Founding Family CEO Pay Incentives and Investment Policy: Evidence from a Structural Model

Mieszko Mazur[1] and Betty (H.T.) Wu[2]

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Abstracts

We examine the relation between founding family and corporate investment policy through the incentives of CEO compensation in a structural framework. We focus on two pay sensitivities, delta and vega, which motivate managerial efforts and risk-taking behavior, respectively. We find that vega is lowest and delta is highest in active family firms despite no significant differences in both measures between passive and non family firms. Delta decreases while vega increases riskier R&D investments. Active family firms allocate less capital to R&D projects. Intriguingly, our subgroup analysis shows that delta and active family firms decrease R&D for high risk firms while vega increases R&D for low risk firms. Capital expenditures are not associated with incentive pay and founding family presence. We also find that vega increases both the number and the value of M&A activities, driven by high risk firms in which delta and active family firms reduce diversification. Overall, our results suggest that CEO pay incentives induce investment policy contingent on firm risk. In addition, despite the preference for low risk in active family firms, after replacing family CEOs with outside professionals, investments in risky R&D projects increase, consistent with the horizon hypothesis.

Keywords: CEO compensation, corporate investments, dual agency problems, founding family firm, option portfolio sensitivities
JEL Classification: G3

[1] IESEG School of Management, 3 rue de la Digue, 59000 Lille, France, email: m.mazur@ieseg.fr.
[2] University of Glasgow Adam Smith Business School, Glasgow G12 8QQ, United Kingdom, phone: +44(0)1413306289, e-mail: Betty.Wu@glasgow.ac.uk.

1 Introduction

In modern corporations, there exists a common organization form noted for its separation of ownership and control, which gives rise to the typical principal-agent problem due to the conflict of interest between shareholders and managers. Concentrated ownership, together with unification of ownership and management, is able to overcome the free-rider problem and provide a remedy to this agency problem (Jensen and Meckling, 1976). Demsetz and Lehn (1985) and Shleifer and Vishny (1986) have long argued that this Berle and Means (1932) type of firms with separated ownership and control is not a comprehensive form of publicly traded firms, which is supported by various cross-country studies (e.g., La Porta et al., 1999; Morck et al., 2000; Claessens et al., 2000; Faccio and Lang, 2002). In the U.S., while public firms are generally regarded as owned by dispersed shareholders, family ownership in fact exists in more than one-third of S&P500 firms, and families own 18 percent of shares on average (Anderson and Reeb, 2003a; Villalonga and Amit, 2006). Other than their prevalence, families constitute a persistent class of shareholders who maintain substantial ownership in nearly one-half of the largest 2000 U.S. industrial firms even decades after going public (Anderson et al., 2009).

Prior literature on family firms most relates family ownership to performance. Several studies show that S&P500 family firms have better performance than their nonfamily counterparts (e.g., Anderson et al., 2009). More recent research investigates other aspects of family firms[3] and also attempts to examine potential sources of outperformance empirically. For instance, Anderson et al. (2012a) explore the relation between family ownership and investment policy from the perspective of different risk preferences between family and nonfamily shareholders. They find that family firms devote less capital to long-term investments, and market seemingly discounts below-industry investment levels. They argue that their empirical evidence indicates that family firms affect corporate investment policy by their preferences for lower risk rather than efficient monitoring or longer horizon.

In addition to family ownership/control, equity-based CEO compensation which makes CEO wealth sensitive to both firm risk and performance (Guay, 1999) is used to address the typical agency problem. One of the observable managerial decisions is the choice of corporate investments. Two CEO pay incentives, delta (i.e., the change in the value of CEO pay in response to a 1% change in the stock price) and vega (i.e., the change in the value of the CEO pay in response to a 1% change in stock return volatility), are expected to affect investment policy that impacts firm risk and performance as a result. One the one hand, delta may induce CEOs to make positive net present value (NPV) investment choices despite its implications on risk-taking is ambiguous theoretically and empirically (e.g., Hagendorff and Vallascas, 2011). On the other hand, vega may make risky investments more tolerable to risk averse CEOs so that they are more willing to undertake risky projects, supported by empirical evidence (Coles et al., 2006; Hagendorff and Vallascas, 2011).

[3] For instance, Anderson et al. (2009) explore the corporate opacity of family firms. Anderson et al. (2012b) study the relation between family firms and the information content of short sales.

Cadenillas et al. (2004) present a model showing that higher managerial efforts and project risks are associated with higher firm value.

In this paper, we examine how founding family influences corporate investment policy through the incentives provided by CEO compensation in a structural model framework. We focus on four types of corporate investments including capital expenditures, research and development (R&D), mergers and acquisitions (M&A) and corporate segments, which reflect varying degrees of riskiness and different value-enhancing sources (e.g., Coles et al., 2006; Hagendorff and Vallascas, 2011, Kothari et al., 2002). We adopt a structural framework for analysis because it enables broad data-analytic modeling that could evaluate multi-equations and address some endogeneity issues better. Lastly, unlike the two-type categorization commonly adopted in the literature, similar to Chen et al. (2007), we classify firms as three types. Type I firm is active founding family firm: i.e. controlled and run by the founding family; Type II firm is passive founding family firm: i.e. controlled but not run by the founding family; Type III firm is non founding family firm: i.e. neither controlled nor run by the founding family. We believe this refines the analysis and avoids spurious inferences.

Anderson et al. (2012a) argue that risk aversion and extended investment horizons of families lead to differences in investment policy between family and nonfamily firms. Risk aversion of families potentially results in fewer risky projects due to substantial and undiversified ownership. Nevertheless, their long-term commitment likely mitigates this risk aversion and allocates capital to investments with long-term horizons. Furthermore, the informational advantage in monitoring of families helps alleviate risk aversion derived from the opaque nature of R&D process (Anderson and Reeb, 2003b). Therefore, both long-term investment horizon and efficient monitoring arguments indicate an opposing effect of family firms on risky projects. Their empirical results show that family firms invest less in risky investments, which suggests that risk aversion is the dominant effect. Given that vega induces risk-taking and the risk aversion hypothesis, we hypothesize that CEO pay in active family firms has lower levels of vega. Besides, CEO pay in passive family firms has higher levels of vega because family ownership in such firms is typically lower than that in active family firms, and we expect the horizon and monitoring arguments to dominate. Since the effect of delta on risk-taking is ambiguous, we use it as a control variable in our analysis. Note that CEO pay in active family firms is expected to be highest because of the significant equity-based holdings.

Our sample construction starts with companies in the S&P600 SmallCap Index between 2001 and 2005. We study small firms because small firms have less aggregation bias, i.e. the aggregation of asynchronous actions across business units can smooth firm-level investment (Whited, 2006). Moreover, other than their economic significance[4], family influence is more prominent and effective in small firms compared with their more established counterparts. We exclude non-surviving firms during this period and firms in the utility and finance industry. To identify family firms, we manually check the proxy statements and other sources. We form a dataset on identity, ownership, tenure, and

[4] According to the 2009 OECD report, Small and median-sized enterprises (SMEs) account for more than 99% of all enterprises in the European Union, and more than half of labor force in the private sector in the OECD area.

biographies of founder(s), board members, blockholders, and the top 5 managers. Because the vast majority of the families identified in our sample are in fact founding families, we focus on founding family and thus family refers to founding family in the remainder of the paper. We match our sample with available accounting data, CEO compensation, and governance characteristics. In the end, we have 1,756 firm-year observations that correspond to 362 unique firms.

