 2014; Jenter et al., 2018). First, I focus solely on CEO sudden deaths rather than that of the top management team. Extant research indicates that CEOs – relative to the other top managers – have the greatest effect on firm performance (Mackey, 2008). Second, my study categorizes CEOs into three groups: founders, descendants of firm founders, and professional managers. Prior research indicates that descendant CEOs hold over 8% of CEO roles in Russell 3000 industrial firms and often have a detrimental impact on firm performance (Burkart et al., 2003; Perez-Gonzalez, 2006; Bennedsen et al., 2007; Villalonga & Amit, 2006). By accounting for the effects of descendant CEOs, my study explicitly analyzes the effect of founder CEOs and professional CEOs on firm performance. Third, by considering the effects of characteristics of incoming CEOs, my study alleviates the concern that the identity of the incoming CEO rather than the sudden death of the previous CEO is driving the stock price reaction. Fourth, using a novel measure of managerial private benefit, I document that once I control for managerial private benefit, the factors that are shown to explain variation in stock prices in the previous literature – managerial ability (Johnson et al., 1985), entrenchment (Salas, 2010), CEO age (Jenter et al., 2018) – become insignificant.

I also contribute to the broader literature on the value of CEO leadership (Bertrand & Schoar, 2003; Marko, 2008; Bennedsen et al., 2010, 2012; Quigley et al., 2017). Using the sudden and unexpected deaths of CEOs as an exogeneous shock to CEO status, I provide clearer evidence of the heterogeneity in the value of CEOs. Particularly, I find that in publicly listed U.S. firms, founder CEOs are less valuable than professional CEOs. Thus, on the one hand, my results contrast with earlier findings that document superior performance of founder-led, publicly traded U.S. firms (Villalonga & Amit, 2006; Fahlenbrach, 2009; Adams et al., 2009). On the other hand, my findings are consistent with several international studies that document poor management practices in family- and founder-led firms (Bloom, Genakos, et al., 2012; Mullins & Schoar, 2016; Bandiera et al., 2018). My study differs from these earlier works by using sudden death methodology. My paper also contributes to the family-firm literature (Anderson & Reeb, 2003; Villalonga & Amit, 2006; Bertrand & Schoar, 2006; Lins et al., 2013; Mullins & Schoar, 2016; Fan & Leung, 2020) by identifying a value-reducing impact of founder CEO leadership in publicly listed family firms.

Moreover, my work is related to studies examining the effect of corporate governance on firm valuation and stock returns (Gompers et al., 2003; Core et al., 2006; Cremers & Nair, 2005; Yermack, 2006; Bebchuk et al., 2009; Giroud & Mueller, 2011; Bebchuk et al., 2013). In contrast to these papers, which focus on firm-level governance problems, my paper focuses on manager-level governance problems. Particularly, using a novel measure of CEO private benefit and sudden-death methodology, my study is among the first to provide direct evidence on the impact of managerial private benefit on stock returns and thus contributes to managerial private benefit literature (Demsetz, 1983; Fama & Jensen, 1983; Demsetz & Lehn, 1985; Yermack, 2006; Fich et al., 2020).

Literature Review

Empirical studies are divided as to whether founder CEOs have a positive or negative impact on firm value. Villalonga and Amit (2006) use a sample of Fortune 500 firms to study the impact of founder CEO leadership and document that the presence of a founder CEO is value enhancing. Fahlenbrach (2009) uses an IRRC (Investor Responsibility Research Center) sample, and Adams et al. (2009) use a sample of 50 founder-CEO firms. Both studies classify CEOs into two groups – founder and non-founder – and document superior firm performance in founder CEO led firms.

Recent studies using survey data have found that founder-CEO leadership negatively impacts firm value. For example, Bloom, Genakos, et al. (2012) use international survey data from more than 10,000 public and private firms from 20 countries and find that family-owned firms have inferior management practices if run by founders or family members. Mullins and Schoar (2016) use international survey data on 800 CEOs from 22 countries and find that founder CEOs place less importance on selecting and nurturing leadership, and they are less likely to report that they feel accountable to shareholders for major investment decisions. However, these studies suffer from reverse causality and omitted variable concerns.

Using sudden death as an identification strategy has become increasingly popular (Johnson et al., 1985; Faccio & Parsley, 2009; Salas, 2010; Nguyen & Nielsen, 2010, 2014; Jenter et al., 2018) because of the randomness of CEO termination. Johnson et al. (1985) and Salas (2010) examine the sudden death of top managers (COB, CEO, and president) and arrive at differing conclusions. Johnson et al. (1985) find that senior executives' characteristics such as managerial ability affect firm value. Salas (2010) finds that senior executives' age and tenure weakly correlate with stock price reactions. However, the study documents a strong, positive stock price reaction (6.8%) to the CEO's sudden death if their tenure exceeds 10 years and if the firm has experienced poor performance over the prior three years, suggesting an entrenchment effect.

In another study, Jenter et al. (2018) examine a combination of senior executives' and CEO deaths – both sudden and expected – and segregate managers based on founder and non-founder status. Similar to Salas (2010), Jenter et al.'s findings suggest an entrenchment effect as the sudden deaths of young and short-tenured CEOs cause large value losses while the deaths of older and longer-tenured CEOs, on average, appear to create value gains. Nguyen and Nielsen (2010) find that stock prices drop by 0.85% on average following the sudden deaths of independent directors.

These sudden death studies, however, leave several issues unresolved that this paper seeks to address. First, these studies' combination of several distinct management positions preclude inference on the differential effect of founder and professional CEOs. Second, segregating CEOs into only two groups – founder and non-founder – runs the risk of grouping descendants with founders or professionals, and it precludes inferences on the differential effect of founder and professional CEOs. This is largely because the current literature shows that descendants are a distinct type of managers (Burkart et al.,, 2003; Perez-Gonzalez, 2006; Bennedsen et al., 2007; Villalonga & Amit, 2006). Third, although market participants may not expect the death of an executive, investors may still have a strong indication or understanding of potential replacements, suggesting that the transition rather than the sudden death is the driving factor behind the stock price reaction. Fourth, the inconclusive results using sudden death likely stem from using different definitions of sudden death. For example, some studies classify death from disease, suicide, and overdose as sudden (Jenter et al. (2018), whereas most studies (Johnson et al., 1985; Nguyen & Nielsen, 2010, 2014; Salas, 2010) follow a stringent definition of sudden death, as in this paper, by not classifying deaths from disease, suicide, and overdose as sudden on the grounds of self-selection and investors' predictability of CEO death.

Data and Descriptive Statistics

CEO Sudden Death Data

My definition of sudden deaths is in line with Johnson et al. (1985), Faccio and Parsley (2009), Nguyen and Nielsen (2010, 2014), and Salas (2010). Specifically, I classify deaths from heart attack, stroke, and other diseases as sudden only if a CEO unexpectedly died within 24 hours of such an event, because if a CEO died 24 hours after an event, health-related episodes might have been rendered public and investors may have considered and priced the possibility of death into the stock. I also classify deaths from non-health related events—accidents, and homicides—as sudden because these are not forecastable. When newspapers report deaths as sudden without mentioning a specific cause (e.g., death in sleep), I classify these as sudden only if I find no past information relating to illness (i.e., something forecastable to investors). Death caused by diseases and complications from surgery are not classified as sudden. Suicides are not classified as sudden because such deaths may be related to firm performance. Panel A, Table 2 provides several examples of sudden and non-sudden deaths.

I conduct a search in NEXIS using several keywords, such as "CEO died," "CEO death," "CEO passed," "company mourn," "CEO sudden death," and "CEO unexpected death". To confirm the sudden death status, I verify the accuracy of the death event using corporate proxy statements and 10K reports. Additionally, my sample excludes firms with important confounding news (e.g., announcement of merger and acquisition, introduction of new product, quarterly earnings, dividend payments) surrounding sudden deaths. I ultimately arrive at 165 sudden deaths of CEOs across 164 firms listed on AMEX, NASDAQ, and NYSE from 1964 to 2018. In my sample, the random nature of CEO sudden deaths is evidenced by no sudden death in certain years (e.g., 0 in 1995 and 2011) and higher than average sudden deaths in some other years (e.g., 11 in 1989). Notably, CEOs' sudden deaths data come from US firms of all sizes for which stock price data is available in CRSP. For example, in terms of size, only 25% of my sample firms are comparable to

S&P 1500 firms, and the remaining 75% are small- and medium-sized publicly traded firms. Thus, my sample has the potential to address sample selection bias in the founder CEO literature. Earlier studies on founder CEOs (Villalonga and Amit, 2006; Adams et al., 2009; Fahlenbrach, 2009) mostly use data from large firms, e.g., S&P 1500 firms; thus, the results are likely influenced by highly successful founder CEOs in large firms.

Panels B–C, Table 2 presents the composition of causes of sudden deaths. Among the 165 CEO sudden deaths, 54.54% were from heart attacks and strokes, and 17.58% were from accidents and murders. The remaining 27.88% are described as sudden and unexpected without specific details about the medical cause of death (e.g., death in sleep). This composition of causes of death and sudden death is comparable to sudden death data used in other studies (e.g., Salas, 2010; Nguyen & Nielsen, 2010). I follow extant literature (Burkart et al., 2003; Perez-Gonzalez, 2006; Bennedsen et al., 2007; Villalonga & Amit, 2006) to classify CEOs into three groups: founders, descendants, and professionals. Out of the 165 suddenly deceased CEOs, 50 are founders, 22 are descendants, and 93 are professionals.

My sample is comparable with other papers that study CEO sudden deaths for U.S. firms. The mean annual number of sudden deaths in my sample is 3 (for the period 1964–2018) which is similar to 2.97 in Salas (2010), which uses 110 CEOs' sudden deaths for 37-year sample period (1972–2008), and 3.6 in Johnson et al. (1985), which uses only 36 CEOs' sudden deaths over a 10-year sample period (1972–1981). Notably, my sample and those from the above-mentioned studies differ significantly from that of Jenter et al. (2018), who find a significantly higher number of sudden deaths per year (162 sudden deaths for the period 1980 to 2012, i.e., 5 sudden deaths per year). In contrast to Jenter et al. (2018)

but consistent with the mainstream sudden-death literature (e.g., Salas, 2010; Nguyen & Nielsen, 2010, 2014), I do not consider death from disease, suicide, and overdose.

Summary Statistics of the Sudden Death Sample

Table 3 presents CEO and firm characteristics for the sudden death sample. Panel A depicts CEO characteristics. Founder CEOs tend to be the oldest (with an average age of 64.58), and professional CEOs tend to be the youngest (with an average age of 58.72). Founders also tend to have a longer tenure (an average of 16.64 years) compared to professionals (an average of 7.59). In addition, founders tend to hold more equity and are more likely to serve as both the CEO and chairman. These findings are consistent with studies on founder CEOs (e.g., Adams et al., 2009; Fahlenbrach, 2009). Panel B reports firm characteristics. Despite the significant differences between founders and professional CEOs, their firms do not differ significantly in terms of (i) valuation (proxied by market-to-book) and (ii) profitability (proxied by return-on-asset and return-on-equity). Consistent with earlier studies (Anderson & Reeb, 2003; Villalonga & Amit, 2006), I find that founder-CEO-led firms are younger than professional-CEO-led firms. Moreover, the founding family maintains significant ownership in founder-led firms.

Founder Status and CEO Characteristics

Data on founder CEO status, CEOs' education, experience, and demographical background (e.g., age, gender) come primarily from corporate proxy statements. Because corporate proxy statements do not provide complete information about firm's founding history, and CEO characteristics, I manually collect these data from other sources. The data mainly come from Nexis, funding universe, reference of business, company websites, Wikipedia, Hoovers, Bloomberg, Who is Who in Finance and Industry, Legacy.com, and

Obituary.com. In this process, I compare data from multiple sources to ensure accuracy and consistency.

Do Founder CEOs Enhance Firm Value?

Univariate Results from Event Study

I start my investigation with the stock price reaction to sudden deaths. Table 4 presents the cumulative abnormal returns and daily returns around a sudden death event. To calculate the abnormal return, I follow the standard event study approach and use market adjusted returns, i.e., stock return minus market return. I observe similar results if abnormal return is computed from the standard single factor model with beta estimated using the data from the pre-event window. I focus on the cumulative abnormal return over the event window of [-1,2] and [-1,1], as well as the daily abnormal return five days prior and five days after the sudden death event, where Day 0 is the sudden death day. The event day is defined as the day of the CEO's death, or the first trading day following the death if the death falls on a non-trading day. In my sample, average death is reported with a time lag of 1.2 days; thus, implies that stock price reaction on average occurs close to the actual date of death. I find similar results using the first public announcement date as event date.

Panel A, Table 4 provides a detailed picture of the cumulative abnormal returns (CAR) around the event over the [-1,2] and [-1,1] event windows. On average, investors react positively to the sudden deaths of founder CEOs (1.56%) and descendants (2.26%), whereas the reaction is negative to the sudden deaths of professional CEOs (-2.89%). Matching up with the average market capitalization of the sample firms, the economic impact on firm value from the sudden death of a founder-CEO, a descendant CEO, and a professional-CEO is $16.16 million, $55.57 million, and – $105.86 million, respectively. Furthermore, the median values reflect the same sign and similar magnitude as the mean.

Next, I tabulate daily abnormal returns for the 11 trading days surrounding sudden death in Panel B, Table 4. The stock market return appears most pronounced around the event day, suggesting that the event return is mainly driven by the sudden death news. Considering the number of positive and negative reactions, of the 11 trading days, the number of days with stock price increase (8 days) is greater than the number of days with stock price decrease (3 days) for founder CEO death. In contrast, for professional CEO death, the number of days with stock price decrease (7 days) is greater than the number of days with stock price increase (4 days). In sum, the results in Table 4 suggests that investors view the sudden departure of a founder CEO or a descendant CEO a value enhancing for the firm, whereas the loss of a professional CEO is also a loss for the firm. However, these unconditional results may be driven by industry, firm, and managerial characteristics (Adams et al., 2005; Jenter & Kanaan, 2015).

Regression Results from Event Study

To examine whether founder-CEO leadership is a determinant of firm value, I pursue a multiple regression approach that allows me to control for industry, firm, and CEO characteristics. Table 5 presents my main results. In all columns, the reference group is professional CEO; therefore, the coefficient on founder-CEO dummy shows the difference in stock price reactions for sudden deaths of founder and professional CEOs. Column (1) shows that controlling for time and industry fixed effects, investors' reactions to the sudden deaths of founder CEOs is 4.85% greater than reactions to deaths of professional CEOs.

Extant literature documents that CEO and CEO-firm match, which are predominantly determined by firm size and growth stage, moderate the impact of CEO on firm performance. Therefore, in column (2), I present results controlling for three salient firm characteristics: firm size, firm age, and profitability. I find that firm size and firm age are positively associated with stock price reaction, and the relationships are statistically significant. However, the relationship between profitability and stock price reaction is not statistically significant. Notably, the coefficient on the founder-CEO dummy is both economically and statistically significant.

The CEO literature further argues that certain CEO characteristics such as CEO tenure, CEO age, and duality (Adams et al., 2005; Pan et al., 2016; Jenter et al., 2018) are associated with financial policies as well as accounting and market-based measures of firm performance. Therefore, in column (3), I present results controlling for CEO age, CEO tenure, and CEO duality. Of the characteristics of deceased CEOs, only CEO age is economically and statistically significant, which is consistent with Jenter et al. (2018). Overall, column (3) shows that controlling for CEO characteristics, investors' reactions to the sudden deaths of founder CEOs is greater than relative to deaths of that of professional CEOs and the difference is statistically significant at 5% level.

The sudden death of a CEO indicates that another manager will assume the position soon, suggesting that the stock price change around the death announcement may be influenced by whether the firm has a succession plan in place and the status of the incoming executive (e.g., Naveen, 2006; Villalonga & Amit, 2006; Ballinger & Marcel, 2010). Column (4) of Table 5 presents the results testing succession argument[2]. In the first test, I

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[2] I search corporate filings to determine whether a given firm has a succession plan in place for each of the 165 sudden deaths of CEOs. Using Nexis, for 98 CEOs' sudden deaths I was able to identify whether firms

control for a firm's formal succession plan in place before the CEO's death. Column (4) shows that the coefficient for the presence of a succession plan is not economically and statistically significant; thus, the positive stock price reaction around sudden death is not likely driven by succession plans in founder-CEO firms. In the second test, I include the incoming-CEO's status (founders, descendants, and professional) in my multiple regression analysis and find that incoming-CEO's status is not statistically significant.

Because column (4) presents results for the most complete model where I control for both firm and CEO characteristics, I use these results as my main results. Overall, I document significant heterogeneity in investors' reactions around sudden and unexpected deaths of CEOs with different backgrounds. For example, the intercept shows that stock price drops by 3.02% around the sudden deaths of professional CEOs; however, the coefficients on founder-CEO dummy and descendant-CEO dummy imply that stock prices increase by almost (-3.02% + 4.46% =) 1.44% around the sudden death of founder CEOs and (-3.02% + 4.82% =) 1.80% around the sudden death of descendant CEOs. Given that the average sizes of professional-CEO-led, founder-CEO-led, and descendant-CEO-led firms are $3663 million, $1036 million, and $2459 million respectively, investors experience $117.22 million value loss around the sudden death of professional CEOs; however, they experience $14.92 million and $44.26 million value gains around the sudden deaths of founder CEOs and descendant CEOs, respectively. The difference of 4.46% in

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had a succession plan in place. Of the remaining 67 cases, I follow the literature and identify the presence of a succession plan as follows: (i) No succession plan if board appoints Interim CEO; (ii) No succession plan if next CEO joined after 3rd working day of deceased CEO's death date. I find that of the 165 cases, 64 firms (38.8%) had a succession plan in place. Using Nexis and corporate proxy statements, I collect information about the incoming CEO.

the stock price reactions between founder and professional CEOs' deaths is significant at the 1% level after controlling for managerial, firm, and industry characteristics.

My initial finding – founder CEOs are less valuable than professional CEOs – stands in stark contrast to extant research on U.S. public firms (Villalonga & Amit, 2006; Fahlenbrach, 2009; Adams et al., 2009). Notably, in contrast to earlier studies, I use the sudden death of the CEO as an exogeneous shock to CEO status; thus, my results are less likely to suffer from causality concerns and sample selection bias. Next, I explore the underlying reason(s) behind the value-reducing effect of founder CEO leadership in public firms.

An Explanation Based on Managerial Private Benefits

Extant literature documents several managerial private benefits associated with founders such as nepotism and hubris arising from pet projects, excessive leisure activities, option back dating, financial reporting irregularities, the misappropriation of firm resources, and bringing friends and family members into the business (Demsetz, 1983; Faccio & Lang, 2002; Hayward et al., 2006; Morck & Yeung, 2003; Wasserman, 2008; Carver et al., 2013; Mullins & Schoar, 2016; Lee et al., 2017; Bandiera et al., 2018; Belenzon et al., 2020). If investors bear a founder-specific agency cost, then upon founders' deaths, *ceteris paribus*, investors no longer bear this risk; consequently, the stock price should increase to reflect the absence of the risk.

Managerial Private Benefit Index

To investigate the empirical relationship between CEO's private benefit use and stock price reaction, I develop a novel measure of managerial private benefits using five dimensions: 1) empire building, 2) enjoying a quiet life, 3) tunneling, 4) violation of fiduciary duties, and 5) nepotism. Then, I sum up individual dimensions to develop a managerial private benefit index (PBI). Tunneling and nepotism have two and three sub-dimensions, respectively; thus, the possible value of PBI ranges from 0 to 8. The rationale for each dimension of private benefit is discussed below.

Empire Building: Agency theory (Jensen & Meckling, 1976; Jensen, 1986; Stein, 2003) suggests that self-interested managers will attain higher utility when running larger firms. Thus, by engaging in increasingly high level of investment activities, managers gain private benefits, a behavior called empire building (Baumol, 1959; Marris, 1964; Williamson, 1964; Stein, 2003; Athanasakou et al., 2018). Accordingly, I use overinvestment as a proxy for empire building. Following Richardson (2006), I estimate overinvestment defined as "investment expenditure beyond that required to maintain assets in place and to finance expected new investments in positive NPV projects"[3].

Enjoying a Quiet Life*:* Manager may also gain private benefits by enjoying a quiet life (Bertrand & Mullainathan, 2003; Bandiera et al., 2006; Lemons et al., 2018). For example, Bandiera et al. (2017) document that compared to a professional CEO, a family CEO works six fewer hours per week. Bertrand and Mullainathan (2003) document that when facing less threat of antitakeover, CEOs reduce plant destruction and plant creation. To proxy for enjoying a quiet life, I use underinvestment as defined in Richardson (2006).

Tunneling*:* The private benefit of control literature predominantly focuses on tunneling by controlling shareholders (Johnson et al., 2000; Faccio et al., 2001; Bertrand et al., 2002; Jiang et al., 2010). In contrast, I focus on managerial tunneling – the transfer of assets and profits out of firms for the benefit of CEO. I use option backdating and related party

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[3] See Richardson (2006) for a discussion on the methodology of identifying overinvestment and underinvestment.

transactions as two proxies for tunneling. In the case of option backdating (Yermack, 1995,1997; Bebchuk et al., 2010; Carver et al., 2013) managers distort option exercise data to have higher selling prices even though the cost of higher exercise is ultimately borne by investors. In the case of related-party transactions (Gordon & Henry, 2005; Gordon & Palia, 2004b), managers engage in transactions in which they have financial interests and can extract private benefits.

Violation of Fiduciary Duty*:* Managers may engage in other activities that benefit them but violate fiduciary duties to investors and creditors. For example, the CEO of a company may make an acquisition decision without taking the consent of major investors (Mullins & Schoar, 2016). I use lawsuit against the CEO by investors as a proxy for violation of fiduciary duties.

Nepotism*:* Managers may extract private benefits by recruiting and promoting family members in the management and other positions in the firm. The main argument against such practice is that probably with proper competition and search process, family members would not make the cut in the firm (Perez-Gonzalez, 2006). Moreover, these family members may help managers to extract private benefits. I proxy for CEO nepotism by using three dimensions: CEO's family member in (i) top management, (ii) board of directors, and (iii) audit and compensation committees.

My data for managerial private benefits comes from different sources; thus, I can check the completeness and accuracy of my data. I start with corporate proxy statements from the SEC EDGAR database; however, for years prior to 1994, I hand collected data from annual reports available on microfiche in the Library of Congress. Then, I supplement my database from different sources such as the Wall Street Journal option backdating database and Stanford Law School's Securities Class Action Clearinghouse database. Finally, I fill in missing data using Nexis. Despite this laborious data collection process, it is likely that my data for managerial private benefits are far from complete and thus likely understate the prevalence of managerial private benefits.[4]

Summary Statistics of CEO Private Benefit Index

Table 6 presents two panels of descriptive statistics related to managerial private benefits for my sample firms. Panel A presents the private benefit index (PBI) and the subindices. In my sample, PBI ranges from a minimum 0 to a maximum 5 with a mean (median) of 2.06 (1) and a standard deviation of 1.56. On average, a founder CEO extracts two times greater private benefits than a professional CEO does. Moreover, the table shows that 40% of CEOs and 18% of professional CEOs enjoy above median private benefits. Furthermore, segregating private benefits into two types – nepotism and non-nepotism – I find that founder CEOs enjoy both types of private benefits to a greater degree than do professional CEOs.

I also find (untabulated) heterogeneity in managerial private benefits for CEOs with different backgrounds. For example, empire building (proxied by overinvestment) is more prevalent among professional CEOs, whereas enjoying a quiet life (proxied by underinvestment) is more prevalent among founder CEOs, which is consistent with Bandiera et al. (2017). Both measures of tunneling – related party transactions and option backdating – are more common among founder CEOs, which is consistent with Carver et

[4] Notably, my measure - private benefits index (PBI) is different from widely accepted measures of corporate governance such as GIM index (Gompers, Ishii, and Metrick (2003)) and entrenchment index (Bebchuk, Cohen, and Ferrell (2009)). Whereas these measures focus on firm-level governance mechanism, my measure focuses on managerial-level governance problem. PBI also differs significantly from the pioneering work of Yermack (2006), who solely uses CEOs' aircraft use as a proxy for CEO perquisites.

al. (2013). Notably, both professional and founder CEOs are equally likely to face lawsuits for violating fiduciary duties. Overall, the initial evidence of private benefits is consistent with the fact that founder CEOs are extremely powerful (Adams et al., 2005), and they might use their power to extract managerial private benefits.

Panel B presents the stock price reaction to sudden and unexpected deaths of CEOs with varying degree of private benefits. For the full sample, stock price increases by 6.04% around the deaths of CEOs with high private benefits, whereas stock price decreases by 2.99% around the deaths of CEOs with low private benefits; this corresponds with a net 9.03% increase in stock price around the deaths of CEOs with high private benefits. The difference is statistically significant at the 1% level. I find similar results in founder CEO and professional CEO sample.

Do Investors Consider Managerial Private Benefits in Pricing Stocks?

Table 7 presents the results for stock price reactions to the sudden deaths of CEOs with varying level of managerial private benefits. Column (1) shows that a one standard deviation increase in private benefit index (PBI) is associated with 4.18*1.56=6.52% increase in stock price. The result is statistically and economically significant, implying that investors price CEO's private rent extraction into the stock price. Column (2) shows that controlling for private benefits, the stock price reaction is no longer different around the sudden departure of founder and professional CEOs. Notably, the result for PBI is economically and statistically significant. I find similar results in column (3), where I use private benefit as a dummy variable.

Next, I try to isolate whether stock price reactions to sudden deaths of CEOs are driven by their private benefit extractions or founder status. Following Wooldridge (2012,

p. 235), I compare stock price reactions around sudden and unexpected deaths of four groups of CEOs: founder CEO with low private benefits, founder CEO with high private benefits, professional CEO with low private benefits, and professional CEO with high private benefits. In this regression framework, I use professional CEOs with low private benefits as the reference group, and for the sake of my research interest, I exclude descendant CEOs from the regression. Column (4) of Table 7 presents the results of this regression framework, which helps me to compare between any two groups and provide valuable insights. I find that compared to the sudden death of professional CEO with low private benefit, stock price increases by (i) 8.72% when professional CEO with high private benefit dies, (ii) 9.47% when founder CEO with high private benefit dies. Also, compared to the sudden death of founder CEO with low private benefits, stock price increases by 8.39% (t>3) when a founder CEO with high private benefit dies. Moreover, I do not observe any systematic difference between stock price reaction due to the deaths of (i) founder CEO with low private benefit and professional CEO with low private benefit (t=1.41), and (ii) founder CEO with high private benefit and professional CEO with high private benefit (t=1.13). Overall, results from Table 7 and panel B of Table 6 suggest that stock price increases around the sudden and unexpected deaths of founder CEOs are driven by their value destroying activities rather than their founder status.

Relative Impact of Different Managerial Private Benefits?

In this section, I investigate which sub-indices of managerial private benefits play a critical role in the relationship between managerial private benefits and firm value. Knowing relative magnitude of these sub-indices may help private and public policy makers who attempt to mitigate managerial private benefits (Bebchuk et al., 2009).

Nepotism and Non-Nepotism Related Private Benefits

CEO literature argues that CEOs, particularly family CEOs, are prone to nepotism. Because nepotism promotes inferior human capital, it is value destroying for investors (Perez-Gonzalez, 2006). However, little is known about whether the value destroying effect of nepotism is more severe than that of non-nepotism related private benefits. Therefore, I run a horse race between these two types of private benefits.

Columns (1)–(3), Table 8 present results for relative role of nepotism and non-nepotism related private benefits. Column (1) shows that both sources of CEO private benefits – nepotism and non-nepotism – are statistically significant, and the economic magnitude of the stock price reactions are quantitatively similar in each case. For example, one unit increase in nepotism related private benefits is associated with 3.81% value decrease whereas one unit increase in non-nepotism related private benefits is associated with 3.95% value decrease. Notably, the correlation between nepotism and non-nepotism related private benefits is very high (0.71); thus, coefficients in column (1) are likely to suffer from severe multicollinearity. To address multicollinearity[5], in column (2), I only include nepotism and in column (3), I only include non-nepotism. Results from column (2) and (3) continue to show that investors react to both type of private benefits and both are key to explain positive stock price reactions around sudden deaths of founder CEOs.

Disclosed and Non-Disclosed Private Benefits

Of the non-nepotism related private benefits, some are disclosed in proxy statements e.g., related party transactions, option backdating, and lawsuits against CEOs

[5] Alternatively, I run two separate regressions – a regression for those firms with no nepotism related private benefits and a regression for firms with no non-nepotism related private benefits. I continue to find similar results to those in column (1)-(3).

for violation of fiduciary duties. Because of identifiable nature and value destroying effects, these private benefits receive much attention from investors and media. In contrast, other private benefits such as investment related private benefits – overinvestment and underinvest – are not disclosed in proxy statements. Because investment related private benefits are difficult to identify, they come under less scrutiny from investors and media. Notably, relative to above mentioned disclosed private benefits, investment related undisclosed private benefits receive much attention in literature. Thus, it is critical to examine the relative impact of these two types of private benefits. Column (4), Table 8 shows that one unit of disclosed private benefits is associated with 5.07% increase in stock price whereas one unit of investment related non-disclosed private benefits is associated with 2.81% increase in stock price. Thus, my findings imply that disclosed private benefits deserve more attention from academicians.

Overinvestment and Underinvestment Related Private Benefits

Numerous studies document that both overinvestment and underinvestment are value destroying for shareholders; however, there is little empirical evidence on the relative value-destroying effect of these two types of private benefits. My research setting provides an opportunity to empirically test this important question. Column (5) of Table 8 shows that on average stock price increases by 1.82% around death of overinvesting CEOs and increases by 3.05% around the death of underinvesting CEOs. The difference between these two types of private benefits is 1.23%, which is statistically significant at the 5% level. Therefore, my findings suggest that investors' reactions are more pronounced for enjoying a quiet life (Bertrand & Mullainathan, 2003; Agarwal, 2006) than empire building (Baumol, 1959; Marris, 1964; Williamson, 1964; Stein, 2003; Athanasakou et al., 2018).

Alternative Explanations

The preceding sections document that founder CEOs who continue to maintain CEO position in public firms destroy investor wealth, and especially those who extract private benefits. In this section, I explore alternative arguments that could account for the evidence presented thus far.

Managerial Entrenchment

The managerial entrenchment literature argues that founder CEOs may elicit concerns from shareholders due to potential entrenchment – for example, a founder CEO, as a powerful insider with significant ownership and voting rights, may decide to stay with the firm even if his skillset is short of the need of a large complex public firm (e.g., Fama & Jensen, 1983; Schwert, 1985; Morck et al., 1988; Hambrick & Fokutomi, 1991; Berger & Yermack, 1997; Wasserman, 2008; Salas, 2010; Lin, Wei, and Xie, 2019). Thus, termination of entrenched founder CEO, on average, likely add to shareholders' wealth. Therefore, it is possible that the documented positive stock market reaction in response to the sudden death of a founder CEO is driven by the deceased CEO's entrenchment rather than private benefits. To test this argument, following Salas (2010), I develop a simple measure of CEO entrenchment. Specifically, I define a CEO as entrenched if market adjusted annual stock returns are negative in the previous two consecutive years and CEO tenure is above the median.

Columns (1)– (3) of Table 9 present the results testing entrenchment hypothesis. Column (1) shows that the association between stock price reaction and CEO entrenchment is economically significant, which is consistent with predictions of entrenchment literature (Salas, 2010). Noticeably, founder CEO dummy remain economically and statistically significant suggesting that much of the difference of stock price reaction due to death of founder and professional CEO remain unexplained by managerial entrenchment. In column (2), I control for private benefits index (PBI) and I find that coefficient of CEO entrenchment decreases significantly, and it is no longer statistically significant; however, the coefficient of PBI remain significant at 1% level.

In column (3), to better understand relative explanatory power of CEO entrenchment and private benefit index (PBI), I run a horserace between CEO entrenchment and PBI. Following Wooldridge (2012, p. 235), I interact PBI and CEO entrenchment, and I classify all CEOs into four groups: entrenched CEO with high private benefit, entrenched CEO with low private benefit, non-entrenched CEO with high private benefit, and non-entrenched CEO with low private benefit. Then, I use non-entrenched CEO with low private benefit as base dummy. Notably, column (3) confirms that investors are more worried about CEO being engaged in value destroying risky activities rather than CEO merely staying with firm too long.

Managerial (In)ability

One could argue that founder CEOs are less valuable for investors not because of founder-CEO's private benefit extraction but because of their inferior managerial abilities and skills (Johnson et al., 1985). To address this concern, following Nguyen and Nielsen (2010), I use CEOs' educational backgrounds as measurable and observable proxies for CEOs' skills. Because almost 90% of the CEOs in my sample hold at least a bachelor's degree, I control for skill by including three dummy variables: post-graduate, MBA, and PhD. Results from column (4) of Table 9 suggest that the positive stock price reaction to the sudden death of a founder CEO is not likely driven by founder CEO's human capital or managerial inability and my main results are robust to controlling for managerial ability.

Control Premium Argument

The death of a founder CEO, who usually owns substantial equity in his firm, is likely to result in the breaking of a "large control block", which in turn can result in a takeover fight. Extant literature (Demsetz, 1983; Demsetz & Lehn, 1985; Shleifer & Vishny, 1997; La Porta et al., 1999) finds that strategic block holders want to control the firm, and they are ready to pay a control premium. Schwert (1985) argues that if death opens the possibility of takeover fight, and if the stock market anticipates a possible takeover, the stock price will rise. Therefore, the positive stock price reaction to the sudden death of founder CEO may arise from a control premium, not necessarily because of the death of founder CEO with private benefits. Empirically, I investigate whether abnormal trading volume surrounding the sudden death of CEOs can explain the positive stock price reaction to the sudden death of founder CEOs. Column (5), Table 9 shows that the coefficient of abnormal volume is both economically and statistically insignificant. This result implies that the control premium plays no role in the positive stock reaction following the sudden death of a founder CEO.

In sum, I show that my results for CEO private benefit are robust to alternative explanations based on managerial entrenchment, managerial ability, and the control premium arising from takeover fight.

Additional Robustness Tests

Alternative Specifications

The results of my study are robust to alternative specifications. First, using a 3-day event window [CAR (-1, +1) and CAR (0,2)], I find (unreported table) results that are similar to my main results. Second, on average, first news of a CEO death came out within 1.2 day. I use first day of news as event date and find very similar results to death date as event date (unreported table).

Controlling Additional Firm and CEO Characteristics

Corporate Governance

Extant literature documents that firm's corporate governance play a key role at critical times. Column 1, Table 10 shows that results for managerial private benefits remain robust controlling for firm level governance variable such as board independence.

Firm Level Risk

One possible explanation of the positive stock price reaction around the sudden and unexpected death of a founder-CEO is that it is driven by firm level risk. Therefore, following Salas (2010), I control for firm level risk using firm beta. Column 2, Table 10 shows that firm level risk is not statistically significant, and my results are robust controlling for firm level risk.

High Growth Firm

Another concern is that stock price reactions may be driven by firms with extremely high growth opportunities (Faccio and Parsley, 2009). Column 3, Table 10 shows results controlling for market to book (M/B) ratio and column 5 shows results excluding firms with M/B ratios higher than 10. Results from columns (3) and (5) show that my main results are robust controlling for firm's growth opportunities and firms with high growth opportunities do not drive my results.

CEO Ownership

The stock price reaction may also be driven by the potential dilution of CEO ownership, as founder CEOs usually hold significant ownership (Lemmons & Lins, 2003). However, agency theory suggests that managers with greater ownership shares are likely to be more aligned with shareholders wealth maximization. Column 3, Table 11 shows that CEO ownership is not statistically significant, and my main results are robust to controlling for CEO ownership.

CEO Age

Conventional wisdom and human resource theories suggest that CEO age captures experience (Norburn and Birley, 1988). For example, Wall Street Journal finds that as of May 1, 2019, almost 94% of CEOs in S&P 500 firms are over 50 years old (WSJ, 2019). However, CEO life cycle theory suggests that CEOs have their most negative impact on shareholders' wealth during their later years (Hambrick & Fokutomi, 1991); thus, firm value may increase when old CEOs are replaced by younger ones (Jenter et al., 2018).

In Table 11, I investigate the relative role of CEO age and managerial private benefits. Results from column (1) show that once I control for private benefit index (PBI), CEO age is no longer statistically significant; however, CEO private benefit remains significant at 1% level. In column (2), I run a horse-race between CEO age and private benefit. Following Wooldridge (2012, p. 235), I classify all CEOs into four groups: (i) CEOs with above median age (60.5 years) and high private benefit, (ii) CEOs with above median age and low private benefit, (iii) CEOs with below median age and high private benefit, and (iv) CEOs with below median age and low private benefit. Here, I use CEOs with below median age and low private benefit as a reference group. In comparing these four groups, results from column (2) suggest that investors are more worried about CEO being engaged in value destroying risky activities rather than CEO age.

Addressing Small Sample Concern

Although sudden deaths are random events, the small sample size (Faccio & Parsley, 2009) implies that my results may be driven by some extreme values. To mitigate this concern, I conducted several robustness tests. *First*, I construct a distribution of CARs. Figure 1 shows that CARs around sudden and unexpected deaths of founder CEOs are greater than that of professional CEOs in every 10^{th} percentile point, suggesting that my results are unlikely to be driven by extreme values. *Second*, I conduct random iteration by dropping CEOs with same letter last name starting from A to Z. Arguably, CEOs' last name should not influence firm performance and sudden deaths. In an unreported table, I find that my results are robust in every iteration and on average. This further suggests that my results are unlikely to be driven by extreme values. *Third*, I test robustness of my main results using 18,022 firm-year observations from ExecuComp sample for the period 2001–2017. Using Tobin's Q as a measure of market-based performance, I find that a founder-CEO led firm is associated with almost 5% to 10% lower Tobin's Q than a professional-CEO led firm (Table 12). These results are robust using coarsened exact matched (CEM) sample where I match founder and professional CEO led firms based on Fama-French 48 industry, firm age, firm size, CEO age, and firm profitability. Overall, results from ExecuComp sample support my results from sudden and unexpected death sample.

Conclusion

Founder CEOs represent almost 25% of the CEO positions in small, publicly listed U.S. firms (Wasserman, 2008) and almost 11% in large firms comparable to the size of S&P 1500 firms (Fahlenbrach, 2009). Whether and how founder CEO leadership can impact shareholders' wealth has been examined extensively; however, in the literature the results are inconclusive mainly because of causality concerns arising from endogeneity and sample selection bias. Using sudden and unexpected deaths of CEOs as a natural experiment, I document that around sudden departure of CEO, an average professional CEO led firm loss 3.02% of its value ($117.2 million) whereas an average founder CEO led firm gain 1.44% ($14.9 million). My findings suggests that in public US firms, investors perceive founder CEOs as less valuable than professional CEOs.

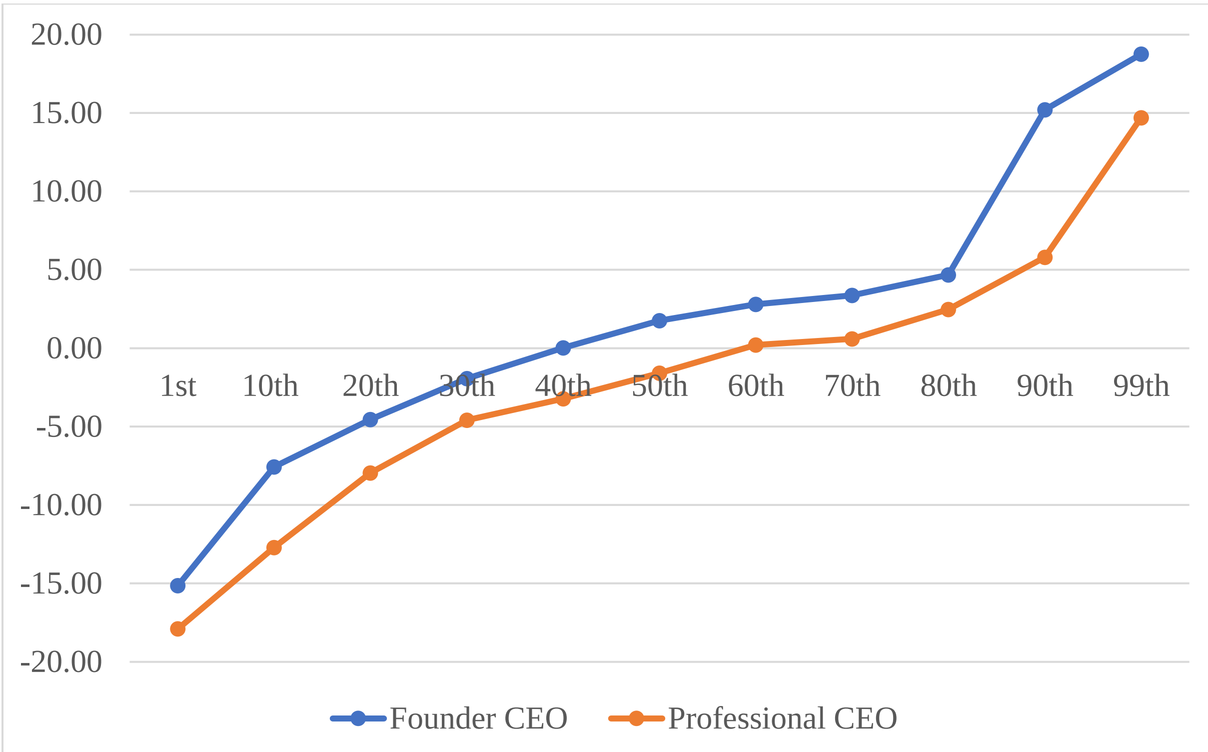
Further investigation suggests that such stock price reaction is mainly driven by the fact that founder CEOs extract two times greater private benefits than professional CEOs do.[6] I also document significant heterogeneity in investors' reactions to different types of private benefits. For example, relative to investment related private benefits, disclosed private benefits such as related party transactions receive stronger backlash from investors. Moreover, investors' reactions are stronger for underinvestment problem than that of overinvestment problem.

[6] I find that sudden death of a CEO with an additional standard deviation of private benefit is associated with 6.08% or $164.52 million value gain for investors. In a related study, Salas (2010) documents that around sudden death of entrenched CEO, firm value increases by almost $114.72 million (6.8% *$1687million). My findings imply that investors are more likely to react to trust busting activities of CEOs (Gurun et al., 2018). The economic magnitude is also plausible if we consider that following the news of related party transactions and other misconduct by founder CEO Adam Neuman, WeWork's value plunged more than 80% within a few months (from $47 billion to below $5 billion). For details see https://markets.businessinsider.com/news/stocks/softbank-wework-valuation-5-billion-staggering-drop-2019-11-1028673855.

My results have critical implications. My results suggest that researchers might benefit from controlling managerial private benefits in addition to controlling firm level governance. Moreover, policy efforts to mitigate managerial private benefits might benefit from focusing on certain aspect of corporate governance, such as not bringing family members in top management.

Figure 1

Stock Price Reaction to Sudden and Unexpected Deaths of CEOs: Percentile Distribution of CARs (-1, +2) %



This figure presents percentile distribution of stock price reaction [CAR (-1, +2) %] around sudden and unexpected deaths of founder CEOs (blue color line) and professional CEOs (yellow color line). CAR (-1, +2) %, cumulative abnormal return (in percentages) over the 1-day prior CEO death and 2 days after CEO death, is presented in vertical axis.

Table 1

Variable Definitions

Abnormal trading volume: calculated as Average trading volume (-1, +2) – Average trading volume (-222, -2).

CAR (-1,2) %: cumulative abnormal return (in percentages) over the 1-day prior event and 2 days after event. Abnormal return is calculated in three ways: (i) Ret-Value Weighted Return (ii) Ret-Equally Weighted Return (iii) Ret-S&P return.

CEO age: age in number of years.

CEO tenure: years since joining as CEO.

CEO duality: binary variable equals to one if CEO assumes Chairman title as well, and zero otherwise.

CEO ownership: percentage of equity of firm owned by CEO.

Descendant CEO: binary variable equals to one if CEO is a member of founding family, and zero otherwise.

Empire building: binary variable equals to one if firm engages in overinvestment (Richardson (2006)), and zero otherwise.

Enjoying quiet life: binary variable equals to one if firm engages in underinvestment (Richardson (2006)), and zero otherwise.

Entrenched CEO: binary variable equals to one if firm had negative stock return in the past two consecutive years and CEO have median above tenure, and zero otherwise.

Family members in top management: binary variable equals to one if CEO's family members are also in top management in the firm, and zero otherwise.

Family member in BOD: binary variable equals to one if CEO's family members are also in BOD, and zero otherwise.

Family ownership: percentage of equity of firm owned by founding family members.

Firm age: number of years since inception.

Founder CEO: binary variable equals to one if CEO is a founder or co-founder, and zero otherwise.

Founder w/ low private benefits: binary variable equals to one if CEO is founder and Private Benefits Index (PBI)≤1.

Founder w/ high private benefits: binary variable equals to one if CEO is founder and Private Benefits Index (PBI)>1.

Growth opportunities: sum of the market value of equity and book value of long-term debt divided by total assets.

Private benefits index (PBI): an index constructed with five dimensions of managerial private benefits: 1) empire building 2) enjoying quiet life 3) tunneling 4) violation of fiduciary duties, and 5) nepotism.

Private benefits (disclosed): is a type of non-nepotism related private benefits which includes tunneling and violation of fiduciary duties.