We find that 48.46% of the sample observations have family influence within the firm. This is consistent with the notion that family control is common in small firms. On average, CEOs have 18.9%, 3.2% and 4.33% of equity stakes in active, passive and non family firms. As expected, the level of delta is highest for active family CEOs despite not significantly different between passive and non family firms. As for vega, non family CEOs have highest level. Active and passive family CEOs have similar levels on average despite the median is relatively higher in passive family firms. After controlling for firm size and growth opportunity, our regression analysis shows that active family firms have lowest level of vega and highest level of delta while the passive and non family firms have similar levels of both measures. Moreover, active family firms commit less capital to R&D expenditures, whereas there is no significant difference in R&D between passive and non family firms after controlling for important firm-specific characteristics such as financial constraints and industry orientation. Family presence and/or CEO pay incentives seem not able to explain capital expenditures, inconsistent with Coles et al. (2006). This might suggest that capital expenditures, although viewed as a type of less risky investments, and R&D are not necessarily substitutes.

Furthermore, following Anderson et al. (2012a), we conduct similar analysis based on the classification of high and low firm risks. Interestingly, the negative association between active family firms and R&D is driven by high risk firms, and the R&D investment patterns are similar irrespective of family presence in low risk firms. This is consistent with the findings in Anderson et al. (2012a) and their risk aversion hypothesis. Moreover, the negative relation between delta and R&D is driven by high risk firms while the positive relation between vega and R&D is driven by low risk firms. It thus suggests that these incentives seem to induce investments to maintain proper firm risk based on existing firm risk. With regard to M&A activities, vega has a positive propensity with both the number and the value of M&A deals, again driven by high risk firms. Similar to capital expenditures, corporate diversification is not affected by family presence and pay incentives as a whole, although active family firms have fewer segments than passive and non family firms, and delta decreases the number of segments too when firms experience high risks. Notice that the relation between family presence and pay incentives remains regardless of firm risks.

These results hold when we replace (family) firm type dummies with (family) ownership and also when we use alternative estimation methods (to address sample selection and endogeneity issues). In summary, our study shows that active family firms tend to have lower vega and higher delta relative to passive and non family firms alike. Delta decreases while vega increases riskier R&D investments, while the former is driven by high risk firms and the latter is driven by low risk firms. Vega seemingly motivates M&A activities, driven by high risk firms. Families diversity less and allocate less capital to R&D projects in active family high risk firms in particular. Overall, by a structural model, consistent with our conjectures, our findings support the risk aversion hypothesis for active family firms and show some evidence for the horizon hypothesis for passive family firms. Our estimates further indicate that CEO pay incentives induce investments with varying degrees of riskiness and investment policy appropriate to firm risks. When facing riskier business environment, active family firms prefer less risky investments. Yet, inconsistent with the risk aversion hypothesis, they tend not to pursue risk reductions through corporate diversification, consistent with Anderson and Reeb (2003b). It can be that these families regard diversification as losing control or business focus instead of reducing risk.

We make several contributions to the literature on family firms. First, to our best knowledge, this paper is the first to analyze how family presence or ownership might influence the choice of investment policy through CEO pay sensitivities. There have been a number of studies that examine the CEO pay (incentives) in family firms (Gomez-Mejia et al., 2003; Li et al, 2012) as well as their investment patterns (Anderson et al., 2012a), but none attempts to consider these simultaneously. It is plausible that the differences observed in CEO pay structure in family firms might explain the differences in investment policy in these firms. Our study fills the gap with better analytical modeling that potentially addresses issues such as endogeneity and missing values. Our empirical evidence supports the notion that active family firms have different pay incentives from the other types of firms that affect their choices of investment policy.

Second, we refine the typical categorization of "family versus non family" firms in terms of degree of involvement or ownership by family members. We argue that the CEO’s identify matters as well. Indeed, we find that the incentives and the investment patterns appear to differ significantly in active family firms relative to passive and non family firms alike, a result which could not be captured by the traditional family firm categorization. So, a CEO’s family affiliation is a valid and important criterion to classify family firms. This also suggests that, replacing a family CEO with an outside professional means not only the transition to non family firms but also different corporate behaviors from the past. Finally, previous work on the corporate investment literature usually focuses on firm-specific characteristics. Several studies explore how managerial incentives influence observable operations and policy choices, as well as the implications (e.g., Guay, 1999; Coles et al., 2006; Hagendorff and Vallascas, 2011). Our analysis incorporates the aspect of organizational structure by considering ownership (founding family presence/ownership) and control (CEO pay incentives) at the same time. Similar to Anderson et al. (2012a), we demonstrate that owner preferences matter in the choice of corporate investment policy.

The remainder of this paper proceeds as follows: Section 2 gives a brief literature review and develops our main testing hypothesis. Section 3 describes the data collection, sample formation, and variable construction. Section 4 shows our empirical results. Section 5 summaries the findings and concludes.

2 Hypothesis development

2.1 Family firms, dual agency problems and investment choices

As mentioned in the beginning, the typical agency problem stems from the separation of ownership and control. Family ownership is able to minimize the free-rider problem that hinders effective monitoring, and to reduce the agency costs when united with management. Additionally, since family members tend to accumulate their wealth through their businesses, they are less likely to have a short time horizon in an opportunistic manner during decision making process (e.g., Anderson and Reeb, 2003a; Bartholomeusz and Tanewski, 2006). Family managers can also create altruistic effects that are beneficial to stakeholders (Schulze et al., 2001). Empirically, some studies find family firms have superior market and accounting performance relative to their comparable nonfamily firms (e.g., Anderson et al., 2009).

However, there exists another type of agency problem in family controlled firms, i.e., the conflict of interests between large and small shareholders (Shleifer and Vishny, 1986; La Porta et al., 1999). Faccio et al. (2001) argue that concentrated ownership gives rise to expropriation of minority shareholder interests in listed family firms. DeAngelo and DeAngelo (2000) and Anderson and Reeb (2003a) suggest that founding family firms are more subject to issues derived from private benefit of control such as extraordinary dividend payouts, risk avoidance, excessive compensation schemes, and related party transactions. In addition, agency costs in family firms might be created through management entrenchment. For instance, several empirical studies document that founding family firms are more reluctant to maintain board independence (Anderson and Reeb, 2004; Bartholomeusz and Tanewski, 2006).

Based on this type of agency problem arising between family and non family shareholders, Anderson et al. (2012a) use 2000 largest U.S. firms from 2003 to 2007 and test two hypotheses, risk aversion and investment horizon, that predict opposing effects of family firms on investment policy. For families, the source of strong risk aversion is their concentrated stake in a firm. Because their wealth largely depends on their firm’s prosperity, families have a greater tendency to reduce firm risk compared with other diversified shareholders. The uncertainties of long-term investments potentially increase the levels of idiosyncratic risk which small shareholders can diversity but families cannot. Moreover, greater risk aversion suggests a higher discount rate that shortens the investment horizons. These two firm risk arguments give rise to the risk aversion hypothesis that predicts fewer long-term and riskier investments in family firms than non in family firms.

On the other hand, the investment horizon hypothesis is developed from the notion that families have long-term commitments and perspectives to ensure their firm’s prosperity. Coupled with their effective monitoring from ownership, they can conceivably avoid myopic behavior typically observed in the nonfamily firms (Stein, 1988). The horizon hypothesis, therefore, indicates that family firms devote more capital to long-term and riskier projects relative to non family firms. The authors find a negative relation between family firms and capital allocation to riskier R&D projects and argue that the risk aversion hypothesis dominates the horizon hypothesis when it comes to investment policy in family firms. On the contrary, Anderson and Reeb (2003b) show that family firms diversity less than, and maintain similar levels of debt as nonfamily firms, which do not support the risk aversion hypothesis.

2.2 CEO pay incentives and risk-taking

Option delta and vega are referred to as the slope and convexity, respectively, of the CEO pay-performance relation (Jensen and Meckling, 1976). In other words, delta is for the purpose of incentive alignment which provides a remedy for the agency problem due to the separation of ownership and control. Vega is for the risk-taking incentive in response to CEO risk aversion because of the undiversifiable wealth concerns, similar to diverging risk tolerances between large and small shareholders.

On the theoretical front, it is commonly argued that convex payoffs of stock options should mitigate CEO risk aversion and provide incentives to CEOs to undertake risky investments. However, it depends on the managerial utility function. Guay (1999) and Ross (2004) show that the concavity of the utility function of a risk-averse manager can way offset the incentives from the convexity of pay structure. Ju et al. (2002) illustrate that a call option contract can induce not only too much but also too little risk-taking behavior. Moneyness of options can have different impact on risk-taking behavior. Out-of-the-money or at-the-money options induce better risk-taking behavior than in-the-money options (Lewellen, 2003; Parrino et al., 2005). Empirically, several studies link managerial stock and/or option holdings to financial strategies as well as corporate focus, with mixed results[5]. The evidence on firm risk is more consistent: return volatility is positively associated with the pay-risk sensitivity (Guay, 1999; Cohen et al., 2000).

Corporate investments are crucial to firm valuation or performance. Different investment types have varying degrees of riskiness and horizons. Accounting treatment separates long-term investments into two different categories of expenditures: R&D and capital expenditures, which are different in terms of information asymmetry, project outcome uncertainty (Kothari et al., 2002), flight-risk of human capital (Anderson et al., 2012a) and tangibility. It is commonly argued that R&D investments are more risky. Kothari et al. (2002) show that R&D spending has a larger effect on the variability of future operating income than capital expenditures by approximately 30-70%. In addition, R&D provides long-term benefits more than capital expenditures (e.g., Hall et al., 2005). Consequently, R&D spending is typically riskier with longer investment horizon, relative to capital expenditures.

Extant literature shows that vega affects the choice of investment policy. Coles et al. (2006) find that vega increases R&D, diversification and leverage while decreases capital expenditures after controlling for delta and the feedback effects of firm policy and risk on the managerial compensation. Similarly, Nam et al. (2003) also find that vega is related to more leverage and higher levels of R&D.

[5] For instance, see Mehran (1995), Berger et al. (1997), Denis et al. (1997), Anderson et al. (2000) and Rogers (2002).

Hagendorff and Vallascas (2011) show that vega increases risk-inducing mergers in the banking industry after controlling for delta and other firm-specific and governance attributes[6].

Despite the clear implications of vega on corporate investments, the relationship between delta and risk-taking is ambiguous. Theoretically, on the one hand, delta motivates managerial efforts to identify positive NPV projects that can be risky. On the other hand, such (high level of) riskiness can expose managers to a level that exacerbates managerial risk aversion (Hagendorff and Vallascas, 2011). This might explain inconsistent findings in empirical studies (e.g., Coles et al., 2006; Datta et al., 2001; Mehran and Rosenburg, 2007).

2.3 Family firms and CEO compensation

To our best knowledge, there is still little research that examines the relation between family firms and CEO compensation. Gomez-Mejia et al. (2003) first investigate the determinants of executive compensation in publicly traded family firms in the U.S., and they find that family CEOs of family-controlled firms receive lower total income than outside professional CEOs, in which the difference increases with family ownership concentration. Meanwhile, their pay tends to be more insulated from systematic risk, which is further moderated by the presence of institutional investors and R&D intensity. They argue that institutional investors might reduce equity-based income in order to avoid conservative decisions in an already risk-averse family business context. Li et al. (2012) analyze the influence of founding family ownership and managerial involvement on pay incentives. They find that when families participate in management, family firms have lower levels of delta and vega. Moreover, family ownership is negatively associated with both pay incentives as well.

Cai et al. (2010) use a detailed survey of Chinese private family firms to examine the relationship between managerial family ties and compensation. They document that, in the same firm, family managers receive more salary and bonus (with lower sensitivity to firm performance), hold higher positions, and are given more decision rights and job responsibilities than non-family managers. Bandiera et al. (2010) also use survey data in Italy with information on managers' risk profile as well as human capital, and on their compensation schemes, along with the firms that employ them. They find that, compared with non-family firms, family firms are more likely to offer lower and flatter compensation schemes. These firms attract less talented and more risk-averse managers, who would put less effort into work and receive lower satisfaction from work. Note that since almost none of their sample managers belong to the family who owns the firm, in their paper family firms in fact refer to passive family firms in our setup.

2.4 Hypothesis

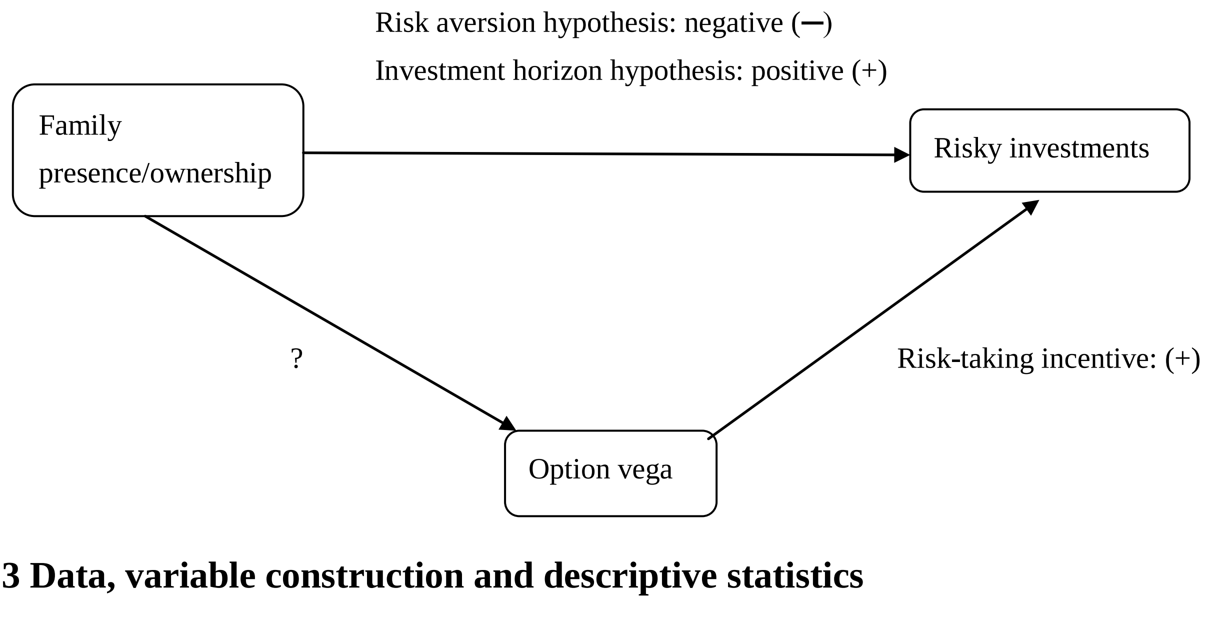
Chen et al. (2007) study how the founding family’s presence affects agency problems related to CEO turnover decisions and on firm valuations after poor performance. They focus on three types of