Private benefits (non-disclosed): is a type of non-nepotism related private benefits which includes empire building and enjoying quiet life.

Market to book: ratio of market value of total assets to book value of total assets, where market value of total assets is equal to the book value of assets, plus the market value of common equity, minus the sum of the book value of common equity and deferred taxes.

Market capitalization: number of outstanding shares multiplied by price per share.

Nepotism: nepotism related private benefits, which is constructed using three proxies: CEO's family member in (1) top management, (2) board of directors, and (3) audit and/or compensation committees.

Non-nepotism: non-nepotism related private benefits, which is constructed with four dimensions of managerial private benefits: 1) empire building 2) enjoying quiet life 3) tunneling, and 4) violation of fiduciary duties.

Option backdating: binary variable equals to one if manager distorts option exercise data to have higher selling price, and zero otherwise.

Professional CEO: binary variable equals to one if CEO is not a founder or co-founder or founding family member.

Professional CEO w/ low private benefits: binary variable equals to one if CEO is professional CEO and Private Benefits Index (PBI)≤1.

Professional CEO w/ high private benefits: binary variable equals to one if CEO is professional CEO and Private Benefits Index (PBI)>1.

Replaced by professional: binary variable equals to one if deceased CEO is replaced by a professional CEO, and zero otherwise.

ROA: operating income before depreciation divided by total assets.

Related party transactions: binary variable equals to one if CEO engages in related party transactions, and zero otherwise.

Succession Plan: binary variable equals to one if firm had a succession plan, and zero otherwise.

Total assets ($m): Total assets in million dollars.

Violation of fiduciary duty: binary variable equals to one if investors file a lawsuit against CEO for violating fiduciary duties, and zero otherwise.

Tunneling: a type of managerial private benefit which is constructed using two proxies: 1) related party transactions, and 2) option back dating.

Table 2

Composition of CEO Sudden Death Sample

A. Classification of deaths		
CEO and Company Name	Cause of Death	Classification
Harold Finch Jr., Nash Finch Co.	car accident	sudden
Raymond J. Homa; Checkmate Electronics	plane crash	sudden
Jose Menendez; Live Entertainment	murder	sudden
Reay Sterling Jr.; Micros Systems, Inc.	heart attack	sudden
Craig Neilsen; Ameristar Casinos	in sleep	sudden
Hal Goldman; Elek-Tek, Inc.	suicide	not sudden
William D O'Hagan; Mueller Industries	cancer	not sudden
Max Reissman; Orbit International Inc	surgery	not sudden
Billy Mitcham Jr; Mitcham Industries	brief illness	not sudden
	N	Share of Total
Panel B: Types of Sudden Deaths		
Accident and murder	29	17.58
Heart attack	81	49.09
Stroke	9	5.45
Unspecified cause	46	27.88
Total Sudden deaths	165	100.00
Unique firms	164	
Panel C: Type of Suddenly Deceased CEO		
Founder	50	30.30
Descendant	22	13.33
Professional	93	56.36

This table presents the composition of my sample of sudden death of CEOs' of Amex-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1,1964 and December 31, 2018. In Panel A, I provide several examples of sudden and non-sudden deaths. I classify deaths from non-health related events - accidents, and homicides - as sudden because these events are not forecastable. I classify deaths from heart attack, stroke, and other diseases as sudden only if a CEO unexpectedly died within 24 hours of such illness. When newspapers reported deaths as sudden without mentioning specific cause, I classify them as sudden only if I find no past information regarding illness. Deaths caused by diseases and complications from surgery are not classified as sudden. Suicides are not classified as sudden because such deaths are susceptible to be related to firm performance. In Panel B, I report type of sudden death and in panel C, I report type of suddenly deceased CEOs. Founder is a dummy variable equals one if CEO is founder or co-founder of the firm; otherwise, equals zero. Descendant is a dummy that variable equals one if the CEO is from a founding family; otherwise equals zero. Professional is a dummy variable that equals one if the CEO is not a founder or descendant; otherwise equals zero.

Table 3

CEO and firm characteristics of the CEO sudden death sample, 1964 to 2018.

	Founder (1)	Professional (2)	Descendant (3)	p-value (1)-(2)	p-value (2)-(3)
Panel A: CEO Characteristics					
Age	64.58	58.72	59.18	0.00	0.83
CEO tenure	16.64	7.59	12.55	0.00	0.07
CEO ownership	16.3	3.88	8.84	0.00	0.10
CEO duality	0.87	0.65	0.78	0.01	0.15
Panel B: Firm Characteristics Prior to CEO Death					
Market capitalization ($m)	1036	3663	2459	0.15	0.65
Total assets ($m)	1066	4408	2722	0.05	0.52
Beta (CAPM)	0.60	0.84	1.00	0.06	0.53
Market to Book	2.73	2.63	2.07	0.87	0.50
Return on Asset	-0.01	-0.02	0.00	0.77	0.30
Return on Equity	-0.20	-0.01	-0.04	0.19	0.41
Family ownership	19.07	4.83	14.61	0.00	0.04
Firm age	25.91	38.25	44.45	0.00	0.82

This table presents summary statistics on the CEOs' sudden death sample, which cover the period 1964 to 2018. The sample contains 165 sudden death, of which 50 are founders, 22 are descendants, and 93 are professional CEOs. "Founder" (labeled as group (1)) reports the mean of the 50 founder CEO sudden deaths, "Descendant" (labeled as group (2)) reports the mean of the 22 descendant CEO sudden deaths, and "Professional" (labeled as group (3)) reports the mean of the 93 professional CEO sudden deaths. The two columns of "p-value" test the difference between founders and professionals ((1) - (3)) and descendants and professionals ((2) - (3)), assuming unequal variance between the two groups. In panel A, I report CEO characteristics, including the age, CEO tenure, CEO ownership, family ownership, and CEO duality. CEO duality is a dummy variable equals one if the CEO assumes the Chairman title as well and equals zero otherwise. In panel B, I report the market capitalization (two days prior to the sudden death, in $millions), beta (using CAPM over the previous 250 trading days), market-to-book, return-on-assets, return-on-equity at the end of the most recent fiscal year prior to the sudden death event. book-to-market, return-on-assets, return-on-equity are all adjusted by industry median.

Table 4

Stock Market Reactions of CEO Sudden Deaths

	Founder							Descendant							Professional						
	N	Mean	Median	Min.	Max.	Pos.	Neg.	N	Mean	Median	Min.	Max.	Pos.	Neg.	N	Mean	Median	Min.	Max.	Pos.	Neg.
CAR [-1,2] (%)	50	1.56	1.04	-17.27	29.89	30	20	22	2.26	1.42	-6.77	18.96	14	8	93	-2.89	-1.64	-18.46	14.71	37	56
CAR [-1,1] (%)	50	1.27	0.90	-18.58	22.28	28	22	22	1.43	0.73	-7.07	10.55	13	9	93	-2.16	-1.06	-25.16	14.01	39	54
Day -5(%)	50	0.38	0.07	-5.82	6.71	26	24	22	0.02	-0.22	-5.69	8.49	7	15	93	1.12	0.39	-12.06	40.27	51	42
Day -4(%)	50	-0.13	-0.10	-7.52	7.18	21	29	22	-1.05	-0.27	-5.88	0.95	9	13	93	-0.48	-0.08	-21.57	5.82	43	50
Day -3(%)	50	-0.17	-0.20	-5.37	11.80	19	31	22	0.60	0.23	-2.54	8.31	13	9	93	0.16	0.09	-9.54	14.47	51	42
Day -2(%)	50	0.21	-0.05	-8.06	9.20	23	27	22	-0.47	-0.85	-4.74	3.43	6	16	93	-0.23	-0.19	-14.64	10.94	39	54
Day -1(%)	50	0.04	-0.01	-5.97	5.37	24	26	22	0.02	-0.05	-4.23	7.43	10	12	93	-0.48	-0.14	-23.78	6.36	42	51
Day 0(%)	50	0.16	0.07	-19.90	17.03	27	23	22	0.35	0.36	-9.18	8.34	13	9	93	-0.52	-0.55	-29.60	9.08	36	57
Day 1(%)	50	1.08	0.86	-9.16	13.67	30	20	22	1.06	0.41	-6.26	10.16	14	8	93	-1.15	-0.27	-18.03	14.93	29	64
Day 2(%)	50	0.28	0.20	-10.73	11.69	26	24	22	0.84	0.34	-2.71	11.16	13	9	93	-0.73	-0.25	-12.68	10.72	39	54
Day 3(%)	50	-0.07	-0.06	-11.73	10.39	23	27	22	-0.48	-0.74	-6.44	4.49	6	16	93	0.24	-0.05	-10.71	14.75	45	48
Day 4(%)	50	0.25	-0.20	-7.39	17.73	20	30	22	0.43	0.27	-5.51	4.80	12	10	93	-0.14	-0.10	-24.76	15.27	46	47
Day 5(%)	50	0.15	-0.21	-6.55	25.50	19	31	22	-1.02	-0.44	-11.14	3.25	6	16	93	0.61	0.09	-11.95	27.14	52	41

This table reports the stock market reactions to CEO sudden deaths. CAR [-1,2] is the cumulative abnormal return over the [-1,2] event window (defined as in Table 1). CAR [-1,1] is the cumulative abnormal return over the [-1,1] event window. Reported are the mean, median, minimum, maximum, number of positive, and number of negative events for the three groups of CEOs (i.e., founder CEO, descendant, and professional CEO). The sample contains 165 CEO sudden deaths during 1964 to 2018, of which 50 are founder CEOs, 22 are descendants, and 93 are professional CEOs.

Table 5

Founder CEO Status and Stock Price Reaction to Sudden Deaths of CEOs

	Dependent variable: CAR (-1,2) %			
	(1)	(2)	(3)	(4)
Founder CEO	4.85***	6.29***	3.20**	4.46***
	(3.89)	(5.07)	(2.52)	(3.47)
Descendant CEO	4.94***	4.92***	4.92***	4.82***
	(2.88)	(3.03)	(3.06)	(3.09)
Market capitalization		1.44**		1.44**
		(2.15)		(2.26)
Firm age		2.61***		1.80**
		(3.23)		(2.25)
ROA(t-1)		-0.15		-1.91
		(-0.05)		(-0.72)
CEO duality			0.60	0.25
			(0.56)	(0.24)
CEO age			0.28***	0.25***
			(5.10)	(4.39)
CEO tenure			0.15	0.13
			(1.62)	(1.59)
Succession plan				0.33
				(1.03)
Replaced by professional				0.80
				(1.13)
Intercept	-2.80**	-3.41***	-2.17***	-3.02***
	(-2.15)	(-4.40)	(-5.26)	(-6.15)
Industry FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	165	165	165	165
Adjusted R-squared (%)	9.43	18.8	22.6	27.2

This table tests the event return in a cross-section regression framework. The sample include sudden deaths of CEOs' of AMEX-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1,1964 and December 31,2018. In all columns, the dependent variable is CAR [-1,2] (in percentages) over the [-1,2] event windows. Founder CEO equals one if the CEO is a founder and equals zero otherwise. Descendant CEO equals one if the CEO is a founding family member and zero otherwise. Market capitalization is log of the firm's market capitalization. Firm age is log of firm age in years since inception of the firm. ROA (return on total assets) is a proxy of firm profitability. CEO tenure and CEO age are measured in years. CEO duality equals one if CEO assumes Chairman title as well, and zero otherwise. Succession plan equals one if the firm had a succession prior the sudden death of CEO and zero otherwise. Replaced by professional equals one if vacant CEO position due to sudden death of CEO is replaced by a professional CEO and zero otherwise. Industry effects are Fama and French's five industry classification. To control for time fixed effect, I use decade dummies. t-statistics are reported in parentheses. Asterisks denote statistical significance at 1% (***), 5% (**), or 10% (*).

Table 6

Private Benefits Index: Summary Statistics

Panel A: Private Benefits Index (PBI)

	All CEOs	Founders	Professionals	Descendants
Min	0	0	0	0
Mean	2.06	2.96	1.45	3.02
Median	1	2	1	2
Max	5	5	4	5
Std	1.56	1.78	1.42	1.66
% CEOs with above median PBI	29	40	18	50
Nepotism related PBI	0.67	1.05	0.12	0.98
Non-nepotism related PBI	1.39	1.91	1.33	2.04

Panel B: CARs (-1,2) % Around Sudden Death of CEOs with Different Level of Private Benefits

Particulars	All CEOs	Founders	Professionals	Descendants
CEOs with low private benefits	-2.99	-2.65	-3.17	-2.53
CEOs with high private benefits	6.04	6.21	5.97	6.46
Difference	9.03***	8.86***	9.14***	8.99***

The table presents summary statistics of Private Benefits Index (PBI) and stock price reactions to the sudden deaths of CEOs with different degree of private benefits. The sample include sudden deaths of CEOs' of AMEX-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1,1964 and December 31,2018. Panel A presents summary statistics of Private Benefits Index (PBI) which is constructed using five dimensions: 1) empire building 2) enjoying quite life 3) tunneling 4) violation of fiduciary duties, and 5) nepotism. To measure nepotism related private benefits, I use three proxies: CEO's family member in (i) top management (ii) board of directors, and (iii) audit and compensation committees. The remaining four dimensions of private benefits are classified as non-nepotism related private benefits. I proxy empire building and enjoying quiet life by using overinvestment and underinvestment (Richardson, 2006). To measure tunneling I use two proxies: (i) related party transactions, and (ii) option backdating. I proxy violation of fiduciary duties using lawsuit against CEO. Panel B presents stock price reactions around sudden and unexpected deaths of CEOs with varying degree of managerial private benefits. CEOs with low private benefits is a dummy variable which equals to one if PBI $\leq$1 and zero otherwise. CEOs with high private benefits is a dummy variable which equals to one if PBI>1 and zero otherwise.

Table 7

Stock Price Reaction to Managerial Private Benefits

	Dependent Variable: CAR (-1,2) %			
	(1)	(2)	(3)	(4)
Founder CEO		1.81	1.29	
		(1.20)	(1.36)	
Descendant CEO		2.35	2.04	
		(1.61)	(1.57)	
Private Benefits Index (PBI)	4.18***	3.90***		
	(4.29)	(4.11)		
Above Median PBI			8.21***	
			(5.09)	
Founder w/ low PBI				1.08
				(1.41)
Founder w/ high PBI				9.47***
				(4.73)
Professional w/ high PBI				8.72***
				(3.96)
Market capitalization	0.79**	0.83**	0.87**	0.78**
	(2.29)	(2.15)	(2.22)	(2.13)
Firm age	0.13	0.15*	0.16	0.12
	(1.34)	(1.72)	(1.56)	(1.54)
CEO tenure	0.23	0.23	0.21	0.24
	(1.36)	(1.24)	(1.32)	(1.54)
CEO Duality	0.54	0.13	0.14	0.10
	(0.33)	(0.08)	(0.07)	(0.06)
Intercept	-1.93***	-3.04***	-3.19***	-3.65***
	(-5.05)	(-5.11)	(-5.53)	(-4.74)
Industry FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	165	165	165	143
Adjusted R-squared (%)	33.4	35.7	35.5	35.2

This table tests the event return in a cross-section regression framework. The sample includes sudden deaths of founder and professional CEOs' of Amex-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1,1964 and December 31,2018. The dependent variable is CAR [-1,2], the cumulative abnormal return (in percentages) over the [-1,2] event window. Founder CEO equals one if the CEO is a founder and equals zero otherwise. Descendant CEO equals one if CEO is a member of founding family and zero otherwise. Professional CEO equals one if CEO is not a founding family member and zero otherwise. Private Benefits Index (PBI) is defined in Table 1. Above median PBI equals one if CEO's private benefit index is non-zero and zero otherwise. Founder w/ low PBI equals one if CEO is founder and PBI ≤1. Founder w/ high PBI equals one if CEO is founder and PBI>1. Professional w/ high PBI equals one if CEO is professional and PBI>1. Market capitalization is calculated as log of market capitalization. Firm age is the number of years since firm first appears in Compustat. CEO tenure is the number of years since joining as CEO. CEO duality equals one if CEO assumes Chair of BOD as well, and zero otherwise. Industry effects are Fama and French's five industry classification. To control for time fixed effect, I use decade dummies. Heteroskedastic-consistent t-values are reported in parentheses below the coefficients.

Table 8

Relative Impact of Different Types of Private Benefits

	Dependent Variable: CAR (-1,2) %				
	(1)	(2)	(3)	(4)	(5)
Founder CEO	1.72	2.62**	2.38**	2.25**	3.49**
	(1.39)	(2.19)	(2.05)	(2.16)	(2.22)
Descendant CEO	2.17	2.68**	2.53**	2.63**	3.60**
	(1.57)	(2.24)	(2.11)	(2.03)	(2.17)
Nepotism	3.81***	3.97***			
	(3.12)	(3.31)			
Non-nepotism	3.95***		4.04***		
	(3.09)		(3.17)		
Disclosed				5.07***	
				(5.02)	
Non-disclosed				2.81**	
				(2.25)	
Underinvestment					3.05***
					(2.73)
Overinvestment					1.82**
					(2.06)
Market capitalization	0.81**	0.75**	0.85**	0.71**	0.79**
	(2.16)	(2.26)	(2.21)	(2.09)	(2.14)
Firm age	0.15	0.21	0.18	0.19	0.27
	(1.61)	(1.59)	(1.49)	(1.52)	(1.55)
CEO tenure	0.19	0.25	0.17	0.21	0.23
	(1.57)	(1.42)	(1.33)	(1.40)	(1.49)
CEO duality	0.26	0.21	0.25	0.18	0.31
	(0.68)	(0.59)	(0.71)	(0.83)	(0.97)
Intercept	-3.01***	-3.11***	-3.18***	-3.05***	-3.03***
	(-5.02)	(-4.59)	(-4.98)	(-4.75)	(-4.52)
Industry FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	165	165	165	165	165
Adjusted R-squared (%)	34.6	32.3	33.5	33.4	32.6

This table tests the event return in a cross-section regression framework. The sample includes sudden deaths of founder and professional CEOs' of Amex-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1,1964 and December 31,2018. The dependent variable is CAR [-1,2], the cumulative abnormal return (in percentages) over the [-1,2] event window. Founder CEO equals one if the CEO is a founder and equals zero otherwise. Descendant CEO equals one if CEO is a member of founding family and zero otherwise. Professional CEO equals one if CEO is not a founding family member and zero otherwise. Different types of private benefits – nepotism, non-nepotism, disclosed, non-disclosed, overinvestment, and underinvestment–are defined in Table 1. Market capitalization is calculated as log of market capitalization. Firm age is the number of years since inception. CEO tenure is the number of years since joining as CEO. CEO duality equals one if CEO assumes Chair of BOD as well, and zero otherwise. Industry effects are Fama and French's five industry classification. To control for time fixed effect, I use decade dummies. Heteroskedastic-consistent t-values are reported in parentheses below the coefficients. Asterisks denote statistical significance at 1% (***), 5% (**), or 10% (*).

Table 9

Alternative Explanations: Isolating The Effect Of CEO Entrenchment, Managerial (In)Ability And Control Premium

	Dependent variable: CAR (-1,2) %				
	Managerial entrenchment			Managerial inability	Control premium
	(1)	(2)	(3)	(4)	(5)
Founder CEO	4.05**	1.69		1.83	1.76
	(2.45)	(1.15)		(1.39)	(1.05)
Descendant CEO	3.90**	2.23		3.36	3.01
	(2.27)	(1.50)		(1.51)	(1.51)
Entrenched CEO	3.03**	1.18		1.25	1.17
	(1.97)	(1.43)		(1.22)	(1.19)
Private benefit index (PBI)		3.81***		3.88***	3.91***
		(3.91)		(4.02)	(4.11)
Entrenched w/ high PBI			11.07***		
			(5.09)		
Entrenched w/ low PBI			1.69		
			(1.52)		
Non-entrenched w/ high PBI			9.77***		
			(4.18)		
Postgraduate				-1.28	
				(-0.65)	
M.B.A.				-2.64	
				(-1.52)	
Ph.D.				0.04	
				(0.12)	
Abnormal trading volume					-0.000
					(-0.75)
Intercept	-2.96***	-3.07***	-5.73***	-3.11***	-3.13***
	(-4.33)	(-4.30)	(-5.06)	(-5.04)	(-5.21)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	165	165	165	165	165
Adjusted R-squared (%)	28.4	35.9	35.6	35.4	35.5

This table tests the event return in a cross-section regression framework. The sample include sudden deaths of CEOs' of AMEX-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1, 1964 and December 31, 2018. In all columns, the dependent variable is CAR [-1,2] (in percentages) over the [-1,2] event windows. Founder CEO equals one if the CEO is a founder and equals zero otherwise. Descendant CEO equals one if the CEO is a founding family member and zero otherwise. Entrenched CEO equals one if the firm had negative stock returns in the past two consecutive years and CEO has above median tenure, and zero otherwise. Private Benefits Index (PBI) is defined in Table 1. Entrenched w/ high PBI equals one if CEO is entrenched and PBI≥1; otherwise equals zero. Other related dummy variables (i) Entrenched w/ low PBI (ii) Non-entrenched w/ high PBI are defined similarly. Postgraduate, M.B.A., and Ph.D. are indicators equal to one if the CEO holds the degree. Using CRSP data, I calculate abnormal trading volume = avg trading volume (-1,+2) -avg trading volume (-222,-2). Controls include market capitalization, firm age, and CEO duality. Market capitalization is log of the firm's market capitalization. Firm age is log of firm age in years since inception of the firm. CEO tenure is log of CEO tenure in years. CEO duality equals one if CEO assumes Chairman title as well, and zero otherwise. Industry effects are Fama and French's five industry classification. To control for time fixed effect, I use decade dummies. t-statistics are reported in parentheses.