[6] Mehran and Rosenburg (2007) find that vega increases volatility of equity return and asset value alike at banks.

family firms, i.e., family CEO firms, professional CEO family firms (family firms managed by a non family CEO), and non family firms. Their findings indicate that agency problems are less severe when family ownership is separated from management, consistent with the hypothesis of dual agency problems. Following this line of arguments, we classify firms by two criteria, family affiliation of CEO and family ownership. As a result, we have three types of family firms shown as follows,

	Family CEO	Non-Family CEO
Family ownership	Active family firm (I)	Passive family firm (II)
No family ownership		Non family firm (III)

The prior research shows that family firms have different CEO compensation structures and corporate investment choices relative to their comparable non family firms. Therefore, it is plausible that, for family firms, the differences in incentive pay explain the differences in choices of investment policy. We develop our testing hypothesis from the following diagram. Based on the two competing hypotheses that predict opposing relations between family presence/ownership and risky investments, together with the positive relation that vega has with risky investments, in this paper we conjecture that, if family-controlled firms have (sufficiently) negative levels of vega to offset the positive effect of vega on risky investments, the total effects of family presence/ownership on risky investments would be negative, which indicates that the risk aversion hypothesis dominates the horizon hypothesis. Otherwise, the total effects of family presence/ownership on risky investments would be positive, if not zero, which suggests that the horizon hypothesis dominates, if at all.



3 Data, variable construction and descriptive statistics

3.1 The sample and data

To avoid the aggregation bias that potentially rises with firm size (Whited, 2006), our analysis focuses on small firms. We form our sample by using companies in the S&P600 SmallCap Index between 2001 and 2005, the most recent period which has no major disruptive financial or economic events. We exclude non-surviving firms in this Index during this entire period. It thus ensures that our sample firms remain to be relatively small. We further exclude utility (SIC codes 1311, 4911 to 4991) and financial firms (SIC codes 6020 to 6799) because these firms are typically under government regulation that might affect their investment policy and ownership structure. We also exclude spin-off firms. These sample selection criteria result in 1756 firm-year observations that represent 362 unique firms. We match our final sample with available accounting data in Compustat, compensation data in ExecuComp[7], corporate governance data in RiskMetrics.

To identify family firms, we manually check the proxy statements for each company, along with other sources whenever needed[8], which provide us with the following information: identity, ownership, tenure, and biographies of founder(s), board members, blockholders, and the top 5 managers, whenever available. We classify a firm as a family firm as long as one of the following two criteria is met: 1. founder or descendant of the founder sits on the board and/or is a blockholder; 2. at least two board members are related, either by blood or marriage[9]. Overall, 48.46% of the sample observations are affiliated with founding families, about 5.13% are with non founding families, and 46.41% are run and owned by outsiders. Given the low presence of the non founding family in our sample, these non founding family firms are classified as non family firms in our sample. In this paper, therefore, we focus on the distinction between founding and non founding family. Among our 1756 firm-year observations, 498 (28.36%) are active family firms; 353 (20.10%) are passive family firms; 905 (51.54%) are non-family firms.

3.2 Variable construction

3.2.1 Pay incentives

Our main estimates for incentive pay are two CEO option portfolio sensitivities. Basically, we follow Core and Guay (2002) and Brockman et al. (2010) to calculate two sensitivity measures. First, the CEO's portfolio price sensitivity (*PRCSEN*) is defined as the change in the value of the CEO's stock holding and option portfolio in response to a 1% change in the firm's stock price. Second, the CEO's portfolio volatility sensitivity (*VOLSEN*) is defined as the change in the value of the CEO's option portfolio in response to a 1% change in stock return volatility. Partial derivatives of the option price with respect to stock price (delta δ) and stock return volatility (vega v) are based on the Black and Scholes (1973) for valuing European call options, adjusted for dividend payouts by Merton (1973). We provide a detailed discussion of the derivation of delta and vega in Appendix A.

According to Core and Guay (2002), in theory the option sensitivity to stock price (delta) and the option sensitivity to price volatility (vega) should have a negative relation. Our data suggest otherwise.

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[7] We rely on the CEO identification in ExecuComp (item *CEOANN*) to form the sample. Note that, in cases of CEO turnover in a given year, the ExecuComp typically identifies the departing CEO as the annual CEO. However, the proxy statement reports the replacing one as the company CEO.

[8] Such as, Linkedin, Zoominfo, the website of the company, and etc.

[9] Follow Gomez-Mejia et al. (2003), we consider father, mother, sister, brother, son, daughter, spouse, in-laws, aunt, uncle, niece, nephew, and cousin.

As shown in Figure 1, by and large delta and vega seemingly have a positive linear relation (or concave relation), which is robust across three firm types in our sample. Moreover, these distribution plots indicate that active family firms have a distinct pattern of pay incentives relative to passive and non family firms that show similar patterns.

3.2.2 Long-term investments, M&A and corporate segments

With regard to accounting-wise long-term investments, we collect data from Compustat database. Capital expenditure and R&D expenses are measured as a fraction of total assets which helps better comparison over time and across firms. We match our sample observations with M&A data from the Securities Data Corporation's (SDC) US Mergers and Acquisitions Database. We measure M&A activity by two proxies, the number and the total transaction value, scaled by market capitalization, of the M&A deals made by a firm in a given year. Note that SDC does not report transaction values for a substantial amount of M&A deals (about 55% in the deals made by our sample firms), especially for those in which the target firm is a private firm or a subsidiary of a public firm, and some small deals could go unrecorded in SDC (e.g., Celikyurt et al., 2010). A common method employed in the literature is to assume these missing values to be zero, which could seriously underestimate the actual transaction values. To address this issue, we use the number of deals as an alternative measure for analysis.

To measure corporate diversification, we gather corporate segment data from the Compustat Historical Segments database, which includes firms' self-reported line of business and geographic segment data since 1979. Note that because these segment data are self-reported, however, the information is not based on standardized definitions of lines-of-business and geographic areas. We first remove duplicates of segment records and ensure that each segment is unique for its corresponding firm-year. We use total sales of each segment, whenever possible, as weights to calculate firm-wise HHI (Herfindahl-Hirschman Index). In addition, we use a binary variable that is assigned to value one when a firm has more than one business segment, and zero otherwise (Anderson and Reeb, 2003b). Finally, we match these two variables to our sample observations.

3.2.3 Control variables

Pay incentives

Prior work shows more interest in the resulting effects of pay incentives than the incentives themselves. Generally, these incentives are regarded as exogenous in the analysis. Even so, a number of studies view the structure of pay incentives as a choice and thus of research interest in its own right. Earlier, delta has attracted a strong academic interest (e.g., Bizjak et al, 1993; Core and Guay, 1999). More recent research shifts the interest to vega, or with delta simultaneously. The evidence suggests that, on the one hand, vega is positively related to sales, market-to-book, firm risk, and CEO cash compensation (Coles et al., 2006). On the other hand, delta is positively associated with market-to-book, CEO tenure, and firm risk (Coles et al, 2003 and 2006; Core and Guay, 2002) despite the evidence with regard to the relation between firm risk and delta is mixed (Aggarwal and Samwick, 1999). These findings together indicate that delta and vega are determined by several common factors. We use total sales, normalized by natural logarithm, Tobin's Q, and CEO duality (as a proxy for corporate governance) as three control variables in our analysis.

Corporate investments

There is a tremendous amount of literature on the determinants of corporate investments. Because we aim to examine how family firms affect their investment choices, similar to Anderson et al. (2011), we include two sets of control variables that capture asset and financing attributes that potentially influence investment policy. To start with, we use the natural logarithm of total sales to control for firm size. We use Tobin's Q, defined as the market value of total assets scaled by the book value of total assets, to control for growth opportunity. We calculate this by summing up total assets and the market value of equity minus book value of equity and balance sheet deferred taxes, normalized by total assets. We also control for life cycle by using the natural logarithm of firm age, which is the difference between the founding year and the current year. We collect data on founding year from various sources such as FundingUniverse.com, proxy statements, and company websites.

Furthermore, we use four measures to account for the impact of financing constraints. First, we use cash holdings over total assets to measure a firm's liquidity or ability to provide internal funding for investments. Second, we use long-term debt over total assets to measure a firm's leverage ratio which shows its funding capacity, both internally and externally. Third, we use total property, plant and equipment over total assets to measure asset tangibility that represents a firm's ability to obtain external financing because it reduces contracting problems (Almeida and Campello, 2007). Lastly, we use cash dividends over total assets to control for dividend payout. On the one hand, firms with financial constraints have significantly lower dividend payout ratios. On the other hand, all else equal, firms allocating more capital to investments have fewer financial resources for dividend payouts. So, the relation between investment expenses and dividend payouts is not clear, depending on whether the financial constraint or the substitution effect dominates. We also include dummy variables for industry and year fixed effects in our regression analysis. Table 1 describes the variable definition and data source in this paper.

3.3 Descriptive statistics

Table 2 provides three panels of descriptive statistics of our sample observations. Panel A shows means, medians, standard deviations, maximums, and minimums for our principal variables of interest. Panel B displays industry classifications of our sample with respect to family firm types. Panel C shows between-sample (family firm type) comparisons of selected CEO- and firm-specific attributes. As shown in Panel A, on the whole, the mean (median) level of delta is $299,190 ($132,140) and the level of vega is $49,630 ($30,800). These numbers are almost half of those reported in Coles et al. (2006) and Hagendorff and Vallascas (2011). This can be because our sample firms are relatively small, and small firms tend to have smaller compensation relative to their larger establishments[10]. Our sample has a mean (median) ownership of 8.23% (2.5%), which is reduced to 3.5% (0.68%) once considering stock ownership only. The average CEO is 55 years old.

Moreover, the sample includes firms with an average asset value of 602.82 million and with a median of 471.42 million. The return on assets is approximately 8%, and the Q ratio is 1.79 as a whole. In general, firms hold cash (12%) and not much debt (16%). An average firm allocates 25% and 1% of its assets in tangible assets and cash dividends, respectively. The mean firm age is 47 while some firms' roots can trace back into the late 18th century. On average, the value of capital expenditures and that of the R&D expenses are 5% and 3% of the book value of assets, respectively. Firms spend 3% of market capitalization and make 0.59 M&A deals each year. There are 2.14 corporate segments within a typical firm whose HHI is 0.73. There are 8 members on the board of directors, and 52% of the firms' CEOs are the chairman of the board. As for the industry orientation, as shown in Panel B, 37.5% of the sample firms are in the manufacturing industry, followed by technology (23.8%) and services (14.6%) industry. The distributions among family firm types are similar, although passive family firms seem more technology and wholesale oriented. Meanwhile, non-family firms are more likely in the manufacturing industry.

Panel C presents the differences of mean and median tests between three types of family firms. Generally speaking, delta is highest in active family firms ($620,570) while vega is highest ($53,470) in non family firms. Other than pay incentives, we find that CEOs in active family firms are older (57) and own much more equity stakes (18.9%, and 8.9% excluding stock options). With regard to firm-specific characteristics, there is no significant difference among three firm types in term of operating performance and firm size. Yet, asset value and age indicate that these three types of family firms represent different life cycles, i.e., family firms tend to be younger and smaller while non family firms tend to be older and larger. Hence, it is not surprising that active family firms have highest firm risk. This also suggests that the status of passive family firms to be transitory. Family firms (active or passive) have higher growth opportunities, hold more cash, issue less debt, and have lower tangible assets. Passive (active) family firms pay highest (lowest) cash dividends.

The level of capital expenditures is similar irrespective of family presence. Passive family firms have higher R&D expenses and M&A deal-making. This can be a result of high risk aversion in active family firms and the lack of investment opportunity in non family firms. Passive family firms also have lower HHI value while non family firms have more segments. It thus suggests that active family firms prefer less diversification through corporate segments. Moreover, active family firms tend to be less entrenched, with fewer anti-takeover provisions and a smaller board of directors which is generally viewed as more effective. However, their CEOs are most likely serve as chairman of the board. On the contrary, CEOs in passive family firms are least likely to serve as the chairman.

4 Empirical results

[10] The levels of vega in our sample are similar to those reported in Low (2009) whereas our numbers in terms of both delta and vega are significantly higher than those reported in Brockman et al. (2010).

4.1 The model

To estimate the impact that families have on corporate investment decisions through their pay incentives, we deploy a structural equation model (SEM) that encompasses a wide range of models by considering various paths (causality) and correlations between variables, both dependent and independent variables. Therefore, relevant to our purposes, the structural equation modeling, when setup properly, can address endogeneity issues and also give estimates similar to seemingly unrelated regression or simultaneous equation analysis, among other desirable features (Tomarken and Waller, 2005). The path diagram in our structural model is displayed in Figure 2. A path is typically shown as an arrow, drawn from one variable to another, and establishes the relation (causality) between these two variables.