Table 10

Robustness Tests: Controlling for Additional Firm Characteristics

	Dependent variable: CAR (-1,2) %				
	(1)	(2)	(3)	(4)	(5)
Founder CEO	2.01	1.98	2.22	3.04*	1.45
	(1.31)	(1.31)	(1.44)	(1.82)	(0.96)
Descendant CEO	3.42	3.54*	3.63*	3.83*	3.47*
	(1.64)	(1.75)	(1.75)	(1.86)	(1.73)
PBI	3.93***	3.86***	3.91***	3.95***	3.82***
	(4.14)	(3.95)	(4.18)	(3.88)	(4.12)
Board Independence	1.90***				
	(2.88)				
Firm beta		0.47			
		(0.39)			
Market to book			-0.03		
			(-0.02)		
Family ownership (%)				-0.07	
				(-1.47)	
Market capitalization	0.74*	0.64*	0.77**	0.80**	0.61*
	(1.97)	(1.96)	(2.31)	(2.49)	(1.87)
Firm age	1.70*	2.04**	1.97**	1.55*	1.89**
	(1.92)	(2.34)	(2.19)	(1.82)	(2.24)
CEO tenure	-0.06	-0.08	-0.07	-0.03	-0.06
	(-0.62)	(-0.85)	(-0.66)	(-0.26)	(-0.68)
CEO duality	0.26	0.86	0.65	0.18	0.42
	(0.15)	(0.51)	(0.37)	(0.11)	(0.26)
Intercept	-3.08***	-2.95***	-3.17***	-2.93***	-2.98***
	(-5.13)	(-5.36)	(-5.18)	(-5.01)	(-5.22)
Industry FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	165	165	165	165	159
Adjusted R-squared (%)	35.6	35.8	35.5	35.9	35.5

This table tests the event return in a cross-section regression framework controlling for additional firm characteristics. The sample includes sudden deaths of founder and professional CEOs' of Amex-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1,1964 and December 31,2018. The dependent variable is CAR [-1,2], the cumulative abnormal return (in percentages) over the [-1,2] event window. Founder CEO equals one if the CEO is a founder and equals zero otherwise. Descendant CEO equals one if CEO is a member of founding family and zero otherwise. Professional CEO equals one if CEO is not a founding family member and zero otherwise. In all columns, professional CEO is used as a reference group. Private benefits index (PBI) is defined in

Table 1. Board independence equals one if proportion of independent directors is above median. Firm beta is proxy of firm level risk. Market to book is ratio of market value of total assets to book value of total assets. Family ownership is the percentage of total equity owned by founding family. Column (5) presents results by excluding firms having market to book ratio greater than 10. Market capitalization is calculated as log of market capitalization. Firm age is the number of years since inception. CEO tenure is the number of years since joining as CEO. CEO duality equals one if CEO assumes Chair of BOD as well, and zero otherwise. Industry effects are Fama and French's five industry classification. To control for time fixed effect, I use decade dummies. Heteroskedastic-consistent t-values are reported in parentheses below the coefficients. Asterisks denote statistical significance at 1% (***), 5% (**), or 10% (*).

Table 11

Robustness Tests: Controlling for Additional CEO Characteristics

	Dependent variable: CAR (-1,2)%		
	(1)	(2)	(3)
Founder CEO	1.55		1.57
	(0.85)		(0.92)
Descendant CEO	2.11		2.24
	(1.52)		(1.31)
Private Benefits Index (PBI)	3.05***		3.01***
	(3.17)		(3.15)
CEO age	0.11		0.14
	(1.63)		(1.59)
Above Med. Age w/ high PBI		7.97***	
		(4.22)	
Above Med. Age w/ low PBI		0.49	
		(1.25)	
Below. Med. Age w/ high PBI		7.33***	
		(3.62)	
CEO ownership			0.09
			(1.05)
Market capitalization	0.71**	0.69**	0.75**
	(2.33)	(2.41)	(2.31)
Firm age	0.11	0.17*	0.19
	(1.45)	(1.68)	(1.49)
CEO duality	0.12	0.16	0.09
	(0.07)	(0.09)	(0.11)
Intercept	-3.01***	-3.34***	-2.94***
	(-4.39)	(-5.35)	(-4.24)
Industry FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	165	165	165
Adjusted R-squared (%)	36.0	35.4	35.3

This table tests the event return in a cross-section regression framework controlling for additional firm characteristics. The sample includes sudden deaths of founder and professional CEOs' of Amex-, Nasdaq-, and NYSE-listed firms who suddenly died between January 1,1964 and December 31,2018. The dependent variable is CAR [-1,2], the cumulative abnormal return (in percentages) over the [-1,2] event window (defined as in equation 1). Founder CEO equals one if the CEO is a founder and equals zero otherwise. Descendant CEO equals one if CEO is a member of founding family and zero otherwise. Professional CEO equals one if CEO is not a founding family member and zero otherwise. In all columns, professional CEO is used as a reference group. CEO private benefit equals one if CEO engages in any of the following: (i) related party transactions, (ii) CEO faces lawsuit for violating fiduciary duties, or (iii) CEO brings family member in top management team. CEO age in CEO age in years. Above Med. Age w/ high PBI equals one if CEO is older than median age of a CEO and PBI≥1. Above Med. Age with low PBI equals one if CEO is older than median age of a CEO and PBI=0. CEO ownership is the percentage of total equity owned by CEO. Market capitalization is calculated as log of market capitalization. Firm age is the number of years since inception. CEO tenure is the number of years since joining as CEO. CEO duality equals one if CEO assumes Chair of BOD as well, and zero otherwise. Industry effects are Fama and French's five industry classification. To control for time fixed effect, I use decade dummies. Heteroskedastic-consistent t-values are reported in parentheses below the coefficients. Asterisks denote statistical significance at 1% (***), 5% (**), or 10% (*).

Table 12

Robustness Test: Results from ExecuComp Sample (Founder CEO Status and Firm Performance)

	Dependent Variable: Tobin's Q		
	OLS	Firm Fixed Effect	Matched Sample
	(1)	(2)	(3)
Founder-CEO	-0.089***	-0.092***	-0.181***
	(3.01)	(2.78)	(2.97)
Descendant CEO	-0.153***		
	(3.59)		
Log (total assets)	-0.060***	-0.065***	-0.046**
	(2.65)	(2.67)	(2.17)
ROA	4.633***	4.512***	0.356***
	(5.01)	(3.09)	(2.95)
Cash to Asset	1.630***	1.584***	1.627***
	(2.83)	(2.79)	(2.68)
Book leverage	0.163***	0.172***	0.193**
	(2.94)	(2.81)	(2.29)
RD to Sales	2.742***	1.889***	0.026**
	(3.51)	(3.09)	(2.31)
Firm age	0.000	-0.009	-0.004**
	(1.21)	(1.59)	(1.99)
CEO ownership	0.038**	0.051**	0.115**
	(2.01)	(2.22)	(2.25)
Other Control	Yes	-	-
Intercept	1.552***	2.181***	2.370***
	(3.92)	(3.04)	(3.11)
Year FE	Yes	Yes	Yes
Industry FE	Yes	No	Yes
Firm FE	No	Yes	No
Observations	18,022	260	4940
Adj. R-squared (%)	33.4	10.1	20.5

This table presents results of regressing firm performance (measured by Tobin's q) on founder-CEO dummy using ExecuComp sample for the period 2001-2017. Founder-CEO is a dummy variable which is one when CEO is the founder, or a member of founding team of the firm and the dummy is zero otherwise. Descendant CEO is a dummy variable which is one when CEO is a member of founding family and is zero otherwise. In all columns intercept captures coefficients for professional CEO dummy, which takes one if CEO is not a founder or cofounder or member of founding family, zero otherwise. Firm ages are the number of years since firm's inception. ROA is defined based on operating income before depreciation. CEO ownership is the percentage of equity of the firm hold by CEO. *Other control* variables include firm risk, Delaware dummy, S&P 500 dummy. All regressions include year effects and Fama French 48 industry dummies. t-stats are in parentheses. Asterisks denote statistical significance at 1% (***), 5%(**), or 10%(*).

CHAPTER 2

THE FAMILY OWNERSHIP DECISION

Introduction

A large fraction of equity in U.S. firms continues to be held by founders and their descendants (Shleifer & Vishny, 1986). Anderson et al. (2009) report that 47% of the largest industrial firms in US retain founding family ownership with families, on average, owning almost 20 percent of their firms' outstanding equity. Conventional wisdom suggests that in developed equity markets, family shareholders should exit these firms and seek the benefits of diversification (Markowitz, 1952; Burkart et al., 2003). Prior research provides plausible explanations for families holding large equity stakes, ranging from private benefits of control (Demsetz, 1983) to gains from their monitoring of the firm (DeMarzo & Urusevic, 2006). Little however, explains the widespread incidence of concentrated family ownership in countries with well-developed legal regimes and equity markets. A simple reference model shows the average founding family among Russell 3000 firms would need to capture an additional $700 million in private benefits to justify holding a single stock over the diversified portfolio. The Walton family (of Wal-Mart Stores) would need to privately capture over $2 billion per year to justify their huge ownership position (2018 proxy filing shows the family owns 50% of outstanding equity) relative to holding a well-diversified portfolio. Rational investors presumably recognize the potential for private family benefits and price this into public offerings of the firm's stock.

We propose an additional explanation – an information advantage – for undiversified founding family ownership in firms operating in developed economies with well-functioning equity markets. Intuitively, family shareholders, as insiders, have a varying information advantage over outside investors in family firms. This information advantage lowers search cost for family owners relative to outsiders and thus provides incentives for family shareholders to retain substantial, undiversified equity stakes in their firms (Van Nieuwerburgh & Veldkamp, 2010). Family owners arguably "specialize" in their firm by holding large, concentrated equity stakes[7], serving on the board of directors, and retaining senior management positions, thereby amplifying the family's information advantage and reducing the ambiguity of their investment relative to outside shareholders. Outsiders, however, have difficulty observing and directly measuring family owners' information advantage, leading them to invest in the market portfolio.

We build a unique model of ambiguity aversion that allows for variations in information advantage between family investors and outside investors, leading to several new and rich predictions on the family investment decision. Our model focuses on the position that insiders hold an information advantage over outside investors and this advantage is more valuable in more ambiguous settings. We assume that investors possess ambiguity about both expected returns and return volatility. Intuitively, the ambiguity about return volatility captures the notion about severe losses that occur on an infrequent basis, i.e., value-at-risk in tail events (Taleb, 2007; Taylor & Williams, 2009). We then quantify the impact of ambiguity about return volatility on the investment decision of family owners. Our model shows that the information advantage possessed by the family

[7] Family block holders are not the only type of investor with large shareholdings in the asset markets. Robinson and Sensoy (2013) find private equity funds and venture capitalists hold less well-diversified portfolios relative to mutual funds. Choi et al. (2017) find that concentrated investment strategies of institutional investors in international markets can be optimal and enhance risk-adjusted returns, which is consistent with the predictions of our model that investors optimally choose to hold concentrated portfolios in which they have an information advantage and amplify their advantage through learning.

shareholders allow them to estimate more accurately the potential loss due to a bad event in the family firm relative to a diversified portfolio, so they are willing to hold a concentrated stake in a single firm. Simulation results from our portfolio choice model show that with reasonable ambiguity about return volatility, that family owners optimally invest 70% or more of their wealth in the family firm. The results of the simulation correspond well with findings of prior empirical research documenting that family shareholders, on average, hold about 25% of the firm's outstanding equity, equating to more than 69% of their wealth invested in the firm (Anderson & Reeb, 2003).

Our ambiguity-based model yields several testable predictions. *First,* our model predicts that family ownership and presence persist in environments where the family has a greater information advantage or can better exploit their information advantage to help reduce the ambiguity of the investment in their firm relative to investments in other firms. In particular, in firms or industries with inverse co-movements with aggregate ambiguity, family shareholders' private information can play a more helpful role in lowering firm-specific ambiguity in their own firms relative to investments in other firms. In environments or settings with positive co-movement with aggregate ambiguity, families' private information proves less useful in reducing ambiguity.[8] Thus, our model implies that family owners concentrate their investment in a single firm in settings where their information advantage yields more benefit and/or they have a larger information advantage, e.g., family owners with family-member CEOs would be less likely to exit the firm relative to family shareholders not holding the CEO position.

[8] Recent studies highlight the difficulties in empirically estimating the dynamics of return volatility and its influence on asset prices (e.g., Bollerslev et al., 2012; Drechsler, 2013). A rich literature finds that aversion about the ambiguity of expected returns helps to qualitatively explain the under-diversification puzzle and nonparticipation puzzle in stock markets (Garlappi et al., 2007 and many others).

Second, our model predicts that family owners consider exiting the family firm or selling their equity if their perception of the ambiguity of the family firm increases relative to outside investments. This may occur when innovation makes the current or existing technology obsolete in the sense of "creative destruction" (Schumpeter, 1942) and the family's information advantage no longer proves useful in reducing their ambiguity perception about their own firm relative to outside investments. Due to the increased ambiguity about their own firm, the family owners might envisage the worst-case expected return of their firm lower than that of the market portfolio and thus reduce their investment in the family firm or sell their shares. *Third*, counter to the classical mean-variance model, our model predicts, *ceteris paribus*, that family owners who are relatively risk averse or wealthy are less likely to exit than less risk averse or less wealthy families. Family owners would consider existing or reducing the share of wealth invested in the family firm if their perceived worst-case expected return of their own firm is smaller than that of the outside investments. Investors with more risk aversion or wealth in general are more conservative in adjusting their investment, so the family owners more risk averse or wealthier reduce less the share of wealth invested in their own firm or less likely to exit.

To empirically investigate the predictions of our ambiguity model in explaining families' choices in holding large, concentrated equity stakes, we examine family ownership in the Russell 3000 firms (non-financial, non-utility) from 2001 through 2017. In our empirical analysis, we use the terms ambiguity and uncertainty interchangeably (Izhakian & Yermack, 2017). We estimate macro-uncertainty at the firm and industry level as the exposure to aggregate economic uncertainty of Jurado et al. (2015, JLN hereafter).[9]

[9] Bali et al. (2017) use this measure of uncertainty and find that stocks with more exposure to aggregate economic uncertainty (i.e., uncertainty beta) exhibit lower rather than higher returns. Risk averse investors

They use more than 100 macro-economic indicators to develop a 1, 3, and 12-month look-ahead indices of aggregate economic uncertainty. The coefficient estimates from 60-month rolling regressions of firm (and industry) excess returns on JLN's uncertainty index is our proxy for insiders' information advantage in their own firms, i.e., the *uncertainty beta.*

What does the uncertainty beta tell us about an information advantage? The uncertainty beta is the correlation between the individual stock return and aggregate macroeconomic uncertainty and hence has implications for insiders' information advantage over outside investors. A large, positive uncertainty beta indicates that the stock moves largely with the aggregate uncertainty of the overall economy and thus, the family's information advantage would not be beneficial in reducing the ambiguity of their own firm relative to outside firms. That is, their own firm is as uncertain or ambiguous as outside investments. A low or negative uncertainty beta indicates that the stock does not co-move with aggregate uncertainty, and thus the firm retains more "firm-specific" uncertainty. In such settings, insiders' information advantage becomes more helpful in understanding firm specific uncertainty relative to outside investments. That is, family owners are less uncertain about their firm versus an outside portfolio. In sum, high uncertainty betas indicate low or no information advantage and thus, family shareholders choose to invest less in their firm and are also more likely to exit relative to low uncertainty beta environments.

The empirical analysis indicates a strong match between the predictions of our model and patterns of family ownership in U.S. publicly traded firms. In particular, we

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demand extra compensation to hold stocks with negative uncertainty betas, suggesting that uncertainty beta is not a measure of risk exposure.

observe a strong, negative relation between the uncertainty beta and family ownership and/or presence. A one-standard deviation increase in the industry uncertainty beta correlates with a 4.5% decrease in the odds of family investors maintaining a high ownership stake relative to a smaller stake. The analysis indicates that family owners are substantially more likely to retain large ownership stakes and presences in environments where their information advantage mitigates uncertainty and ambiguity about their firm relative to outside firms.

We further test the model by examining 164 family exit decisions relative to a coarsened exact matched (CEM) sample of families choosing not to exit their ownership stakes to assess whether ambiguity surrounding the firm's information environment affects the choice to exit. Family members can maintain an information advantage and reduce ambiguity relative to other investors by holding senior management positions. If so, our model predicts, *ceteris paribus*, that family shareholders will be significantly less likely relative to other investors to exit the firm when holding management positions. Using Cox multivariate survival analysis, the results indicate that family owners with family-member CEOs are significantly less likely to exit the firm relative to family shareholders not holding the CEO position. Our analysis supports the model's prediction and suggests that family owners are more likely to retain their ownership stakes when they can exploit their information advantage to reduce ambiguity about the firm's prospects.

Private benefit models of insider ownership without uncertainty or ambiguity imply that family shareholders are more likely to exit when under-diversification costs are higher, i.e., families are more risk averse and wealthier. As discussed earlier, our model predicts the opposite. Strikingly, consistent with our model's predictions, we find that families are indeed less likely to exit their ownership stakes as family absolute wealth increases and family risk-aversion increases. The results are statistically and economically significant. We instrument for family risk aversion using representation by female family members on the board of directors and/or as large shareholders.[10] Our analysis suggests that families are significantly less likely to exit the firm when more female family members remain as board members and/or large shareholders.

We make three important contributions to the literature. First, our analysis contributes to the growing family firm literature by providing an explanation for family owners' decision to maintain ownership and control in countries with well-developed financial markets and strong legal regimes. Prior literature posits that family ownership arises as a response to markets or legal systems offering weak protection of shareholder rights, suggesting that family shareholders must make a trade-off between their monitoring of the firm (or signaling, commitment, asset protection, etc.) and diversifying their wealth across a broad basket of assets (Leland & Pyle, 1977; Shliefer & Vishny, 1986; DeMarzo & Urusevic, 2006). Notably, markets in the United States offer strong shareholder protections, indicating that family owners need not make the trade-off between concentrated equity stakes and holding a diversified portfolio (Burkart et al., 2003). Yet, we observe that family shareholders continue to hold concentrated stakes in nearly one-half of U.S. firms. Our analysis indicates that founding family control in economies with well-developed equity markets need not rely on expropriation arguments but instead can represent the benefit of exploiting information advantages to reduce uncertainty.

[10] Croson and Gneezy (2009) and Bertrand (2011) provide comprehensive surveys on the literature on differences in risk aversion between women and men. Borghans et al. (2009) provide experimental evidence of greater risk aversion in women relative to men, while any ambiguity aversion differences appear relatively inconsequential.

Furthermore, our model predicts that family firms are more likely to persist in industries where the information advantage is more useful to reduce uncertainty about the family firm relative to other firms, and family firms are more likely persist if their information advantage is easier to pass on from one generation to the next, or can be amplified through management experience, all of which are consistent with prior empirical evidence in literature on family firms in the United States.

Second, the study joins the growing literature on the important effect of ambiguity on economic decisions. By incorporating ambiguity about return volatility as well as the information advantage of family owners, we generate substantial insights on decision makers' use of specialized knowledge or information to reduce the uncertainty of their investment. Our analysis indicates that family owners exploit their information advantage by removing model or parameter uncertainty and thus, can warrant holding a large, undiversified stake in a single firm. Barillas et al. (2009) estimate the benefits of removing aggregate uncertainty regarding aggregate consumption, while we provide evidence of the benefits of reducing relative uncertainty of individual firms based on firm-level real investment decision.

Third, we present theoretical explanations and empirical evidence based on family ownership and family exit decisions that ambiguity about volatility plays an important role in investment decisions. Using only ambiguity about return volatility, we can explain the large, concentrated stakes of family investors in an economy with strong shareholder protections and low diversification costs. Our model with ambiguity about return volatility uniquely predicts that family shareholders are more likely to exit with less wealth, less risk aversion, and less experience or time-in-the-firm. Our model offers starkly different predictions from standard investment models without ambiguity or models incorporating only ambiguity about expected returns.

The Model

Our model is motivated by the quantitative aspect of the puzzle as to why family owners invest a large proportion of their wealth in a single firm, and what drives their decision to exit from the family firm and invest in a diversified portfolio. We seek to answer these questions in a model of investment decision with ambiguity-averse investors (family owners) who choose between investing in two risky assets with different degrees of ambiguity about expected return and return volatility, namely, a single stock (family firm) and a diversified portfolio of other equities.

In the classic portfolio choice model proposed by Markowitz (1952) and Merton (1971), investors are assumed to make decisions with the knowledge about the unique probability distribution of stock prices and firm fundamentals. However, investors do not observe the true distribution or model of asset prices. They usually form multiple perceptions about the distribution or model with the information at hand and try to make optimal decisions given the existence of multiple scenarios. The quality and quantity of available information about the firm differs for different classes of investors. Inside investors of a firm, such as CEOs or family owners, have access to more accurate information about company fundamentals than outside investors and thus can make better inferences about the true distribution of asset prices. That is, inside investors have less ambiguity about the distribution of future stock prices than do outside investors. On the other hand, corporate insiders (CEOs and family owners) do not possess an information advantage with outside firms or a diversified portfolio of outside firms and thus have the same degree of ambiguity as other outside investors with respect to these investment choices.

Our model resembles other models that relate ambiguity aversion to portfolio choice puzzles such as the nonparticipation puzzle and under diversification puzzle.[11] However, the important feature that differentiates our model from most of the existing portfolio choice models with ambiguity is that we allow ambiguity about both expected return and return volatility.[12] In the general framework with ambiguity, investors are uncertain about the entire distribution of the asset return. More importantly, decision makers with ambiguity aversion care about the ambiguity regarding the potential downfall in returns, which is captured by the ambiguity about the volatility rather than the ambiguity about the expected return. Notably, we find that ambiguity about expected return is not enough to rationalize the concentrated ownership of family owners; ambiguity regarding the volatility of the return appears to play a very important role in understanding the concentrated ownership decision. In Table A.1, we report the calibration of the share of wealth invested in the family firm and the diversified portfolio with different degrees of ambiguity about expected return and return volatility. If there is no ambiguity about volatility, then even if the ambiguity about the expected return of the diversified portfolio is so high that the family owners think the minimum expected return of a single stock is 150% of that of the diversified portfolio, they will only invest 6% of their wealth in the single stock. On the other hand, if the family owners care about ambiguity surrounding

[11] Our model is similar to that of Boyle et al (2012) with one critical difference, that is, in our model, the investors (family owners) are ambiguous about both expected return and return volatility, while in their model, the investors are only concerned with ambiguous expected return and know the exactly structure of covariance matrix of stock return.
[12] Easley and O'Hara (2009) also allow for ambiguity about both mean and standard deviation of returns when studying nonparticipation in stock markets.

volatility, then with moderate ambiguity about the volatility such that the family owners think the maximum volatility of a single firm is equivalent to that of the diversified portfolio, then they will invest 50% of their wealth in the single firm. The impact on ownership level with respect to the relative ambiguity about volatility is much larger than the relative ambiguity about the expected return.

Our model builds on the MEU framework of Gilboa and Schmeidler (1989), and does not separate ambiguity and ambiguity aversion. Klibanoff et al. (2005) show that the maxmin-preference model is a limiting case of the smooth recursive preferences when the degree of ambiguity aversion trends to infinity.[13] This framework is useful for studying the economic equilibrium impact of changing ambiguity aversion while holding ambiguity constant or vice versa. However, due to data limitations, neither ambiguity aversion nor ambiguity is easily observed or measured, and variations in ambiguity aversion and ambiguity are often observationally equivalent. Hence, we adopt the MEU framework, which allow us to solve the model explicitly and derive rich testable implications that relate family ownership and family exit decisions to the observable characteristics of the family owner and family firm. Furthermore, our model implications are consistent with the numerical simulation results of Klibanoff et al. (2005).