As shown in Figure 2, there are four sets of linear regressions in the model. Two are related to investment choices, and in the meantime, two are for the decisions of pay incentives that are allowed to further affect investment choices too. We also specify variables to be correlated (based on the correlations between variables of interest, as shown in Table 3) and include industry and year dummy variables in the two linear regressions of investment choices (not shown in the model path diagram for simplification). Standard deviations are clustered on the firm-level. Note that, to test our hypothesis properly, family presence impacts investment decisions through pay incentives only.

4.2 Primary results

4.2.1 Capital expenditures and R&D expenses

In this section we investigate the extent to which family presence affects corporate investment policy through the pay structure by focusing on capital expenditures and R&D expenses. Compared with capital expenditures, R&D expenses are viewed as being riskier with long-term investment horizons. As hypothesized, we expect vega increases R&D and decreases capital expenditures. The impact of family presence on pay incentives and thus investment choices hinges on whether the risk aversion hypothesis or the horizon hypothesis dominates. Table 5 reports the SEM estimates (total effects). Similar to prior work, we assume missing values of R&D expenses to be zero.

As shown in Table 5 (Models 1 and 2), family firms, more specifically active family firms, devote less capital to R&D projects. Nonetheless, family presence has no impact on capital expenditures. Once controlling for firm size, growth opportunity, and CEO duality, vega is lowest in active family firms that have highest delta, as expected. Consequently, the risk aversion hypothesis prevails, particularly in firms controlled and run by families. Yet, our results suggest that families might not consider capital expenditures as an investment type with lower risk which can substitute for risky R&D investments as a result. As expected, vega induces managerial decision to invest in risky R&D projects. Higher delta results in lower R&D. Tobin's Q (+) and firm age (-) that capture investment opportunities have the same signs for both types of investments. Firm size decreases and cash holding increases R&D. Leverage has an adverse effect on capital expenditure but not R&D.

Cash dividends lower R&D which suggests the substitution effect outweighs the financial constraint effect. Asset tangibility is positively associated with capital expenditures despite the relation with R&D is negative.

Similar to Anderson et al. (2012a), we conduct separate tests based on firm risk. If the risk aversion hypothesis prevails, we should observe that the negative relation between family presence and risky investments is more prominent in firms with higher risk. Alternatively, if the investment horizon hypothesis prevails, families should invest more (or at least the same as non family firms) in risky projects, regardless of firm risk. This subgroup analysis thus provides additional tests on these hypotheses. We use standard deviation of stock returns for the past 60 months to classify the riskiness of a firm. Basically, our findings (as shown in Models 3-4 for firms below median risk and Models 5-6 for firms above median risk) support the risk aversion hypothesis. (Active) family firms prefer fewer risky R&D projects especially when they face riskier business environment. Vega increases R&D investments in low risk firms. Moreover, delta decreases R&D investments in high risk firms. These results indicate that pay incentives induce (proper types of) investments contingent on the firm's existing level of riskiness.

Furthermore, the choice of delta is irrespective of firm risk. Yet, family presence seems to affect vega differently due to different effects of vega on R&D investments contingent on firm risk. More specifically, for low risk firms, firms use vega to motivate investments on risky projects. Because of the risk preference of families, vega is lower in family firms so that the total effects of family presence does not affect the choice of risky investments (the relation is slightly negative but without statistical significance). For firms with higher risks, because vega does not induce risky projects (which can be limited by higher delta), the need for a low vega in family firms is reduced. Hence, the vega is both less negative economically and less significant statistically relative to low risk firms. The total effects of family presence in active family firms, however, are still strong and negative because of the high risks that these firms have to bear. Note that there are more active family firms in the subgroup of high firm risk, which potentially aggravates their preference for lower risks[11].

As for other firm-specific attributes, the results are generally similar to the pooled analysis. Still, there are some differences. For instance, firm age is not associated with investments in low risk firms. Moreover, nothing induces CEOs to invest in risky R&D projects in high risk firms. It thus suggests that risky R&D projects are avoided in firms facing high risk already. Overall, our model has higher explanatory power for the subgroup of high firm risk. Using three types of family firms, rather than the conventional two-type categorization, increases model explanatory power.

4.2.2 M&As

In this section, we focus on M&A activities by examining the number and the value of M&A deals. Following the setup of Table 4, Table 5 Panel A reports the estimates. On the whole, as shown

[11] More specifically, in our sample, almost 60% of the active family firms are classified as high risk firms, whereas 47% and 42% of the passive and non family firms, respectively, are classified as high risk firms.

in Models 1 and 2, we find that M&A activities are not affected by family presence. Although the related coefficients are negative, they are not statistically significant. Vega increases both the number as well as the value of M&A deals. Delta seems irrelevant in the decision to make M&A deals. The results regarding incentives are mainly driven by high risk firms, as shown in Models 3-6. For low risk firms, neither family presence nor pay incentives affect M&A activities.

Besides, an old firm conducts fewer and smaller M&A deals while a larger firm conducts more deals. In terms of financial constraints, a firm with lower cash holdings, tangible assets, and cash dividends, but more leverage, has a higher tendency to make (larger) M&A deals. In other words, M&A is associated with less availability of (both internal and external sources of) funding, which is inconsistent with the financial constraint argument. It thus suggests that M&A investments are not restricted by funding availability. Since internal funds are scarce, many of these deals are likely financed by external funding. Tobin’s Q is not related to M&A, which might suggest these deals are not made to take advantage of (internal) growth opportunity.

Interestingly, the positive effect of leverage on M&A is mainly driven by firms with lower risk. Lower risk firms afford to bear more risks from potentially even higher leverage resulted from M&A deals. Similar to the results in the previous section, nothing induces M&A in high risk firms, except firm size. So, larger firms tend to make M&A deals (without higher deal value) even when they face riskier firm prospects. Overall, M&A models using the subgroup of high firm risk have higher explanatory power. Yet, the explanatory power in these models is generally much lower relative to capital expenditure and R&D models.

4.2.3 Corporate segments

Finally, we study managerial decision to diversify by using corporate segments. We use a binary variable that equals one when there is more than one segment in a firm. To account for the relative significance of each segment, we also use sales as weights to calculate firm-wise HHI for each firm. This continuous variable incorporates the effect of segment number that the binary variable cannot. As stated earlier, if the risk aversion holds, we should expect to observe more segments (lower HHI in general) in active or passive family firms. Table 5 Panel B reports the estimates. We do not find that family presence influence diversification or the level of HHI. Even pay incentives do not affect these diversification choices. Therefore, it suggests that the number of corporate segments is not a proper indicator of riskiness. Having more segments does not necessarily mean to reduce firm risk, at least for families. This might explain that families prefer not to diversify even when facing higher firm risks. Delta also decreases diversification in high risk firms. For low risk firms, neither family presence nor pay incentives explain either diversification choice.

As for firm-specific characteristics, on the whole firm size and age increase diversification. However, there exist significant differences between high versus low risk firms. For high risk firms, firm age increases and CEO duality decreases diversification. In addition, leverage decreases the level of HHI. Hence, high risk firms and more debt tend to diversify by having more business segments.

For low risk firms, except for Tobin's Q (-), nothing explains the choice of diversification. This might simply because there seems no obvious reason to diversify for low risk firms already.

4.3 Robustness: alternative model specifications

In this section, we use family ownership as an alternative proxy for family and several alternative model specifications to test the robustness of our findings.

4.3.1 Family ownership

So far, we measure the family presence by using dummy variables. Their ownership, a continuous variable, can potentially capture the extent of risk aversion better. In this section, I replace the family dummy variables with (family) ownership variables and replicate the analysis in Table 4. The estimates are shown in Table 6. Basically, the results are qualitatively (and mostly quantitatively) similar to Table 4. The models have slightly higher explanatory power when using (family) ownership variables than when using family dummy variables.

To further examine the relationship between (family) ownership, vega (the main variable of interest) and R&D, Figure 3 shows three contour plots that demonstrate R&D distributions based on ownership and vega for three types of family firms. First, for active family firms, R&D distribution is most scattered while a significant amount of high R&D cluster in one area of high ownership and high vega. Second, for non family firms, R&D distribution is also scattered to some extent while some high levels of R&D cluster in a few areas of low ownership and vega. Lastly, for passive family firms, R&D distribution is relatively narrower. There are more high-R&D areas, which tend to coincide with areas with higher vega. These three plots show distinct patterns for each type of family firms.

In addition to contour plots, Figure 4 (Figure 5) shows sunflower and scatter plots of (family) ownership and vega (R&D). All these plots demonstrate that active family firms have different distributions compared with other two types of family firms. When it comes to ownership and vega, the relation seems to be negative in active family firms and concave (if not slightly positive when excluding outliers) in the other two types of firms. This indicates that, for firms run by professionals, ownership allows for some risk taking incentive until it reaches some threshold. Exceeding this threshold, ownership is (too) high that exacerbates risk aversion, resulting in lower vega. For active family firms, higher family ownership is usually associated with lower vega. As for ownership and R&D, the relation is more scattered in active family firms and clustered in passive and non family firms. There seems no obvious relation for each type of firms. Therefore, these plots provide evidence that family presence does not seem to affect R&D investments directly, potentially through some mechanisms (e.g., incentives) if at all. All taken, these plots indicate that active family firms considerably differ from the rest. Even so, for professional CEOs, having family presence in their firms appears to motivate risk-taking behavior that result in a higher likelihood of R&D projects.

4.3.2 Alternative estimation models

In this section, we employ three different models to conduct robustness tests. The first is an ordinary least square (OLS) model, which gives us the most straightforward estimation results. Second, we use a Tobit model that deals with censored data. As emphasized in the previous literature on R&D, the data coverage of R&D expenses in the Compustat database is not comprehensive. Following a common method in prior studies, we set the missing values to be zero for R&D. In other words, we assume that firms with missing R&D data have no financial resources allocated to R&D investments. Nevertheless, it can be that these some missing values are unrecorded by the Compustat or unreported by the firm itself. For the latter, this can a result that the level of R&D and the likelihood of the data being reported are jointed determined. Namely, the occurrence of these missing values is endogenous (Anderson et al., 2012a). To address such sample selection issue, finally we use a Heckman model for testing.

Table 7 reported estimates for these three model regressions (Models 1-3 for the OLS, Models 4-6 for the Tobit, and Models 7-9 for the Heckman regressions). In these models, we use interaction terms of pay incentives and family presence (dummy and continuous variables) to examine how family presence affects R&D through pay incentives, apart from the effects of these incentives themselves. We also include all control variables (and industry and year dummy variables) used in our main analysis of R&D (as in Table 4). Generally speaking, delta decreases and vega increases capital input on risky R&D projects, similar to our previous results. However, we do not find that R&D efforts are discouraged in (active) family firms, which is inconsistent with the risk aversion hypothesis found in our previous analysis. Intriguingly, the results show that passive family firms invest more in R&D projects, compared with non family firms. This is consistent with the investment horizon hypothesis. The estimates of the control variables are qualitatively similar to Tables 4 and 6. Overall, our main results still hold with these alternative model choices, although these models show the horizon hypothesis seems to dominate the risk aversion hypothesis.

Another major and typical issue concerns endogeneity. That is, family presence or ownership is not random and determined by investment policy itself or some unobservable factors (can be common with factors that determine investment policy). To address such issue, we employ OLS and Tobit models that allow for endogenous variables for testing. The results are reported in Table 8. Similar to Table 7, we use interaction terms to examine the influence of family ownership, again with a set of control variables as well as industry and time dummy variables. After controlling for endogeneity, vega increases R&D investments. Moreover, on top of the motivation derived from vega, relative to non family firms, R&D is reduced by active family ownership. Alternatively, the level of R&D is higher in passive family firms. These results provide evidence that the risk aversion hypothesis dominates in active family firms while the investment horizon hypothesis dominates in passive family firms.

4.4 Discussion: firm age and vega in active family firms

Our paper studies the two hypotheses of family risk profiles by examining their investment decisions. We focus on the pay incentives that motivate the decision to allocate capital to risky investments. This is one innovative element of our paper. So, in this section we look closer at the relationship between family presence/ownership and vega, the main incentive variable of interest. Because of risk aversion, (very) high ownership is hypothesized to be associated with low vega, as shown in Figure 4. Nevertheless, we expect that firm age to be critical in vega conditional on ownership. For instance, an old firm typically faces scarce growth opportunities and might need to have high vega to motivate managerial efforts on long-term and risky investments that ensure prosperity of the firm. Figure 6 shows three contour plots of firm age, family ownership, and vega in three types of family firms. These plots provide evidence for our conjecture. For each type of firms, there are areas of high vega (in colors red and yellow) located on the middle-right side of the plot. Hence, high vega (together with substantial ownership) is provided by some old firms despite less so in active family firms, which suggests the risk aversion hypothesis. Interestingly, for active family firms, there is one area of high vega (in red) located on the bottom-left side of the plot. This indicates that high vega is provided by some young active family firms, which supports the horizon hypothesis.

Figure 7 shows sunflower and scatter plots of firm age and family ownership. These plots show that, similar to Figures 4 and 5, active family firms have different patterns relative to the other two types of family firms. More specifically, the relation between firm age and ownership is positive (slightly concave) active family firms, although there seems no relation in passive and non family firms. This indicates that ownership accumulates over time for family CEOs only. Consequently, for active family firms, in their early stage of business, delta is not very high because of (relatively) lower ownership, but vega can be very high due to their risk seeking preferences (e.g., entrepreneurship). Over time, when firms age and thus lack growth opportunities, vega can be high to induce CEOs to engage in long-term investments. However, there are fewer such cases in active family firms due to high levels of risk aversion.

5 Concluding Remarks

Anderson et al. (2012a) document that families prefer to allocate financial resources to capital expenditures relative to risky R&D investments. They argue that this is because risk aversion of these families outweighs their longer investment horizon for their long-term commitment. Another line of research on family firms shows that these firms have different CEO pay structure compared with their non family counterparts. Since pay incentives potentially induce managerial behavior that enhances firm performance from different perspectives, and investment decision is one of the important observable decisions that CEOs make, it is plausible that family presence affects investment policy through pay incentives, in particularly option vega. Based on the two hypotheses, risk aversion and investment horizon that have opposing effects on risky and long-term investments, we predict that vega has to be low enough in family firms so that risk aversion can dominate because vega motivates risk-taking behavior. Otherwise, family firms should prefer more risky and long-term investments, and the horizon hypothesis dominates.