To focus on the decision of family owners, we assume the choice set of family owners contains two risky assets with different degrees of ambiguity and no risk-free asset. From a practical perspective, investors rarely find a risk-free asset. Table A.2 shows, for

[13] Both approaches have widely varying implications for optimal portfolio allocation, Abdellaoui et al. (2011), Bossaerts et al. (2010), Hayashi and Wada (2010) and Dimmock et al. (2016) examine the effect of uncertainty on portfolio choice via experiments. Peijnenburg (2014) shows that the maxmin approach better matches the data. Ahn et al. (2014) explicitly compare the maxmin preferences and smooth preference via a portfolio choice experiment to explore which describes actual behavior and find evidence in favor of a kinked specification.

example, the average real return and volatility (of real returns) for treasury bonds versus the real return on the CRSP market index from 1995 to 2017. The volatility of the 5-year treasury bonds is 5.93%, significantly different from zero, and the volatility of 30-year bonds is 17.61%, close to that of the CRSP stock market index (20.19%). Furthermore, we obtain similar implications on the relationship between the family ownership and characteristics of the family owner and the family firm in a model with two risky assets and a government bond.[14]

The Portfolio Choice with Ambiguity about Return Volatility and Expected Return

We consider a static discrete-time economy with two risky assets.[15] Asset 1 refers to the stock of a single firm (family firm), and asset 2 is a diversified portfolio. The return on each risky asset is

$$r_i = e_i + \varepsilon_i, \ \ for\ i = 1, 2 \tag{1}$$

where e_i stems from the earnings and other learnable fundamentals of firm operations by those with inside information, and ε_i stems from external forces that no one can understand or learn. We assume that the learnable fundamentals e_1 and e_2, and the noises ε_1 and ε_2 are independent of each other and all follow normal distributions so that the returns on both risky assets, r_1 and r_2, also follow normal distributions and are independent of each other.[16]

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[14] See the Appendix for details.

[15] Our static model abstracts from the complicated dynamics of stochastic volatility, while maintaining the assumption that investors are ambiguous about volatility if volatility is time varying. Our simple model allows us to derive testable implications from the explicit solution of the model and confront them with cross-sectional data. Peng (2006) formulates the stochastic calculus of Itô's type for Brownian motions with ambiguous volatility (G-Brownian motion). Epstein and Ji (2013) formulate a continuous-time asset pricing model with ambiguity about both volatility and drift.

[16] We maintain the normality assumption so that means and variances are sufficient statistics of the distributions. The assumption of independence is not essential to our results, with the main results continuing to hold if we allow for a correlation between returns on the family firm and the diversified portfolio.

The true values of the expected return and return volatility on both assets are denoted as $(\bar{r}_{i,0}, \sigma_{i,0})$, for i =1, 2.

In financial markets, investors do not observe the true value of expected return and volatility and rely on other data to make inferences about these values. In a general model with ambiguity, investors are uncertain about the distribution of the asset returns. With the normality assumption of the distribution, it is sufficient to assume that investors are uncertain about the mean and standard deviation of returns. We assume investors believe that the expected return of each asset i draws from a set of N possible values $R_i = \{\bar{r}_{i,n}:\ n = 1,2,\dots,N\}$, which contains the true value of the expected return $(\bar{r}_{i,0})$, for $i = 1,2$. That is,

$$\bar{r}_{i,min} \le \bar{r}_{i,0} \le \bar{r}_{i,max},$$

where $\bar{r}_{i,min} \equiv \min_{n=1,2,\dots,N} \bar{r}_{i,n}$, and $\bar{r}_{i,max} \equiv \max_{n=1,2,\dots,N} \bar{r}_{i,n}$, for i = 1, 2. In addition, we assume the investors believe that the return volatility on asset i come from a set of M possible values, $\Sigma_i = \{\sigma_{i,m}: m = 1,2,\dots,M\}$, which contains the true values of return volatility $(\sigma_{i,0})$, for $i = 1,2$. That is,

$$\sigma_{i,min} \le \sigma_{i,0} \le \sigma_{i,max},$$

where $\sigma_{i,min} \equiv \min_{m=1,2,\dots,M} \sigma_{i,m}$, and $\sigma_{i,max} \equiv \max_{m=1,2,\dots,M} \sigma_{i,m}$, for i = 1, 2.

We model ambiguity aversion in the maxmin expected utility (MEU) framework proposed by Gilboa and Schmeidler (1989). That is, investors care about the ambiguity regarding the distribution of returns, and choose the optimal portfolio to maximize their utility in the worse-case scenario. In this framework, there is no separation between ambiguity and aversion to ambiguity, and we allow the range of potential expected return and return volatility to capture both the ambiguity about the returns and the ambiguity aversion of the investors. Naturally, investors who are more ambiguity averse or face more ambiguity will exhibit concerns about wider ranges of potential expected returns and volatility.[17] Consequently, this simple framework allows us to represent family investors who face more ambiguity and thus tend to consider a wider range of possible values of expected returns.

We further assume that the family owners possess private information regarding the fundamentals of the family firm that allows them to reduce the ambiguity about the fundamentals of their own firm over time and through experience. However, like other outside investors, the family owners do not possess material private information about other firms in the diversified portfolio, as they do not manage these other firms. In our setup, the reduction in the ambiguity regarding the family firm relative to the diversified portfolio is captured by the shrinkage in the distance between the worst case and the true values of expected return and volatility. Hence, for the family owners who can exploit private information to reduce the ambiguity regarding the family firm, the ambiguity range of the expected return and volatility of family firm is tighter than that of the diversified portfolio, i.e. $\bar{r}_{2,max} - \bar{r}_{2,min} > \bar{r}_{1,max} - \bar{r}_{1,min}$ and $\sigma_{2,max} - \sigma_{2,min} > \sigma_{1,max} - \sigma_{1,min}$.

The portfolio choice problem of the ambiguity-averse family owners with CARA utility can be formulated as

$$\max_{\alpha} \min_{\bar{r}_{1,n_1},\bar{r}_{2,n_2},\sigma_{1,m_1},\sigma_{2,m_2}} \left\{\left[\alpha\bar{r}_{1,n_1} + (1-\alpha)\bar{r}_{2,n_2}\right] - \frac{\gamma W_t}{2}\left[\alpha^2\sigma_{1,m_1}^2 + (1-\alpha)^2\sigma_{2,m_2}^2\right]\right\} \tag{2}$$

[17] In this optimal portfolio choice problem within the maxmin framework, it is the worse-case, risk-return tradeoff that measures ambiguity and ambiguity aversion.

Let us first examine the minimization problem of (2). Since the objective function in (2) is monotonically decreasing in σ_1^2 and σ_2^2, the maximum possible standard deviation is always chosen, that is,

$$\sigma_1^* = \sigma_{1,max} \equiv \max_{m=1,2,..,M}\{\sigma_{1,m}\}$$

$$\sigma_2^* = \sigma_{2,max} \equiv \max_{m=1,2,..,M}\{\sigma_{2,m}\}$$

If the family is long in both the family firm and the diversified portfolio ($0 < \alpha < 1$), then the minimum possible mean returns are chosen for both assets. If the family shorts the diversified portfolio ($\alpha \geq 1$), then the maximum possible mean return of the diversified portfolio and minimum possible mean return of the family stock is chosen, and vice versa, that is,

$$(\bar{r}_1^*, \bar{r}_2^*) = \begin{cases} (\bar{r}_{1,min}, \bar{r}_{2,max}), & if\ \alpha \geq 1 \\ (\bar{r}_{1,min}, \bar{r}_{2,min}), & if\ 0 < \alpha < 1 \\ (\bar{r}_{1,max}, \bar{r}_{2,min}), & if\ \alpha \leq 0 \end{cases}$$

Given the solution to the minimization problem, the optimal share invested in the family business (α^*) can be then characterized as following,

$$\alpha^* =$$

$$\begin{cases} 1 & if\ \bar{r}_{1,min} - \bar{r}_{2,min} \geq \gamma W_t \sigma_{1,max}^2 \\ \frac{\bar{r}_{1,min} - \bar{r}_{2,min}}{\gamma W_t(\sigma_{1,max}^2 + \sigma_{2,max}^2)} + \frac{\sigma_{2,max}^2}{(\sigma_{1,max}^2 + \sigma_{2,max}^2)} & if\ -\gamma W_t \sigma_{2,max}^2 < \bar{r}_{1,min} - \bar{r}_{2,min} < \gamma W_t \sigma_{1,max}^2 \\ 0 & if\ \bar{r}_{1,min} - \bar{r}_{2,min} \leq -\gamma W_t \sigma_{2,max}^2 \end{cases}$$

(3)

The ambiguity-averse investor makes decision based on the worse-case expected return and variance.

We focus on the scenario where the two risky assets have identical expected returns ($\bar{r}_{1,0} = \bar{r}_{2,0}$), but different return volatility, and the true value of the volatility of the diversified portfolio is less than that of a single stock ($\sigma_{1,0} > \sigma_{2,0}$). Hence, if ambiguity about the expected return of the family firm is less (more) than that of the diversified portfolio, then$\bar{r}_{1,min} > (<) \bar{r}_{2,min}$. It is straightforward that in the model without ambiguity, the investor would choose to invest more in the diversified portfolio with same expected return and lower risk; but in the model with ambiguity, it depends on the relative ambiguity of the two risky assets.

We compare the choice sets of investors with and without ambiguity in Figure 1. Note that if the family owners believe the minimum expected return of the family firm is larger than that of a diversified portfolio, that is, $\bar{r}_{1,min} > \bar{r}_{2,min}$, then the family owners would always hold a positive share of their wealth in the family firm unless the volatility or ambiguity about the volatility of the family firm gets large enough ($\sigma_{2,max} \rightarrow +\infty$), we refer to this case as the "non-exiting family". On the other hand, if $\bar{r}_{1,min} < \bar{r}_{2,min}$, then the family owners would consider exiting when their risk aversion, wealth and ambiguity about the expected return or return volatility of the family firm changes. We refer to this case as the "exiting family". Panel A of Figure 1 illustrates the scenario for non-exiting family owners ($\bar{r}_{1,min} > \bar{r}_{2,min}$). For investors without ambiguity aversion, the choice set is represented by (F_0, D_0), where F_0 represents the family firm and D_0 represents the diversified portfolio. Based on numerical calibration results, we find that the family owners would hold merely 3% of their wealth in the family firm (F_0). For a family with ambiguity aversion, but only with respect to expected return, (DB, FB) represents the choice set. In this case, the family owners would hold just 6% of their wealth in the family firm (F_B) if $\bar{r}_{1,min} = 1.5\bar{r}_{2,min}$. For the family with ambiguity aversion with respect to expected return and return volatility, (DA, FA) represents the choice set. In this case, the family owners would hold over 80% of their wealth in the family firm (F_A) if $\bar{r}_{1,min} = 1.5\bar{r}_{2,min}$ and $\sigma_{1,max} = 0.5\sigma_{2,max}$.

The Family's Exit Decision

We find the family exit decision depends crucially on the ambiguity regarding the expected return and return volatility of the family firm relative to the diversified portfolio. When private information no longer permits the family owners to reduce the ambiguity about their firm relative to other firms, the family owners will exit. Intuitively, this indicates the family owners will exit when they become less certain about their firm's expected return and volatility relative to the diversified portfolio. If the family owners believe the worse-case expected return of the family firm is small enough or the worse-case volatility of the family firm return is large enough, then they are likely to exit. Note that solution (3) implies that the necessary conditions for family owners to exit are,

$$\bar{r}_{1,min} - \bar{r}_{2,min} \leq -\gamma W_t \sigma_{2,max}^2 \tag{4.a}$$

$$\text{or } \ \sigma_{1,max}/\sigma_{2,max} \to \infty \tag{4.b}$$

That is, either ambiguity about the family-firm's expected return increases such that the family owners think the worse-case expected return of the family firm is lower than the worse-case expected return of the diversified portfolio; or the ambiguity about the risk of the family firm increases dramatically.

Van Nieuwerburgh and Veldkamp (2010) show that information advantages can be amplified when investors can choose what to learn. When a family member serves as CEO, the family's information advantage about the firm is amplified through learning; hence, the family holds a larger stake. The implication is that families with family members as CEO are less likely to exit the firm, all else equal. Note that we do not make assumptions about the investment horizons of either the family or outside investors. Our model predicts that family owners with longer tenures in the firm will be less likely to exit the firm. In this context, our model provides important insights on family owners' horizons.[18] A simple comparative statics analysis under condition (4.a) implies that the family owners are *more* likely to exit as their risk aversion and wealth decreases. This prediction may seem surprising, as the classical model without ambiguity predicts the investor would invest more in a riskier asset (family firm) when they are more risk averse or wealthier. However, this prediction assumes unexpected shocks increase the ambiguity in family firms such that the worst-case expected return of the family firm is smaller than the worst-case expected return of the diversified portfolio. In this situation, the family firm *appears* to be an asset with lower expected return and possibly lower risk; hence, the more risk averse family owners invest more, instead of less, in the family firm. The family owners may consider exiting in this situation and would be more likely to exit if they are less risk averse. This prediction sharply contradicts the implication of models based on agency costs or overconfidence that indicate less risk averse families are less likely to exit.

Panel B in Figure 1 illustrates the investment decision for the exiting family ($\bar{r}_{1,min} < \bar{r}_{2,min}$). For family owners with ambiguity aversion and are ambiguous about both expected return and risk (volatility of return), their choice set is represented by (D_E,

[18] Empirical literature on family firm argues that family owners have longer horizons than non-family firms. For instance, Anderson and Reeb (2003) posit that the long horizon of family owners leads them to make better investment choices. However, the mechanism for this longer horizon is typically not addressed.

F_E). Risk neutral family owners would choose to invest 100% of their wealth in the diversified portfolio (D_E). E represents the optimal portfolio of a risk-averse investor, which is between D_E and F_E. By comparing the optimal portfolio choice of a risk neutral and a risk averse investor, we find that the ownership of the family firm increases with risk aversion; that is, the family owners are more likely to exit when they are less risk averse.[19]

In summary, our model solution (3) implies the following hypotheses regarding the relation between the characteristics of family firms and family owners, and family ownership and exit decision.

Hypothesis 1.1: The family invests more in their own business in industries where it is easier for family owners to exploit private information to reduce ambiguity about the family firm relative to other firms.

Hypothesis 2.1: The family is less likely to exit in industries where it is easier for family owners to exploit private information to reduce ambiguity about the family firm relative to other firms.

Hypothesis 2.2: The family is less likely to exit when family owners are more risk averse.

Hypothesis 2.3: The family is less likely to exit when family owners are wealthier.

Hypothesis 2.4: The family is less likely to exit when family members serve as CEO.

In our empirical tests, we use the exposure to aggregate economic uncertainty to

[19] The standard agency model implies a negative relation between (relative) risk aversion and ownership (Bitler et al., 2005). Faccio et al. (2011) emphasize how family owners may seek diversification through firm-level investments.

identify those firms and industries in which it is easier for family owners to exploit private information to reduce ambiguity about their firm relative to other firms.

Notably, the comparative statics on the family owners' share invested in the family firm, as relative ambiguity increases, are unchanged for family owners exiting the firm and for family owners remaining in the firm. That is, the comparative statics are unchanged regardless of whether the family owners think the worse expected return of the family firm is bigger or smaller than that of the diversified portfolio. As long as the family owners develop more ambiguity about their own firm or the relative ambiguity of diversified portfolio decreases, the family owners tend to invest less in the (relatively riskier) family firm, or are more likely to exit. This is because diversification benefits increase as the relative ambiguity of the diversified portfolio decreases.

Contrast with Extant Theory on the Predictions of the Family's Exit Decision

To explain the concentrated equity stakes of family owners, extant theories build on market frictions, private benefits of control, and/or non-pecuniary benefits of control. Leland and Pyle (1977) argue that family owners hold large stakes to signal firm quality. DeMarzo and Urusevic (2006) highlight the trade-off between agency considerations and diversification in the family exit decision. Shleifer and Vishny (1986) rely on private payoffs to justify foregoing the benefits of diversification. Morck and Yeung (2003) and Roussanov (2010) indicate that family owners could receive non-pecuniary benefits, thus explaining their decision to hold a large, concentrated stake. A common theme running through extant theories is that risk-averse investors receive compensation through other channels for holding a concentrated stake in a single firm. These theories indicate that the cost of concentrated ownership increases as risk aversion increases, as family wealth invested in the firm increases, and as the riskiness of the firm increases. This suggests that family owners will exit as family risk aversion, wealth, and industry risk increase. The hypotheses from our model (Hypotheses 2.1 – 2.3) stand in sharp contrast to the predictions from these existing models.

Investor overconfidence offers another explanation for the under diversification of corporate insiders. Odean (1998) shows that overconfident investors who believe they have precise knowledge of security value – but actually have less precision than believed – hold riskier portfolios than rational investors with the same degree of risk aversion. Overconfident investors hold unrealistic beliefs about the precision of their estimates and about superior future returns. Unlike the overconfident investor, the ambiguity-averse investor in our model rationally improves the precision of their estimates using relevant information. Overconfidence models factor in investor under diversification, thus predicting that family owners are more like to exit the firm as family risk aversion and wealth increase or when the family firm operates in a less risky industry. These predictions from overconfidence models again stand in sharp contrast to Hypothesis 2.1-2.3 from our model.

Another generally accepted explanation of family ownership suggests that family owners will exit a firm as soon as possible after going public to obtain the benefits of a diversified portfolio (Admati et al., 1994). Zingales (1995) models the family exit decision, suggesting that the family continuously reduces their stake in the firm until they hold only a control stake, which they then sell to outside investors at a premium. Similarly, Mello and Parsons (1998) describe family exits as sequential processes; sell small stakes to atomistic shareholders and then sell the control stake to an active investor at a premium price. In each of these settings, the benefits of diversification suggest that the longer the family remains in the firm, the more likely the family decides to sell their control stake and exit the firm. Our model predicts the opposite effect.

Ambiguity, by definition, is neither directly observed nor easily differentiated from risk in empirical analysis. The testable hypotheses obtained through our comparative statics, however, allow us to test the importance of ambiguity when making investment decisions by developing a proxy for ambiguity and then partitioning family investors by the degree or level of ambiguity they face. Most of the hypotheses from our model disagree with predictions from models without ambiguity, i.e., opposing signs. In the next section, we setup our empirical analysis to test the hypotheses from our model.

Primary Variable Measurement

In this section, we test the implications of our model. The model yields several hypotheses that indicate that family owners' concern about return ambiguity and their information advantage that leads to the decision to hold large, concentrated equity stakes in a single firm. To examine the predictions and hypotheses of the model, we start with the Russell 3,000 largest industrial firms in the United States with a fiscal year-end in 2001. To collect the sample, we pull all firms from CompuStat for data-year 2001 with information available for total assets. We exclude public utilities (SIC codes 4812, 4813, and 4911 through 4991), financial firms (SIC codes 6020 through 6799), firms listed as master limited partnerships (21-firms), foreign firms, and firms with a share price less than $0.25. These firms are excluded to make our work comparable to previous literature on family ownership and because government regulation potentially affects firm ownership structure, corporate transparency, and performance.

We manually collect family-ownership data from corporate proxy statements and 10-k's from 2001 through 2017, including ownership level, dual-class share structures, voting power, and CEO type. Corporate histories (i.e., family lineage) are garnered from RefereneforBusiness.com, FundingUniverse.com, and individual company websites.[20] To control for survivorship bias, we allow firms to exit and re-enter the sample. Consistent with previous research, family firms are those where the founding family continues to maintain a five percent or larger ownership stake in the firm (Shleifer & Vishny, 1986; Villalonga & Amit, 2006). To measure family presence, similar to McConnell and Servaes (1990), we use the fractional level of family ownership. Specifically, we determine the total number of shares held by the family (and their relatives), and divide by total outstanding shares – including both traded and untraded share classes (dual-class firms). Firms without family owners are referred to as diffuse shareholder firms, i.e., nonfamily firms with professional managers. After developing our proxies for firm-level ambiguity, industry-level ambiguity and collecting control variables from CompuStat, our final sample consists of 2,154 unique firms from 2001 through 2017, yielding 22,426 firm-year observations.

Level of Family Ownership

In our first set of tests, we examine the relationship between the level of family ownership and firm-level and industry-level proxies of uncertainty. Studies with non-U.S. data typically use minimum thresholds for family ownership (e.g., 10%, 20%) to delineate between these controlling shareholders and diffuse shareholder firms (Claesssens et al., 2000; Dyck & Zingales, 2004). For this test, we choose an arbitrary benchmark of a 20%

[20] In designating family firms, we do not include shares held by charitable foundations as part of the family holdings. Foundations hold substantial equity stakes in several firms (e.g., Hershey Co, Eli Lilly & Co, Kellogg Co, Hormel Foods Corp, and etcetera – less than 20 firms) with the express intent of promoting public welfare rather than financially or economically benefiting family members.

ownership stake to maintain firm control. Shleifer and Vishny (1986) indicate that the size of the equity stake needed for firm control depends on the degree of legal protection afforded to shareholders; suggesting that in the U.S., a 20% ownership would provide ample influence to control firm policies and direction. The mean ownership stake across our family firm sample (family firms only) is 24.75% of the firm's outstanding equity. We define high family ownership with a dummy variable that equals one when the family owns an equity stake greater than 20% of the firm's outstanding equity, and zero otherwise.[21]

Family Owners Exiting the Firm

In an additional analysis, we compare firms where family owners exit their concentrated ownership stakes in a single firm (family exit firms) to those where family owners maintain steady ownership stakes. A family-exit firm is defined as a binary variable that equals one if family ownership drops from 5% or greater in year *t-1* to 3% or less in year *t*. We identify 169 cases in our sample period meeting this requirement. In the year prior to the reduction in ownership stakes, families held, on average, 9.994% of the firm. In the exit year, families hold just 0.564%, indicating that the family group sold 94.36% of their equity stake from *t-1* to *t*. Family-exit firms are matched to family firms using coarsened exact matching (CEM) based on total assets, debt ratio, ROA, growth opportunity, equity issuance, and volatility, resulting in 164 family-exit firms and 164 family firms (Iacus et al., 2012).

Uncertainty Measures

We employ 60-month rolling regressions (e.g., Bali et al., 2017) to estimate the exposure to the macro-economic uncertainty or ambiguity of the firm-level or industry-

[21] Different cut-off levels for high and low ownership (15% and 25%) provide similar results.

level returns, that is the *uncertainty beta*. In particular, our measure of uncertainty beta at the firm-level is the coefficient estimate (β_1) from the following factor model:

$$R_{it} - R_{Ft} = \alpha + \beta_1(\text{Macro Uncertainty } t_{-60} \text{ to } t_{-1}) + \varepsilon_{i,t} \quad (5)$$

Where:

$R_{it} - R_{Ft}$ – *Firm's monthly stock return less the risk-free rate*

Macro Uncertainty – 12-month ahead macro-uncertainty measure from JLN (2015).

The coefficient estimate on the uncertainty factor (β_1) captures the sensitivity of firm stock returns to macro-economic uncertainty as measured by JLN (2015). JLN calculate uncertainty from more than 100 macro-economic variables that exhibit a strong correlation with real activity. Their measure is arguably superior to stock market volatility measures, as stock returns can change even with little or no change in real economic fundamentals, e.g., change in firm leverage, investor risk aversion or sentiment, etc. Figure 2 provides a plot of the JLN (2015) data with years on the *x*-axis and three-month and twelve-month ahead macro-economic uncertainty on the *y*-axis. We use the twelve-month ahead macro-uncertainty index and monthly stock returns for the primary analysis and conduct robustness testing with the three-month ahead indices[22]. We also use alternate factors models (market model and a five-factor model) when estimating firm-level uncertainty beta (β_1).[23] The results with the other factor models are in Tables 17 and 18 and

[22] Using three-month ahead indices, the results yield the same signs and inferences but are generally significant at the 5% to 10% level. For brevity, results are not shown in paper.

[23] In robustness testing, we also use alternative factor models. Section 4.3 outlines the results from the following two specifications when estimating firm- and industry- level uncertainty:

$$\text{Monthly Firm(Industry) Returns} = \alpha + \beta_1(\text{Uncertainty}) + \beta_2(R_{Mt}-R_{Ft}) + \beta_3(SMB) + \beta_4(HML) + \beta_5(RMW) + \beta_6(CMA) + \varepsilon_{i,t}$$

provide similar inferences. We use the simpler model shown in Equation (5) to control for the possibility that JLN's measure captures well-established factors (e.g., SMB, HML, etc.).

Table 14, Panel A provides summary statistics for the inputs into the calculation of our uncertainty measure. Our sample period spans from January 2001 through December 2017, providing 204 monthly observations. The mean value of JLN's uncertainty index over this period is 0.925, with minimum and maximum values of 0.849 and 1.153, respectively, and a standard deviation of 0.056. Our sample comprises 2,154 unique firms with an average monthly return (over the 204 months) of 0.80%.

We also measure uncertainty at the industry level. Using Equation (5), we substitute monthly Fama-French 48-industry level returns for firm-level returns. The coefficient estimates on the macro-uncertainty index then captures the sensitivity of each industry's stock returns relative to macro-economic uncertainty. Panel A of Table 14 shows the average adjusted return across the 48 Fama-French industry groups (over the 204 months) is 0.80%.

Proxies for The Family Characteristics

Our model predicts that family owners are less likely to exit the firm as their total wealth increases. Family absolute wealth levels are not directly observable. However, Anderson and Reeb (2003) note that family shareholders, on average, hold about 69% of their total wealth in their firm's stock, suggesting that the majority of family wealth resides in the firm's stock. We measure family wealth as the natural log of the family's fractional

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$Excess\ return = \alpha + \beta_1(uncertainty) + \beta_2(R_{Mt}\text{-}R_{Ft}) + \varepsilon_{i,t}$

equity stake multiplied by year-end firm's total market value of equity. To measure market value for firms with an untraded class of stock (dual-class shares), we use the share price of the traded class as a proxy for the price of the untraded class.

The model further indicates that family shareholders are less likely to exit their ownership positions as family risk aversion increases. Borghans et al. (2009) and others based on experimental data, find that women are more risk averse than men. We instrument for risk aversion of family owners using the presence of women in family firms using a binary variable that equals one when a female member of the family serves on the firm's board of directors and/or is listed in the proxy statement as holding a 5% or larger equity stake in the firm and zero otherwise. Due to legacy issues of families commonly giving directorships to male family members or listing male family members as share owners, we potentially understate the influence of female family members on decision-making and thus, understate the level of risk aversion. If so, we potentially bias our results towards zero.

Our model also predicts that family owners are less likely to exit the firm if family members serve as CEO. We proxy for family management as a binary variable that equals one when either the founder or a founder's descendant serves as CEO of the firm and equals zero when an outside professional manager serves as CEO of the firm.

Control Variables

We include several controls variables in our analysis. Firm size is measured as the natural log of total assets (Arora & Ceccagnoli, 2006). Leverage is long-term total debt divided by total assets (Elkamhi et al., 2014). Performance is earnings before interest, tax, depreciation, and amortization (EBITDA) divided by total assets, measured at *t-1*.

Volatility is the standard deviation of the growth of income before extraordinary times for the prior 20-quarters for each firm (Faccio et al., 2011). Growth opportunities are measured as the market value of equity divided by total assets (Bekaert et al., 2007). Equity issuance is measured as the sum of common and preferred stock annual issuances divided by total assets (Masulis & Korwar, 1986). All regressions, where noted, include industry-level dummies based on the Fama-French 48 industry grouping (less those groupings for financial and regulated public utilities). We obtain data and data definitions for the Fama-French industry groups from Kenneth French's website.[24] Table 13 provides a description of the variables used in our analysis.

Descriptive Statistics

Level of Family Ownership

Table 14, Panel B presents summary statistics for the full sample. We present mean, median, minimum, maximum, and standard deviation values for the variables. Our measure of firm (industry) level uncertainty beta – using the simple model – is 0.003 (-0.061) for the full sample, ranging from a minimum of -1.879 (-0.723) to a maximum of 2.306 (1.034). Higher values of uncertainty beta indicate greater correlation of stock returns to the macro-economic uncertainty. Average firm size as measured by total assets is $4.771 billion, but we note a great deal of variability with minimum and maximum values of $30.11 million and $81.98 billion, respectively.

Columns 1, 2, and 3 of Table 14, Panel C present data for non-family firms, family firms, and *t*-statistics for difference of mean tests between non-family and family firms. The full sample consists of 22,426 firm-year observations for 2,154 unique firms,

[24] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

comprising 15,003 (66.9%) observations for non-family firms and 7,423 (33.1%) observations for family firms. Similar to prior studies examining family ownership (Villalonga & Amit, 2006), we find that family firms tend to be smaller, less levered, and less risky than their nonfamily counterparts. In particular, family firms maintain $2.613 billion in total assets compared to $5.839 billion in nonfamily firms. Debt as a fraction of total assets is 17.3% in family firms and 20.3% in nonfamily firms. Volatility, measured as standard deviation of the growth of income before extraordinary items for the prior 20 quarters for each firm, is 36.15% in family firms and 69.50% in nonfamily firms. Family owners, on average, hold 24.75% of their firm's shares. Nonfamily firms exhibit an uncertainty beta of -0.008 and family firms have an uncertainty beta of 0.026, on average the stock return of family firms correlates more with that of nonfamily firms, the difference in uncertainty beta between nonfamily and family firms is significant at the 5% level.

We also segregate family firms into two groups: those with low ownership (greater than 5% but less than or equal to 20%) and those with high ownership (greater than 20%). Table 14, Panel C, columns 4, 5, and 6 present firm characteristics for low- and high-ownership family firms along with t-statistics for difference of mean tests between low- and high- family ownership firms. In the high family ownership group, family shareholders hold, on average, 39.38% of the firm's outstanding equity. In the low family ownership group, the average equity stake is 11.17%. Firms with low- and high- family ownership tend to exhibit similar characteristics with the exception of return-on-assets. We find that low- and high- family ownership firms are similar in size (total assets), use about the same level of debt (leverage), have similar market valuations (Tobin's Q), and exhibit similar levels of firm-level and industry-level uncertainty betas. However, firms with high family ownership exhibit superior accounting performance relative to firms with low family ownership (ROA: 13.28% versus 9.89%).

Family Exit Firms

Table 14, Panel D presents summary statistics of the matched family-exit firms and family firms. We observe a relatively homogenous match between the family-exit and family firms. Using a difference of mean tests, we do not observe significant differences between the two sets of firms for total assets, debt ratio, ROA, growth opportunities, equity issuance, and volatility. In univariate analysis, firm-level and industry-level uncertainty betas do not differ significantly for family-exit firms and family firms. Firm-level uncertainty beta for family-exit (family) firms is 0.183 (0.088). Industry uncertainty beta for family-exit (family) firms is -0.004(-0.037). In the next section, we explore our central hypotheses in a multivariate framework.

Multivariate Tests

Cross-Sectional Analysis of Family Ownership

Our first set of multivariate tests to examine the Hypothesis 1.1 exploiting cross-sectional differences in the level of ownership across the Russell 3000 industrial firms from 2001 through 2017. The model predicts that family shareholders maintain larger equity stakes in the firm where their private information is more useful in reducing the ambiguity about their own firm relative to other firms, that is, in the firm with lower uncertainty beta, or less correlation with aggregate uncertainty. We examine this proposition using the following specification:

$$Family\ Shareholder = \alpha + \gamma_1(Uncertainty\ Beta) + \gamma_2 X_{i,t} + \varepsilon_{i,t}$$

We proxy for family shareholder with two measures. The first measure is the percentage of outstanding equity held by the family. The second measure is a dummy variable that designates high and low levels of family ownership. Ownership levels above 20% or more of outstanding shares are designated as high and less than 20% are designated as low family ownership. We measure the uncertainty beta at the firm- and industry- level as outlined in section 3.3.1. *X* represents a vector of control variables. Table 13 provides variable definitions.

The empirical analysis indicates a robust, negative relation between family ownership and uncertainty beta. Table 15, columns 1 and 2 present regression results with family ownership as the dependent variable and firm and industry uncertainty beta, respectively, as the primary explanatory variables. Column 1 shows that family ownership levels exhibit a significantly negative relation to firm-level uncertainty beta; suggesting that as the returns of the firm co-move more with the macro-uncertainty, family investors hold significantly smaller equity stakes. A one standard deviation increase in firm uncertainty beta indicates a 0.266% decrease in family ownership.

Column 2 presents regression results with family ownership levels as the dependent variable and industry-level uncertainty beta as the explanatory variable. Again, we observe a significantly negative relation between family ownership and uncertainty beta. The coefficient estimate on industry uncertainty beta is -0.024 and significant at the 1% level, suggesting that family shareholders tend to hold significantly smaller stakes in their firms in the industries that co-move more with the macro-uncertainty. A one standard deviation increase in industry uncertainty beta corresponds to a 0.81% decrease in family ownership. In the full sample, 66.9% of firms are designated as non-family firms, suggesting the coefficient estimates on uncertainty beta understate the economic impact of uncertainty on family ownership. We further investigate the economic importance by only examining family firms in our next set of tests.

In columns 3 and 4 of Table 15, using only family firms, we examine the relation between family ownership and uncertainty beta using a logit specification. The dependent variable equals 0 for low-family ownership firms (>=5% and <=20%) and 1 for high family ownership firms (>20%). The cross-sectional analyses with the logit regressions further support Hypothesis 1.1 of our model with ambiguous volatility. Specifically, family owners tend to maintain larger equity stakes when their information set allows them to better assess the risk and return of their investment (i.e., in environments where the return of firm stock co-move less with macro-uncertainty) A one standard deviation increase in firm uncertainty beta indicates 5.85%[25] decrease the odds of a family investor maintaining a high ownership stake. In column 4, using industry rather than firm level uncertainty beta, we note that a one standard deviation increase in uncertainty beta is associated with a 4.50% decrease in the odds of family investors maintaining a high ownership stake relative to a smaller equity stake. The results provide support for H1.1.

Family Exit Analysis

The cross-sectional analysis indicates that family shareholders hold larger equity stakes in environments where return of firms co-move less with economic uncertainty, so that their information sets allow these investors to better assess risk and return of their own firms relative to other firms. Our model implies,

[25] Panel B, Table 14 shows that under simple model, a one standard deviation of firm uncertainty beta is 0.665. Therefore, (0.912-1)*100%*0.665=- 5.85%. Similarly, for industry uncertainty beta, we get (0.866-1)*100%*0.336=-4.50%.

(1) *family owners are less likely to exit in firms or industries with smaller uncertainty beta, where their private information is more helpful in assessing future returns and risk (H2.1),*

(2) *family owners are less likely to exit, if more female family owners on the board, so that the family is more risk averse (H2.2),*

(3) *family owners are less likely to exit, if the family has more wealth invested in the firm relative to other family owners (H2.3),*

(4) *family owners are less likely to exit when the family members serve as CEO. (H2.4)*

To examine these propositions, we examine family-exit firms versus family firms using a Cox survival rate specification:

$$(\textit{Family Time in Firm, Family Exit Dummy}) = \alpha + \gamma_{1\text{-}2}(\textit{Firm or Industry Level Uncertainty Beta}_{i,t}) + \gamma_{3\text{-}7}(\textit{Family Characteristics}_{i,t}) + \gamma X_{i,t} + \varepsilon_{i,t}$$

The variables are defined in Table 13 with *X* representing a vector of control variables. In the Cox survival model (Lane et al., 1986), we relate the time that passes before the family exits to our series of covariates on firm (industry) uncertainty beta and family characteristics that potentially affect the family's exit decision. For example, we examine whether family management influences the family's decision to exit their equity ownership stake. We present the coefficient estimates as odds ratios. An odds ratio that is greater (less) than 1.0 indicates that the family is more (less) likely to exit the firm relative to the independent variable, e.g., a coefficient estimate on family management of 0.29 indicates that family firms with a family manager or only 29% as likely to exit the firm as a family firm without a family manager. We control for serial correlation and heteroskedasticity using the Huber-White sandwich estimator (clustered on firm-level identifier) for the standard errors on the coefficient estimates. In robustness, testing, we also use exponential and Weibull hazard specifications rather than a Cox specification and find similar results and inferences.

Table 16 displays the results for family-exit firms versus the matched sample of family firms. Columns 1 through 4 incorporate a firm-level uncertainty beta and columns 5 through 8 use an industry-level uncertainty beta. The results across all specifications indicate that family investors are more likely to exit their ownership position as the uncertainty beta increases. We find that family investors are about 21.28% to 29.93% more likely to exit the firm with a one standard deviation increase in firm-level uncertainty beta.[26] Columns 5 through 8 indicate that family owners are about 21.84% to 27.89% more likely to exit their firms with a one standard deviation increase in industry (rather than firm) uncertainty beta. The results on the family exit decision on firm- and industry- level uncertainty betas are significant at the 5% or better level across all of the specifications and suggest that uncertainty plays an economically important role in families' decisions to maintain their equity stakes. The exit results confirm the cross sectional analysis and provide evidence consistent with our model's prediction.

Columns 2, 3, and 4 of Table 16 display the Cox regression results when examining family characteristics while controlling for the level of firm uncertainty beta. Columns 6, 7, and 8 show similar results but we control for the level of industry uncertainty beta rather

[26] We calculate the economic influence of a one standard deviation in firm level uncertainty as: (coefficient estimate on firm level uncertainty – 1.0) x (1-standard deviation change in firm level uncertainty). For model 1 in Table 16, this is: Increase in the probability of a family exit = (1.45 – 1.0) x 0.665*100% =29.93%.

than firm uncertainty beta. Because the results across firm- and industry- uncertainty provide similar and near identical inferences, we restrict our discussion to columns 2, 3, and 4 that control for firm uncertainty.

The model predicts that family owners with ambiguity-reducing private information will be less likely to exit the firm relative to families with less helpful private information (H2.1). Family members serving as CEO of the firm arguably provides the family shareholders with more helpful private information regarding the firm's future prospects versus an external professional manager serving as CEO. If so, we expect firms with family CEOs to be less likely to exit their ownership positions. Column 2 of Table 16 presents the family-exit results when a family member serves as CEO. The analysis indicates that family exits are only 29% as likely when a family member serves as CEO as compared to an external CEO, suggesting that families with more helpful private information tend to remain in the firm relative to families with less private information. The results provide support for H2.4.

Our model also predicts that family owners should be less likely to exit their ownership stake as family risk aversion increases, i.e., families will maintain their ownership position as their level of risk aversion increases, all else equal. We instrument for risk aversion using a dummy variable if a female member of the family serves on the board of directors and/or holds a 5% or larger stake in the firm (Borghans et al., 2009). The analysis strongly indicates that family exits are far less likely to occur as family risk aversion increase (female representation increases). Column 4 of Table 16 displays the results and suggests that more risk averse families (those with female board representation) are only about 29% as likely to exit the firm as less risk averse family investors (no female board representation).[27] Our results on family risk aversion support Hypothesis 2.2 of the model; all else equal, families with greater risk aversion tend to stay invested in the firm.

Our model predicts that wealthier families are less likely to exit the firm than less wealthy families, i.e., families with a larger absolute, dollar wealth stake should be less likely to exit than families with smaller absolute wealth stakes. The results of the analysis indicate that a one-standard deviation in the absolute value of family wealth invested in the firm yields a 25% decrease in the likelihood of a family exit. Our analysis supports Hypothesis 2.3 of the model and indicate that as family invested wealth increases, family owners are less likely to exit the firm.

Overall, the family-exit analysis based on firm- and industry- uncertainty beta and family characteristics supports the predictions of the model. Specifically, our empirical analysis indicates that family owners are less likely to exit their ownership positions in the firm or industry co-move less with macro-uncertainty (smaller firm-/industry- level uncertainty beta), where their private information is more helpful, when they possess more helpful private information (family management), exhibit greater risk aversion (female board representation), and as their invested wealth in the firm increases.

Robustness Testing

Cross-sectional Robustness Testing

In section 4.2, we examined the relation between the levels of family ownership and firm and industry uncertainty beta. For that analysis, we used only the 12-month ahead

[27] An alternative explanation for our finding on family female representation centers on the notion that because women are more risk averse than men, family owners may be more willing to place female family members on board in sectors characterized by high (or low) risk. We examine this proposition by regressing firm volatility on female-family representation and our control variables (with and without industry controls). The analysis indicates that female-family representation is not significantly related to firm risk (volatility).

JLN (2015) uncertainty index in our computation of firm and industry uncertainty beta. Table 17, panel A shows the cross sectional results when using the JLN index plus a market factor. Panel B of Table 17 displays cross sectional results when using the JLN index factor plus a Fama-French five-factor model (market factor, SMB, HML, RMW, and CMA). Our main results are robust to the different ways of computing the uncertainty beta, whether with the market factor or with the Fama-French five-factor model. As the level of the firm (or industry) uncertainty beta increases, family owners hold smaller equity stakes in their firms. Notably, the coefficient estimates reported in our primary analyses (Table 15) and those reported in the robustness tests are of similar magnitudes, have the same sign, and have the same significance, suggesting that the construction of our uncertainty measure is relatively insensitive to the specification. Overall, our cross sectional analyses indicate that as firm and industry uncertainty betas increase, family shareholders hold smaller stakes; providing evidence consistent with the predictions of the model.

Family-Exit Robustness Analysis

The primary family-exit analysis in section 4.2 used only the 12-month ahead JLN, (2015) uncertainty index in the computation of firm and industry uncertainty beta. Table 18, panel A, shows the family exit results when using the 12-month ahead JLN index and to compute firm- and industry- level uncertainty betas. Panel B shows the results when using JLN index and to compute firm- an industry- level uncertainty beta.

The family-exit analysis with the alternate constructions of firm and industry uncertainty beta continues to indicate that family owners are significantly more likely to exit their ownership stakes as the level of firm and industry uncertainty beta increases. The results when including the market factor indicate that family investors are about 26.69%

(21.50%) to 46.22% (29.25%) more likely to exit their stakes with a one-standard deviation in firm (industry) uncertainty beta. Consistent with the earlier analysis, we also find that family owners are substantially less likely to exit their ownership stakes when having a private information advantage (family management), with greater risk aversion (female board representation), and with greater wealth invested in the firm. Similarly, the family-exit results remain unchanged with using the Fama-French five-factor model (rather than just the JLN index and the market factor) to compute firm- and industry- level uncertainty betas. Overall, the family-exit robustness testing indicates that family owners are more likely to exit when having more helpful private information in reducing the ambiguity of their own firm relative to other firms, either in the firm or industry with less uncertainty beta or when family CEO presents, greater levels of risk aversion, and greater levels of absolute wealth invested. The results are consistent with the predictions of the model.

Summary and Conclusion

Classical investment theory and conventional financial advice suggest that investors should hold well-diversified portfolios instead of holding large, concentrated stakes in a single firm. Yet, we continue to observe that founding families of many publicly traded firms invest the bulk of their wealth in just one stock in well-developed equity markets such as those in the United States. With the ability to control senior management posts, board seats, and the prevalence of super-voting dual-class shares, the notion that family shareholders must maintain such large stakes to extract private benefits is puzzling.

We propose an information advantage explanation for families holding large, concentrated stakes based on decision theory in which investors have concern over ambiguity about both the expected return and return volatility and they can exploit specialized knowledge to reduce the relative ambiguity. Using simulation analysis, we show that family owners with private information about the firm can reduce the ambiguity about their own firm relative to outside firms, resulting in a portfolio where most of their investable funds are held in the family firm. In contrast, atomistic shareholders without access to private information invest in a diversified portfolio. We find that ambiguity about return volatility is critical to explain quantitative aspect of the puzzle that family shareholders maintain large stakes in the family firm.

Furthermore, our model provides rich testable implications, including several that appear contrary to standard expectations in the literature on family exiting decision. The model predicts that family owners are more likely to retain their ownership stakes where private information and experience allows the family to understand better the nature of the firm's prospects. The model distinctly predicts that families will be less likely to sell-off their ownership positions (exit the firm) as family wealth invested in the firm increases[28]; as family (absolute) risk-aversion increases and; as family tenure in the firm increases.

Finally, we empirically investigate the model's predictions using two testing procedures. First, we examine family ownership, in the cross-section, for a large sample of family held U.S. industrial firms. Second, in a more robust test environment, we examine family decisions to sell-off their ownership stakes and exit the firm. Our first series of test, the cross-sectional analysis, suggests that families hold larger ownership stakes in firms and industries with a smaller uncertainty beta, in which private information is more useful in reducing the relative ambiguity of family firms. The second series of tests examining

[28] Bitler et al. (2005) argue that the standard agency model also implies a positive relationship between wealth and ownership, as absolute risk aversion is typically thought to decreasing in wealth. However, for investors with constant absolute risk aversion, this implied positive relationship between wealth and ownership does not hold.

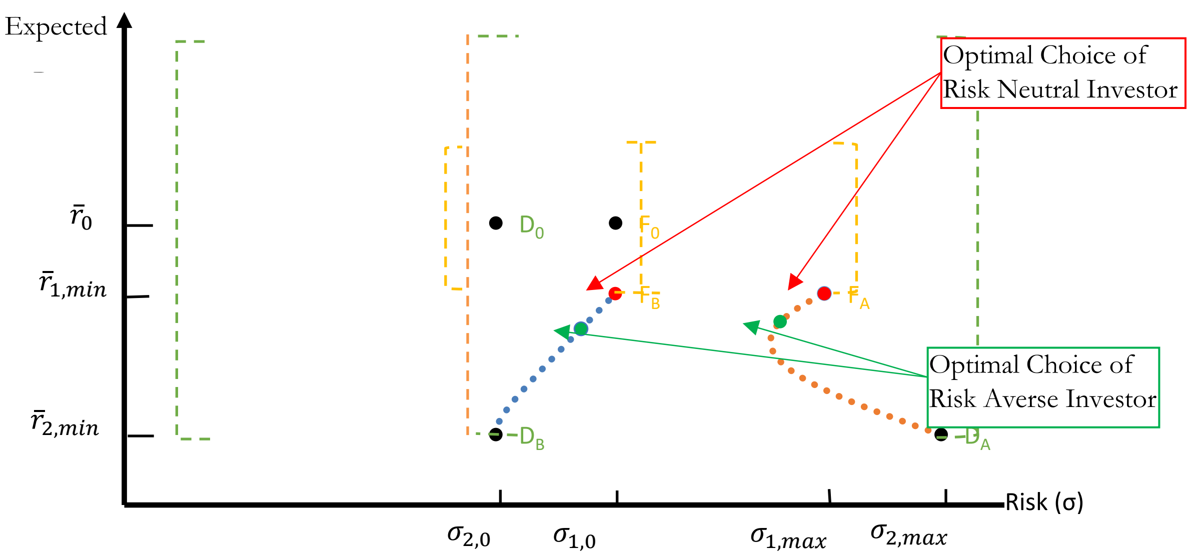
family exits also confirms the predictions of our ambiguity model. Notably, the exit analysis indicates that families are less likely to sell-off their ownership stakes as their invested wealth increases, as their risk aversion increases, and when the family actively manages the firm. In sum, the empirical analyses support the models' predictions, suggesting that families rationally choose to hold an undiversified portfolio when their private information allows them to reduce ambiguity about the firm's prospects relative to outside firms.

Our analysis is motivated by the quantitative feature of the family ownership puzzle; that is, why family owners defy conventional finance wisdom by maintaining large, concentrated stakes in a single firm. We show that information advantage on the family firm allows family owners to reduce the ambiguity about expected return and especially about return volatility of the family-owned stock relative to that of a diversified portfolio of other firms. Yet, family block holders are not the only type of investor with large shareholdings in the asset markets. Robinson and Sensoy (2013) find private equity funds and venture capitalists hold less well-diversified portfolios relative to mutual funds. A recent study by Choi et al. (2017) finds that concentrated investment strategies of institutional investors in international markets can be optimal and enhance risk-adjusted returns, which is consistent with the predictions of our model that investors optimally choose to hold concentrated portfolios in which they have an information advantage and can amplify their advantage through learning.

Figure 2

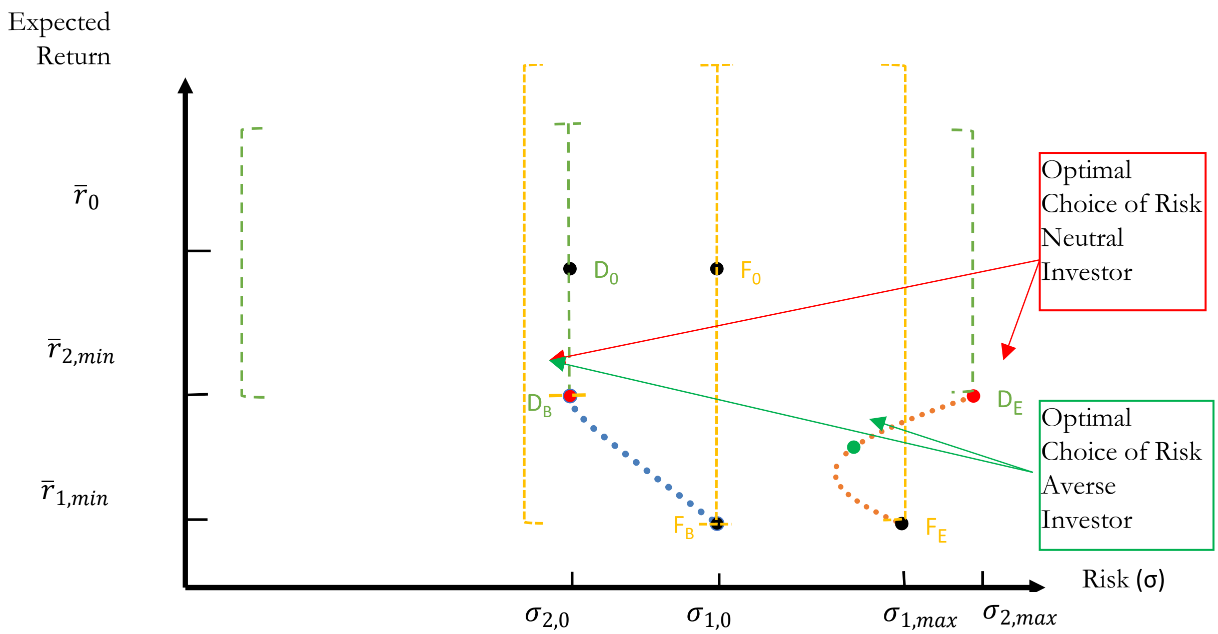
Optimal Portfolio Choice of Family Owners

Panel A: Non-Exiting Case ($\bar{r}_{1,min} > \bar{r}_{2,min}$)



F_A corresponds to the worse-case scenario return-volatility pair of the family firm stock ($\bar{r}_{1,min}, \sigma_{1,max}$), D_A corresponds to the worse-case-scenario return-volatility pair of the diversified portfolio ($\bar{r}_{2,min}, \sigma_{2,max}$). F_B and D_B correspond to the worse-case scenario of return-volatility pair of the family firm stock and the diversified portfolio, respectively, in the case where there is no ambiguity about return volatility.

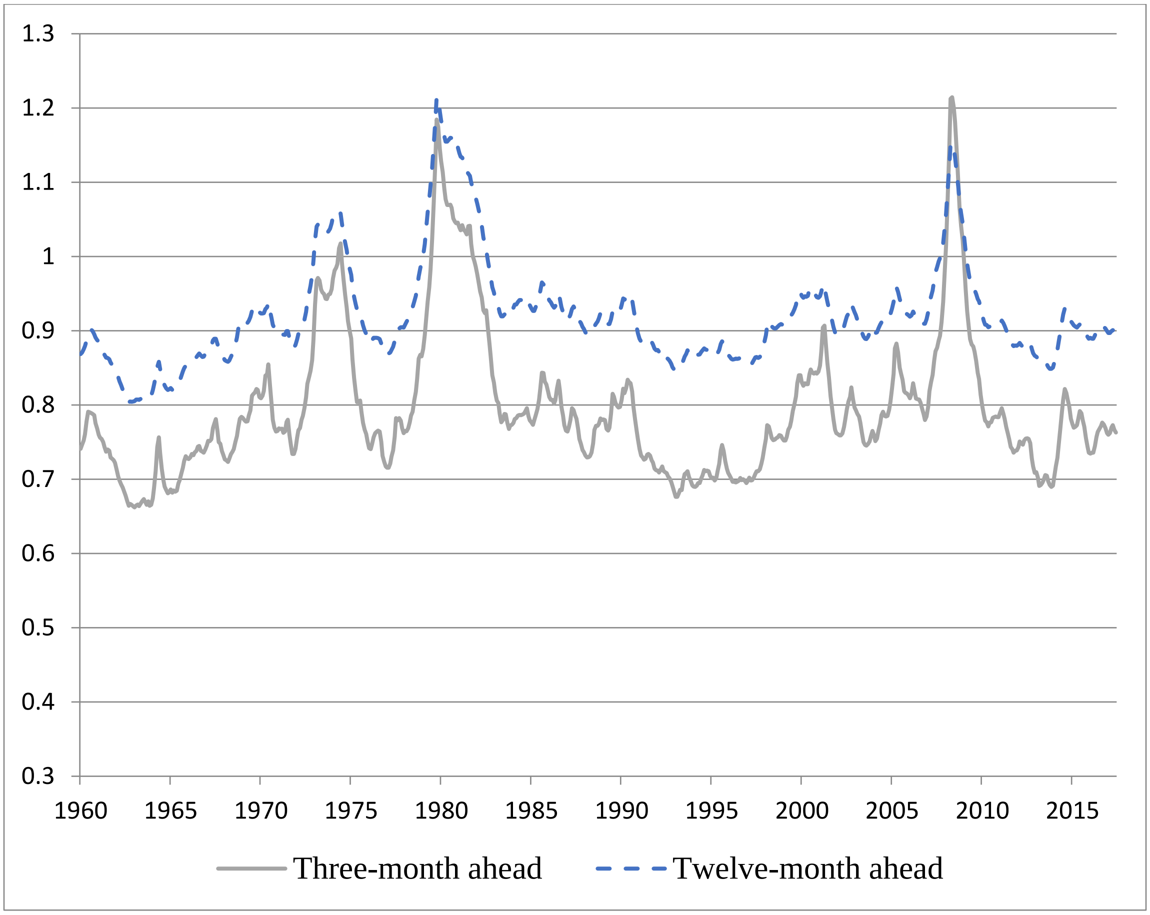
Panel B: Exiting Case ($\bar{r}_{1,min} < \bar{r}_{2,min}$)



F_E corresponds to the worse-case scenario return-risk of family firm stock ($\bar{r}_{1,min}, \sigma_{1,max}$), D_E corresponds to the worse-case-scenario return-risk of the diversified portfolio ($\bar{r}_{2,min}, \sigma_{2,max}$). F_B and D_B correspond to the worse-case scenario return-risk of the family firm stock and the diversified portfolio, respectively, in the case where there is no ambiguity about risk of the returns.

Figure 3

Macro-Economic Uncertainty Index



This figure displays the three-month, and 12-month-ahead macro-economic uncertainty index developed by Jurado, Ludvigson, and Ng (2015). The data for the period July 1960-December 2017 are obtained from Sydney Ludvigson's website < https://www.sydneyludvigson.com/data-and-appendixes/ >.

Table 13

Variable Definitions

Debt Ratio – year-end long-term debt divided by total assets for each firm.

Equity issuance – the sum of common and preferred stock annual issuances divided by total assets.

Family Firm – binary variable that equals one when the family holds a five percent or larger ownership stake and zero otherwise.

Family Management – binary variable that equals one when either the founder or a founder's descendant serves as CEO of the firm; equals zero when an outside professional manager serves as CEO of the firm.

Family Ownership – the percent of common equity held by the family.

Family Risk Aversion – equals one when a female member of the family serves on the firm's board of directors and/or holds a 5% or larger equity stake.

Family Wealth – family fractional equity ownership stake multiplied by year-end firm total market value.

Growth Opportunities – market value of equity divided by total assets.

High Family Ownership – level of family equity stake greater than 20% of the firm's outstanding equity

Firm Uncertainty Beta - the coefficient estimate (β_1) of the JLN Macro Uncertainty index from the factor models.

Industry Uncertainty Beta - the coefficient estimate (β_1) of the JLN Macro Uncertainty index from the factor models.

Industry Dummy - equals one for each Fama-French industry group and zero otherwise.

Low Family Ownership - level of family equity stake greater than 5% but less than 20% of the firm's outstanding equity

Return on Assets$_{t-1}$ – earnings before interest, tax, depreciation and amortization (EBITDA) divided by total assets for the prior year-end for each firm.

Total Assets – year-end total assets for each firm.

Volatility – standard deviation of the growth of income before extraordinary items (ibq) for the prior 20-quarters for each firm.

Table 14

Summary Statistics

Panel A: Monthly descriptive statistics for the Inputs to the Uncertainty Measure

	N	*Mean*	*Median*	*Min*	*Max*	*SD*
Risk free rate	204	0.001	0.001	0.000	0.005	0.001
Return	204	0.008	0.010	-0.190	0.161	0.047
Excess return	204	0.007	0.009	-0.191	0.161	0.047
Ind. adjusted return	204	0.008	0.009	-0.433	0.800	0.075
Uncertainty	204	0.925	0.910	0.849	1.153	0.056

Panel B: Descriptive Statistics on the Firm Characteristics for the Full Sample

	Mean	*Median*	*Min.*	*Max.*	*SD.*
Firm Uncertainty Beta					
w/simple model	0.003	-0.085	-1.879	2.306	0.665
w/market model	0.217	0.134	-1.655	2.486	0.651
w/Fama-French 5-factor model	0.115	0.054	-1.873	2.515	0.674
Industry Uncertainty Beta					
w/simple model	-0.061	-0.120	-0.723	1.034	0.336
w/market model	0.155	0.132	-0.477	0.857	0.250
w/Fama-French 5-factor model	0.073	0.047	-0.522	0.896	0.251
Family ownership (%)	8.43	0	0	69.4	15.41
Total assets ($m)	4,771	1,007	30.11	81981	11,587
Ln(total assets)	7.045	6.915	3.405	11.31	1.656
Debt ratio	0.193	0.159	0	0.927	0.195
Return on Assets$_{t-1}$ (%)	11.24	12.77	-0.585	0.483	0.156
Tobin *Q*	2.00	1.611	0.702	7.676	1.234
Volatility	58.46	13.43	0.761	949.2	138.1
Equity issuance/assets	11.45	0.053	0.007	1.406	0.200

Panel C: Descriptive Statistics for Family and Non-family Firms

	Firm Type			*Family Firms Only*		
	Non-family	*Family*	*t-stat*	*Low (<=20%)*	*High (>20%)*	*t-stat*
Observations	15,003	7,423		3,851	3,572	
Family ownership (%)	0.356	24.75	35.87***	11.17	39.38	34.04***
Firm uncertainty beta	-0.008	0.026	2.2**	0.042	0.009	1.28
Industry uncertainty beta	--0.063	-0.059	.640	-5.233	-6.421	1.25
Total assets ($m)	5,839	2,613	6.52***	2970	2228	1.18
Ln(total assets)	7.28	6.56	9.88***	6.63	6.49	1.4
Debt ratio	0.203	0.173	3.72***	0.1667	0.1801	1.07
Return on Assets$_{t-1}$ (%)	11.09	11.52	0.78	9.89	13.28	4.19***
Tobin *Q*	2.03	1.91	2.64***	1.96	1.87	1.28
Volatility	69.5	36.15	6.28***	42.64	29.15	1.92*
Equity issuance/assets	11.36	11.63	0.37	13.01	10.15	2.38**

Panel D: Family exit sample

	All Firms	*Family-Exit Firms*	*Family Firms*	*t-statistic*
Family ownership (%)	5.28	0.564	9.994	7.39***
Firm uncertainty beta	0.1357	0.183	0.088	1.16
Industry uncertainty beta	-0.021	-0.004	-0.037	0.84
Ln(family wealth)	1.519	0.936	2.107	5.16
Ln(total assets)	6.274	6.27	6.29	0.11
Debt ratio	14.00	14.41	13.99	0.21
Return on Assets$_{t-1}$ (%)	8.54	8.60	8.67	0.04
Tobin *Q*	2.04	2.04	2.03	0.07
Volatility	48.33	48.90	45.31	0.22
Equity issuance/assets	18.30	18.21	18.30	0.03

Panel A reports summary statistics of the dependent variable and main independent variables used to estimate uncertainty beta. The sample spans from January 2001 through December 2017, providing 204 monthly observations. The monthly risk-free rate of return, r_f, is taken from Kenneth French's website. The monthly stock return is taken from CRSP and excess return is calculated by deducting risk free rate from each firm's monthly stock return. Industry adjusted return is Fama-French monthly industry return for 48 industries minus monthly risk-free rate. Uncertainty is the 12-month ahead macro-economic uncertainty index from JLN (2015).

Panel B provides summary statistics on annual data for the Russell 3000 non-financial, non-utility firms from January 2001 through December 2017, providing 22,426 firm-year observations on 2,154 unique firms. Firm and industry uncertainty beta is calculated using JLN (2015) 12-month ahead uncertainty index. Table 13 provides variable definitions.

Panel C provides summary statistics on annual data for the Russell 3000 non-financial, non-utility firms – segregated into family firms and non-family firms – from January 2001 through December 2017. Columns 1 and 2 use the full sample, providing 22,426 firm-year observations on 2,154 unique firms. Columns 3 and 4 using only family firms divided into low ownership (<=20% of outstanding equity) and high ownership (>20% of outstanding equity), providing 7,423 firm-year observations for 907 unique firms. *t*-statistics for difference of mean tests between non-family and family firms (low- and high family ownership) are provided in column 3 (6) and corrected for serial correlation by clustering on firm-level identifier. Table 13 provides variable definitions. ***, **, and * indicates significance at the 1%, 5%, and 10% levels, respectively.

Panel D provides annual summary statistics for families exiting their concentrated equity ownership stake (family-exit firms) and a matched sample of families maintaining their ownership stake (family firms). Family-exit firms are matched to family firms using coarsened exact matching (CEM) based on total assets, debt ratio, ROA, growth opportunity, equity issuance, and volatility. The process results in 292 unique firms (164 observations of family-exit firms matched to 164 family firm observations. Family-exit and family firms come from our base Russell 3000 non-financial, non-utility firms from January 2001 through December 2017. The variables are defined in Table 13.

Table 15

Family Ownership Analysis

	OLS		*Logit*	
	Dependent variable = Family ownership (%)		*Dependent variable = (High Family Ownership=1; Low Family Ownership=0)*	
	(1)	*(2)*	*(3)*	*(4)*
Firm uncertainty beta	-0.004***		0.912***	
	(2.79)		(2.67)	
Industry uncertainty beta		-0.024***		0.866***
		(5.93)		(2.02)
Ln (total assets)	-0.025***	-0.024***	0.811***	0.809***
	(28.65)	(26.10)	(8.68)	(8.73)
Debt ratio	-0.041***	0.010*	1.886***	1.905***
	(7.72)	(1.91)	(4.89)	(4.97)
Return on assets	0.060***	0.100***	7.277***	7.099***
	(7.45)	(12.37)	(9.47)	(9.36)
Growth opportunity	-0.003***	-0.007***	0.955*	0.957*
	(3.12)	(7.11)	(1.92)	(1.81)
Equity issue	-0.052***	-0.053***	0.509***	0.497***
	(7.45)	(7.13)	(3.41)	(3.54)
Volatility	0.000***	0.000***	0.999	0.999
	(3.76)	(3.20)	(0.630)	(0.53)
Constant	0.292***	0.256***	0.3109***	3.100***
	(43.25)	(38.82)	(6.99)	(6.97)
Observations	22,426	22,426	7,423	7,423

Adj./*Pseudo* R^2	17.85	5.82	2.35	2.32
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	No

This table presents OLS regression results of family ownership on firm level and industry level uncertainty beta and firm characteristics. In columns 1-2, the dependent variable is *family ownership*, the percentage of ownership a family holds in the firm. In column 3-4, the dependent variable equals 0 for low-family ownership firms (>=5% and <=20%) and 1 for high family ownership firms (>=20%). Uncertainty betas are estimated using JLN (2015) 12-month ahead uncertainty index. The variables are defined in Table 13. Columns 1 and 2 include Russell 3000 non-financials and non-utility firms for the years 2001-2017. Columns 3 and 4 include only family firms. Columns 1 and 2 present coefficients from OLS regression with t-statistics in parentheses. Columns 3 and 4 present the odd ratios from logit regression with z-values in parentheses. ***,**, and * indicate significance at the 1%,5%, and 10% levels, respectively and corrected for serial correlation and heteroskedasticity by clustering on the firm-level identifier.

Table 16

Family Exit Analysis: Family Characteristics

	Dependent Variable = Family Exit (0 if no exit, 1 if an exit)							
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Firm uncertainty beta	1.45***	1.40***	1.41***	1.32**				
	(3.46)	(3.18)	(3.21)	(2.23)				
Industry uncertainty beta					1.72**	1.65**	1.70**	1.83**
					(2.37)	(2.21)	(2.32)	(2.48)
Family management		0.29***				0.33***		
		(-3.74)				(-3.35)		
Ln (family wealth)			0.88***				0.87***	
			(-2.86)				(-2.97)	
Family risk aversion				0.29**				0.29**
				(-2.12)				(-2.13)
Ln (total assets)	0.70***	0.68***	0.72***	0.70***	0.72***	0.72***	0.76***	0.69***
	(-3.50)	(-3.86)	(-3.19)	(-3.43)	(-3.43)	(-3.44)	(-2.90)	(-3.48)
Debt ratio	1.83	1.78	1.68	1.75	1.56	1.55	1.56	1.78
	(1.19)	(1.14)	(1.03)	(0.95)	(0.91)	(0.87)	(0.89)	(0.97)
Return on Assets	1.18	0.87	1.26	1.01	1.78	1.14	1.67	1.20

	(0.24)	(-0.20)	(0.34)	(0.02)	(0.84)	(0.20)	(0.75)	(0.25)
Growth opportunity	1.04	1.06	1.06	1.03	0.91	0.92	0.92	0.99
	(0.49)	(0.81)	(0.80)	(0.27)	(-1.30)	(-1.17)	(-1.17)	(-0.04)
Equity issue	2.16	1.88	2.10	1.20	3.16**	2.55*	3.07	1.18
	(1.48)	(1.23)	(1.43)	(0.30)	(2.35)	(1.91)	(2.30)	(0.28)
Volatility	1.00**	1.00**	1.00*	1.00***	1.00*	1.00*	1.00**	1.00***
	(2.07)	(2.11)	(1.93)	(2.60)	(1.78)	(1.65)	(1.43)	(2.63)
Observations	328	328	328	266	328	328	328	266

Columns 1 through 8 report hazard ratios with a COX model of family exits and a coarsened exact matched (CEM) sample of family firms not exiting. Family exit is defined as binary variable which equals one if family ownership dropped to 3% and below in year *t* from 5% and above in year *(t-1)*. Uncertainty betas are estimated using JLN (2015) 12-month ahead uncertainty index. Variables are defined in Table 13. z-values are reported in parentheses and are corrected for serial correlation and heteroskedasticity by clustering on firm level identifiers. ***, **,* indicate significance at the 1%,5%, and 10% levels, respectively.

Table 17

Family Ownership Analysis

Panel A: *Uncertainty Beta calculated as estimate of β_1 in:*

$$Excess\ return = \alpha + \beta_1 uncertainty + \beta_2\, R_{Mt}\text{-}R_{Ft} + \varepsilon_{i,t}$$

	Dependent variable = Family ownership (%)		*Dependent variable = (High Family Ownership=1; Low Family Ownership=0)*	
	(1)	*(2)*	*(3)*	*(4)*
Firm uncertainty beta	-0.006***		0.873***	
	(4.13)		(3.88)	
Industry uncertainty beta		-0.046***		0.752***
		(9.03)		(2.91)
Controls	Yes	Yes	Yes	Yes
Observations	22,426	22,426	7,423	7,423
Adj. R-squared (%)	17.88	6.01	2.42	2.36
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	No

Panel B: *Uncertainty Beta calculated as estimate of β_1 in:*

$$Excess\ return = \alpha + \beta_1 uncertainty + \beta_2\, R_{Mt}\text{-}R_{Ft} + \beta_3\, SMB + \beta_4 HML + \beta_5\, RMW + \beta_6 CMA + \varepsilon_{i,t}$$

Firm uncertainty beta	-0.005***		0.880***	
	(3.74)		(3.77)	
Industry uncertainty beta		-0.036***		0.753***
		(7.48)		(2.80)
Control	Yes	Yes	Yes	Yes
Observations	22,426	22,426	7,423	7,423

Adj./Pseudo R-squared (%)	17.87	5.90	2.42	2.35
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	No

This table presents OLS regression results of family ownership on firm-level and industry-level uncertainty betas and firm characteristics. In columns 1-2, the dependent variable is *family ownership*, the percentage of ownership a family holds in the firm. In column 3-4, the dependent variable equals 0 for low-family ownership firms (>=5% and <=20%) and 1 for high family ownership firms (>=20%). Uncertainty betas are estimated using JLN (2015) 12-month ahead uncertainty index. Panel A include the JLN factor and a market factor. Panel B includes the JLN factor and the Fama-French 5-factors. The variables are defined in Table 13. Columns 1 and 2 include Russell 3000 non-financials and non-utility firms for the years 2001-2017. Columns 3 and 4 include only family firms. Columns 1 and 2 present coefficients from OLS regression with t-statistics in parentheses. Columns 3 and 4 present the odd ratios from logit regression with z-values in parentheses. ***,**, and * indicate significance at the 1%,5%, and 10% levels, respectively and corrected for serial correlation and heteroskedasticity by clustering on the firm-level identifier.

Table 18

Family Exit Analysis: Family Characteristics

Panel A: *Uncertainty Beta calculated as estimate of β_1 in:*

Excess return $= \alpha + \beta_1 uncertainty + \beta_2 R_{Mt}\text{-}R_{Ft} + \varepsilon_{i,t}$

	Dependent Variable = Family Exit (0 if no exit, 1 if an exit)							
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Firm uncertainty beta	1.71***	1.65***	1.67***	1.41***				
	(4.29)	(4.06)	(4.10)	(2.62)				
Industry uncertainty beta					1.91**	2.00**	1.86**	2.17**
					(2.22)	(2.43)	(2.11)	(2.33)
Family management		0.32***				0.29***		
		(-3.74)				(-3.69)		
Ln (family wealth)			0.89**				0.88***	
			(-2.66)				(-2.79)	
Family risk aversion				0.28**				0.30**
				(-2.16)				(-2.08)

Panel B: *Uncertainty Beta calculated as estimate of β_1 in:*

Excess return $= \alpha + \beta_1 uncertainty + \beta_2 R_{Mt}\text{-}R_{Ft} + \beta_3 SMB + \beta_4 HML + \beta_5 RMW + \beta_6 CMA + \varepsilon_{i,t}$

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Firm uncertainty beta	1.26**	1.30**	1.28**	1.35**				
	(2.03)	(2.27)	(2.18)	(2.40)				
Industry uncertainty beta					2.81***	3.11***	2.94***	2.24**
					(3.52)	(4.04)	(3.80)	(2.55)

Family management		0.31***				0.29***		
		(-3.51)				(-3.72)		
Ln (family wealth)			0.87***				0.86***	
			(-3.09)				(-3.24)	
Family risk aversion				0.28**				0.29**
				(-2.20)				(-2.11)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	328	328	328	266	328	328	328	266

Columns 1 through 8 report hazard ratios with a COX model of family exits and a coarsened exact matched sample of family firms not exiting. Family exit is defined as binary variable which equals one if family ownership dropped to 3% and below in year *t* from 5% and above in year *(t-1)*. Uncertainty betas are estimated using JLN (2015) 12-month ahead uncertainty index. Variables are defined in Table 13. z-values are reported in in parentheses and are corrected for serial correlation and heteroskedasticity with firm clustering. ***, **,* indicate significance at the 1%,5%, and 10% levels, respectively.

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APPENDIX A

MODEL IMPLIED FAMILY OWNERSHIP

In part one, we present the implied share of family wealth invested in the family firm for various levels of relative ambiguity and expected returns in the model with ambiguity. The implied family-ownership is computed for different levels of ambiguity about the diversified portfolio relative to the family firm, and for three cases where the worse expected return of the family firm is the same, less, and more than that of the diversified portfolio. For comparison, we also present the implied ownership of a single stock in the model without ambiguity.

Table A.1.

Calibration of Stock Ownership

Panel A: Model with Ambiguity			
Relative Ambiguity of Return Volatility $(\sigma^2_{2,max}/\sigma^2_{1,max})$	Relative Ambiguity of Expected Returns		
	$\bar{r}_{1,min} = \bar{r}_{2,min}$	$\bar{r}_{1,min} = 0.5\bar{r}_{2,min}$	$\bar{r}_{1,min} = 1.5\bar{r}_{2,min}$
Infinity	100%	81%	>100%
4.00	82%	65%	98%
2.00	68%	54%	82%
1.00	50%	39%	61%
0.50	30%	22%	38%
0.25	13%	8%	17%

Panel B: Model without Ambiguity about Return Volatility			
Relative Return Volatility $(\sigma^2_{2,0}/\sigma^2_{1,0})$	Relative Ambiguity of Expected Returns		
	$\bar{r}_{1,min} = \bar{r}_{2,min}$	$\bar{r}_{1,min} = 0.5\bar{r}_{2,min}$	$\bar{r}_{1,min} = 1.5\bar{r}_{2,min}$
0.15	3%	0%	6%

Model implied share of wealth invested in the single stock in models with and without ambiguity[29]. These estimates are computed in the benchmark model in Section 2. In the model without ambiguity, the true values of annual expected return ($\bar{r}_{2,0}$) and variance ($\sigma_{2,0}^2$) of the diversified portfolio are assumed to be 9% and 0.037, respectively. The true value of annual return variance ($\sigma_{1,0}^2$) of the single stock is assumed to 0.242, the correlation coefficient between diversified portfolio and single stock assumed to be 0.123 (see Elton and Gruber, 1977). In the model with ambiguity, the worse-case values of annual expected return ($\bar{r}_{2,min}$) and variance ($\sigma_{2,max}^2$) of the diversified portfolio are assumed to be same as the true values in the model without ambiguity.

[29] The risk aversion and wealth level are calibrated such that 30% of wealth is invested in the risky portfolio and 70% invested in the safe asset, in Markowitz (1952) framework that contains a safe asset with return of 2% and a risky asset with expected return of 9%.

APPENDIX B

FAMILY INVESTMENT DECISION WITH TREASURY BILLS

We also consider the optimal portfolio choice problem faced by the family owners who choose to invest in three assets, the family's firm with return r_1, a diversified portfolio with return r_2 and Treasury Bills with return r_3. We use Treasury Bills as a proxy for the risk-free asset with nonzero variance.[30]

Table A.2 shows that the average return and standard deviation of 30-day Treasury Bills is significantly lower than that of the market portfolio, and the standard deviation of the return on Treasury Bills is significantly different from zero. The standard deviation of longer-term Treasury Bonds is much higher.

[30] 30-day Treasury Bills are commonly used as a proxy for the risk free asset in asset pricing and optimal portfolio choice literatures.

Table A.2.

Summary Statistics of Return on Treasury Bonds and Market Index

Summary statistics of annual real returns on Treasuries and CRSP Stock Market Index. The returns are deflated using inflation rate computed from CPI. The returns on treasuries, CPI and market index are from CRSP dataset available on WRDS.

		Treasury Bonds/Bills				
	Market Index	*30 year*	*10 year*	*5 year*	*2 year*	*30 day*
Annual Return (%) 1942-2017	9.15	2.11	1.86	1.80	1.31	0.15
Annual Volatility (%) 1942-2017	18.50	13.51	9.71	7.10	5.20	3.55
Annual Return (%) 1995-2017	9.56	6.10	4.38	3.64	2.16	0.41
Annual Volatility (%) 1995-2017	20.19	17.61	8.95	5.93	3.59	2.11

We assume that returns on all three assets, r_1, r_2 and r_3, are independent and normally distributed. To focus on the investment choice between the family firm and the market portfolio, we assume no ambiguity regarding the return on Treasury Bills. That is, we assume the true value of the mean and variance of returns on the family firm and the market portfolio, r_1 and r_2, are unknown to investors while the true value of the mean and variance of returns on Treasury Bills are known to all investors. The true value of the mean and variance of the return on asset i, r_i, is denoted as $(\bar{r}_{i,0}, \sigma_{i,0})$ for i =1, 2, 3. Investors perceive that the mean and variance of r_1 and r_2 belong to a set of possible values $\Theta_1 = \{(r_{1,n}, \sigma_{1,m}), n = 1,2, \dots, N, m = 1,2, \dots, M\}$, and $\Theta_2 = \{(r_{2,n}, \sigma_{2,m}), n = 1,2, \dots, N, m = 1,2, \dots, M\}$, which contain the true values of mean and standard deviation $(\bar{r}_{i,0}, \sigma_{i,0})$, for i = 1, 2. That is, the true values $\bar{r}_{i,0}$ and $\sigma_{i,0}$ lie between $[\bar{r}_{i,min}, \bar{r}_{i,max}]$ and $[\sigma_{i,min}, \sigma_{i,max}]$, respectively, for i = 1, 2. We further assume that the mean return on Treasury Bills is smaller than the minimum mean returns on the family firm and the market portfolio, and the variance of return on Treasury Bills is smaller than the minimum variances of returns on the family firm and the market portfolio, that is,

$$\begin{gathered} \bar{r}_{1,min} > \bar{r}_3,\ \bar{r}_{2,min} > \bar{r}_3 \\ \sigma_{1,min} > \sigma_3,\ \sigma_{2,min} > \sigma_3 \end{gathered} \tag{A.1}$$

As in our benchmark model, we assume that family owners have private information regarding the fundamentals of the family firm, which allows them to reduce the ambiguity about the fundamentals of their own firms over time and through experience. However, the family owners cannot obtain material, non-public information about firms in the broad portfolio as they do not manage these other firms. In our setup, the reduction in the ambiguity is captured by the shrinkage in the range of all possible means and variances on the return on the family firm.

A.1.1 The family's investment decision

For each time period t, the decision problem of the family owners with CARA utility can be formulated as

$$\max_{\alpha_1,\alpha_2} \min_{\theta_1\in\Theta_1,\theta_2\in\Theta_2} E_t[-exp(\gamma W_{t+1})]$$

$$s.t. W_{t+1} = W_t[\alpha_1 r_{1,t+1} + \alpha_2 r_{2,t+1} + (1-\alpha_1-\alpha_2) r_{3,t+1}] \tag{A.2}$$

where W_t is the wealth of the family at time t, $r_{1,t+1}$, $r_{2,t+1}$ and $r_{3,t+1}$ are the returns on the family firm, market portfolio and Treasury Bills at time t+1, respectively. α_1 and α_2 are the shares of wealth invested in the family firm and market portfolio, respectively. We allow for short sales in all the assets, and do not restrict α_1 and α_2 to be positive and less than one.

It can be easily shown that the decision problem of the family owners can be transformed as,

$$\max_{\alpha_1,\alpha_2}\ \min_{\bar{r}_{1,n_1},\bar{r}_{2,n_2},\sigma_{1,m_1},\sigma_{2,m_2}} \Big\{\big[\alpha_1\big(\bar{r}_{1,n_1}-\bar{r}_3\big)+\alpha_2\big(\bar{r}_{2,n_2}-\bar{r}_3\big)+\bar{r}_3\big] - \frac{\gamma W_t}{2}\big[\alpha_1^2\sigma_{1,m_1}^2+\alpha_2^2\sigma_{2,m_2}^2+(1-\alpha_1-\alpha_2)^2\sigma_3^2\big]\Big\} \quad (A.3)$$

Let's first examine the minimization problem of (A.3). Since the objective function in (A.3) is monotonically decreasing in σ_1^2 and σ_2^2, the maximum possible value of variance is always chosen, that is

$$\sigma_1^* = \sigma_{1,max} \equiv \max_{m=1,2,..,M}\{\sigma_{1,m}\}$$

$$\sigma_2^* = \sigma_{2,max} \equiv \max_{m=1,2,..,M}\{\sigma_{2,m}\}$$

As long as the family is long in the assets, they only care about the minimum possible expected return of this asset. If the family shorts the asset, then the maximum possible mean return of this asset is chosen, that is,

$$(\bar{r}_1^*,\bar{r}_2^*) = \begin{cases}(\bar{r}_{1,min},\bar{r}_{2,max}), & if\ \alpha_1>0\ and\ \alpha_2<0\\ (\bar{r}_{1,min},\bar{r}_{2,min}), & if\ \alpha_1>0\ and\ \alpha_2>0\\ (\bar{r}_{1,max},\bar{r}_{2,min}), & if\ \alpha_1<0\ and\ \alpha_2>0\end{cases}$$

Assumption (A.1) implies that it is never optimal for the family owners to short both the family firm and the market portfolio at the same time. Given the solution to the minimization problem (A.3), the optimal share invested in the family business and the market portfolio can be characterized as following:

Case 1: If the following condition is satisfied,

$$\big(\bar{r}_{1,min}-\bar{r}_{2,max}\big)\sigma_3^2 > \big(\bar{r}_{2,max}-\bar{r}_3\big)\sigma_{1,max}^2+\gamma W_t\sigma_3^2\sigma_{1,max}^2$$

then the family owners go long on the family stock and short the diversified portfolio

$$\alpha_1^* = \frac{(\bar{r}_{1,min} - \bar{r}_3)\sigma_{2,max}^2 + (\bar{r}_{1,min} - \bar{r}_{2,max})\sigma_3^2 + \gamma W_t \sigma_{2,max}^2 \sigma_3^2}{\gamma W_t(\sigma_{1,max}^2 \sigma_{2,max}^2 + (\sigma_{1,max}^2 + \sigma_{2,max}^2)\sigma_3^2)} > 0$$

$$\alpha_2^* = \frac{(\bar{r}_{2,max} - \bar{r}_3)\sigma_{1,max}^2 + (\bar{r}_{2,max} - \bar{r}_{1,min})\sigma_3^2 + \gamma W_t \sigma_{1,max}^2 \sigma_3^2}{\gamma W_t(\sigma_{1,max}^2 \sigma_{2,max}^2 + (\sigma_{1,max}^2 + \sigma_{2,max}^2)\sigma_3^2)} < 0$$

$$1 - \alpha_1^* - \alpha_2^* = \frac{-(\bar{r}_{1,min} - \bar{r}_3)\sigma_{2,max}^2 - (\bar{r}_{2,max} - \bar{r}_3)\sigma_{1,max}^2 + \gamma W_t \sigma_{1,max}^2 \sigma_{2,max}^2}{\gamma W_t(\sigma_{1,max}^2 \sigma_{2,max}^2 + (\sigma_{1,max}^2 + \sigma_{2,max}^2)\sigma_3^2)} \gtrless 0$$

This is the case when the family's private information allows them to significantly reduce the ambiguity of their family firm relative to the other firms, and the minimum expected return of family firm is much larger than the maximum possible expected return of the diversified portfolio (in excess of return on Treasury Bills), then the family chooses to invest as much as possible in their own firm. In this case, the share invested in the family firm decreases with the risk aversion and family wealth. However, we argue this is an extreme case and does not apply to the marginal family owners who may exit, as the family would never exit in this case. Furthermore, we argue this is a case rare in the reality, as it is extreme for the family to think the minimum risk adjusted expected return of the family firm is much larger than the maximum possible expected return of the diversified portfolio.

Case 2: If the following condition is satisfied,

$$-(\bar{r}_{1,min} - \bar{r}_3)\sigma_{2,max}^2 - \gamma W_t \sigma_3^2 \sigma_{2,max}^2 < (\bar{r}_{1,min} - \bar{r}_{2,min})\sigma_3^2 < (\bar{r}_{2,min} - \bar{r}_3)\sigma_{1,max}^2 + \gamma W_t \sigma_3^2 \sigma_{1,max}^2,$$

then the family owners invest positive shares in both the family stock and the diversified portfolio

$$\alpha_1^* = \frac{(\bar{r}_{1,min} - \bar{r}_3)\sigma_{2,max}^2 + (\bar{r}_{1,min} - \bar{r}_{2,min})\sigma_3^2 + \gamma W_t \sigma_{2,max}^2 \sigma_3^2}{\gamma W_t(\sigma_{1,max}^2 \sigma_{2,max}^2 + (\sigma_{1,max}^2 + \sigma_{2,max}^2)\sigma_3^2)} > 0$$

$$\alpha_2^* = \frac{(\bar{r}_{2,min} - \bar{r}_3)\sigma_{1,max}^2 + (\bar{r}_{2,min} - \bar{r}_{1,min})\sigma_3^2 + \gamma W_t \sigma_{1,max}^2 \sigma_3^2}{\gamma W_t(\sigma_{1,max}^2 \sigma_{2,max}^2 + (\sigma_{1,max}^2 + \sigma_{2,max}^2)\sigma_3^2)} > 0$$

$$1-\alpha_1^*-\alpha_2^*=\frac{-(\bar{r}_{1,min}-\bar{r}_3)\sigma_{2,max}^2-(\bar{r}_{2,min}-\bar{r}_3)\sigma_{1,max}^2+\gamma W_t\sigma_{1,max}^2\sigma_{2,max}^2}{\gamma W_t(\sigma_{1,max}^2\sigma_{2,max}^2+(\sigma_{1,max}^2+\sigma_{2,max}^2)\sigma_3^2)}\gtrless 0$$

In this case, the family owners still have less ambiguity about the expected return on their own firm relative to other firms. However, the private information advantage is not as large as it is in Case 1, so the family firm chooses to invest positive share of wealth in both the family firm and the diversified portfolio.

Case 3: If the following condition is satisfied,

$$(\bar{r}_{1,max}-\bar{r}_{2,min})\sigma_3^2<-(\bar{r}_{1,max}-\bar{r}_3)\sigma_{2,max}^2-\gamma W_t\sigma_3^2\sigma_{2,max}^2$$

then the family owners short the family stock and go long on the diversified portfolio

$$\alpha_1^*=\frac{(\bar{r}_{1,max}-\bar{r}_3)\sigma_{2,max}^2+(\bar{r}_{1,max}-\bar{r}_{2,min})\sigma_3^2+\gamma W_t\sigma_{2,max}^2\sigma_3^2}{\gamma W_t(\sigma_{1,max}^2\sigma_{2,max}^2+(\sigma_{1,max}^2+\sigma_{2,max}^2)\sigma_3^2)}<0$$

$$\alpha_2^*=\frac{(\bar{r}_{2,min}-\bar{r}_3)\sigma_{1,max}^2+(\bar{r}_{2,min}-\bar{r}_{1,max})\sigma_3^2+\gamma W_t\sigma_{1,max}^2\sigma_3^2}{\gamma W_t(\sigma_{1,max}^2\sigma_{2,max}^2+(\sigma_{1,max}^2+\sigma_{2,max}^2)\sigma_3^2)}>0$$

$$1-\alpha_1^*-\alpha_2^*=\frac{-(\bar{r}_{1,max}-\bar{r}_3)\sigma_{2,max}^2-(\bar{r}_{2,min}-\bar{r}_3)\sigma_{1,max}^2+\gamma W_t\sigma_{1,max}^2\sigma_{2,max}^2}{\gamma W_t(\sigma_{1,max}^2\sigma_{2,max}^2+(\sigma_{1,max}^2+\sigma_{2,max}^2)\sigma_3^2)}\gtrless 0$$

This is scenario where the private information does not help to reduce the ambiguity of the family firm enough, so that the minimum possible expected return of the family business is less than the minimum possible expected return of the diversified portfolio.

Let us again focus on Case 2 where family owners invest positive shares in both the family firm and the diversified portfolio. In this case, we can rewrite the optimal investment share in the family firm as

$$\alpha_1^*=\frac{(\bar{r}_{1,min}-\bar{r}_3)/\sigma_3^2+(\bar{r}_{1,min}-\bar{r}_{2,min})/\sigma_{2,max}^2+\gamma W_t}{\gamma W_t(\sigma_{1,max}^2/\sigma_{2,max}^2+\sigma_{1,max}^2/\sigma_3^2+1)} \qquad \text{(A.4)}$$

The optimal share depends on the Sharpe ratio of the family firm relative to the treasury bills as well as the market portfolio. When the family has less ambiguity about the variance and the expected return of the family firm, that is, the smaller are $\sigma_{1,max}^2/\sigma_{2,max}^2$ and

$\sigma_{1,max}^2/\sigma_3^2$ or the larger are $(\bar{r}_{1,min} - \bar{r}_3)/\sigma_3^2$ and $(\bar{r}_{1,min} - \bar{r}_{2,min})/\sigma_{2,max}^2$, the more likely the family will continue to invest in the family firm. Thus, the key concern about risk adjusted return centers on the ambiguity of the variance rather than the level of the variance. Moreover, if the family has little information about the return volatility of the diversified portfolio (relative to their own firm), then they would put a very high upper bound on the perceived return volatility of this asset ($\sigma_{2,max}^2$ is high). This implies that they would invest little in the diversified portfolio. Suppose the family is extremely averse to ambiguity, or the relative ambiguity about the return volatility of the diversified portfolio gets extremely large, then the family would invest nothing in the diversified portfolio, regardless of their risk aversion or wealth level.

To study the relationship between the share invested in the family firm and the characteristics of the family such as risk aversion and wealth of the family, we found it is necessary to focus on the Case 2. Taking the derivative of the optimal share in family share (α_1^*) with respect to risk aversion (γ) and wealth (W_t), we have

$$\frac{\partial \alpha_1^*}{\partial(\gamma W_t)} = -\frac{(\bar{r}_{1,min}-\bar{r}_3)/\sigma_3^2+(\bar{r}_{1,min}-\bar{r}_{2,min})/\sigma_{2,max}^2}{(\gamma W_t)^2(\sigma_{1,max}^2/\sigma_{2,max}^2+\sigma_{1,max}^2/\sigma_3^2+1)} \tag{A.5}$$

If the family owners have less ambiguity regarding the family firm and think the return on their family firm is so good that the minimum return is sufficiently larger than that of the market portfolio such that the Sharpe ratio relative to the market portfolio is larger than the Sharpe ratio relative to the Treasury Bills, that is,

$$\frac{(\bar{r}_{1,min} - \bar{r}_{2,min})}{\sigma_{2,max}^2} > -\frac{(\bar{r}_{1,min} - \bar{r}_3)}{\sigma_3^2}$$

then the family will always invest positive share in the family business will not consider exiting. However, we are more interested in the case where

$$\frac{(\bar{r}_{1,min} - \bar{r}_{2,min})}{\sigma^2_{2,max}} < -\frac{(\bar{r}_{1,min} - \bar{r}_3)}{\sigma^2_3} < 0$$

The family thinks the minimum expected return of the family business is smaller than that of the market portfolio. This is the case that captures the marginal family investors who might consider the exit decision. In this case, (A.5) is positive and the more risk averse is the family or the more wealth the family has, the larger share of wealth is invested in the family firm, and the less likely for the family to exit, *ceteris paribus.* Hence, the predictions of our benchmark model still hold when the choice set of the family owners includes not only two risky assets with different levels of ambiguity but also a government bond that proxies for the relatively low risk asset without ambiguity.