Using a sample of 1,756 firm-year observations that represent 362 small U.S. publicly traded companies between 2001 and 2005, our structural equation model estimates show that active family firms have lowest vega and highest delta. They prefer to devote less capital to risky R&D projects, especially for high risk firms. Our results also show that passive and non family firms are similar, in terms of their pay incentives as well as their choices of investment policy. Therefore, risk aversion effects dominate horizon considerations for firms owned and run by families. Capital expenditures, usually viewed as less risky with a short-term feature, are not affected by family presence. This suggests that capital expenditure and R&D might not necessarily be substitutes. Moreover, we do not find significant differences in M&A activities between different types of family firms. Active family firms facing high risk seem to diversify less in spite of their preference for low risk. Apparently, families do not think that having more business segments is able to reduce risk. More segments might lose focus and ownership, which these families value greatly.

Overall, our paper provides evidence that incentive pay is one mechanism that influences the choices of investment policy in (active) family firms. This helps us test risk aversion and investment horizon hypotheses better. As shown in our simple OLS model, no relation exists between family presence and investment choices without identifying potential mechanisms properly. Furthermore, our study shows that firms owned and run by families are considerably different from the others. Our robustness tests show that outside CEOs in passive family firms tend to invest more in risky R&D projects relative to those in non family firms. So, replacing a family CEO with an outside professional seems to encourage some risk-taking initiatives, which is consistent with the horizon hypothesis, to a lesser extent though. This also indicates that, to avoid spurious relations, the classification of family firms should consider not only the ownership but also the control of the firm.

One main drawback in this paper is our analysis on M&A activities. The reason that we do not find results might be because we do not identify deals based on their levels of riskiness, similar to the distinction between capital expenditures and R&D expenses. In the next step, we aim to classify high risk vs. low risk deals and examine whether family presence prefers to invest low risk deals to test the risk aversion hypothesis.

Appendix A: Computation of Portfolio Sensitivities

We follow Core and Guay (2002) and Brockman et al. (2010) to calculate option grant sensitivities. We define the CEO's portfolio price sensitivity (*PRCSEN*) as the change in the value of the CEO's stock holding and option portfolio in response to a 1% change in the firm's stock price. The CEO's portfolio volatility sensitivity (*VOLSEN*) is defined as the change in the value of the CEO's option portfolio in response to a 1% change in stock return volatility. Partial derivatives of the option price with respect to stock price (δ) and stock return volatility (v) are based on the Black and Scholes (1973) option-pricing Model, adjusted for dividend streams by Merton (1973) as follows,

$$\delta = e^{-dT} N(Z_i)$$

$$v = e^{-dT} N'(Z_i) \mathrm{S}\sqrt{\mathrm{T}}$$

$$\mathrm{Z} = \frac{\ln\left(\frac{S}{X}\right) + T[r - d + \sigma^2]}{\sigma\sqrt{T}}$$

where N is the cumulative probability function for the normal distribution; N' is the density function for the normal distribution; S is the underlying stock price; X is the exercise price of the option; σ is the expected stock return volatility and d is the natural logarithm of the expected dividend yield over the life of the option; r is the natural logarithm of the risk-free interest rate; T is the time to maturity of the option in years.

Instead of applying the full-information method (FI) which might require up to 10 years of historical proxy statements to perfectly identify the required characteristics of CEO option portfolios for Black and Sholes valuations, we follow Core and Guay's (2002) one-year approximation method (OA) which requires information from only the most recent proxy statement. They argue that the OA method explains 99% of the actual variation in option portfolio values and sensitivities.

We divide the CEO's option portfolio into three parts: (1) options from new grants; (2) exercisable options from previous grants; (3) unexercisable options from previous grants. Three of the six inputs necessary to compute the delta and vega of an option are available in Compustat (stock price: item *prcc_f*; expected stock return volatility: item *bs_volatility*; expected dividend yield: item *bs_yield*). For new grants, two of the remaining three inputs are available in ExecuComp (exercise prices: item *expric*; times to maturity: item *exdate*).

For previously granted options, we have to estimate the exercise prices and time to maturity. To estimate the exercise prices, we use the realizable values, i.e., the in-the-money value of the CEO's option portfolio, in ExecuComp (items: *opt_unex_exer_est_val* and *opt_unex_unex_est_val*). Note that since we consider the new option grants and previously granted options separately, the number and the fiscal year-end realizable value of new options are deducted from the number and realizable value of unexercisable options. Similar to Core and Guay (2002), in those cases when the number of new options granted exceeds the number of unexercisable options, the (positive) excess realizable value and number of options is deducted from the number and realizable value of exercisable options. Next, by dividing the resulting exercisable and unexercisable realizable values by the number of exercisable and unexercisable options (items: *opt_unex_exer_num* and *opt_unex_unex_num*), respectively, we obtain estimates of how much, on average, each group of options is "in-the-money". Subtracting these average profits per option from the stock price yields estimates of the average exercise price of the (previously granted) exercisable and unexercisable options.

To estimate the time to maturity of previously granted options, we apply different rules to unexercisable and exercisable options. First, we assume that the time to maturity of an unexercisable option is one year less than that of a new option grant. This assumption is consistent with Kole (1997). Second, we assume that the time to maturity of an exercisable option is three years less than that of an unexercisable option. If there are no new grants in the current year, we set the time to maturity of an unexercisable and an exercisable to nine and six years, respectively, because most firms grant new options with ten years to maturity. Lastly, we use the U.S. Treasury Notes as estimates for the risk-free rates corresponding to the time to maturity of options.

Once the option delta (δ) and option vega (v) of each option partition are computed, we calculate *PRCSEN* and *VOLSEN* for each CEO as follows,

$$\begin{aligned} PRCSEN &= \text{Equity } delta + \text{Option } delta \\ &= N_s S * 0.01 + \textstyle\sum_{i=1}^{N_0} e^{-dT} N(Z_i)\, S * 0.01 \\ &= \frac{S}{100}(\delta_{NG} N_{NG} + \delta_{PGEX} N_{PGEX} + \delta_{PGUNEX} N_{PGUNEX} + N_s) \end{aligned}$$

$$\begin{aligned} VOLSEN &= \text{Option } vega \\ &= \textstyle\sum_{i=1}^{N_0} e^{-dT} N'(Z_i) \mathrm{S}\sqrt{\mathrm{T}} * 0.01 \\ &= \frac{1}{100}(v_{NG} N_{NG} + v_{PGEX} N_{PGEX} + v_{PGUNEX} N_{PGUNEX}) \end{aligned}$$

where N_s and N_o are the number of shares and option grants, respectively, owned by the CEO. The subscripts *NG*, *PGEX*, and *PGUNEX* denote new grants, previously granted exercisable options, and previously granted unexercisable options, respectively.

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Figure 1
Sunflower and scatter plots of option delta and option vega

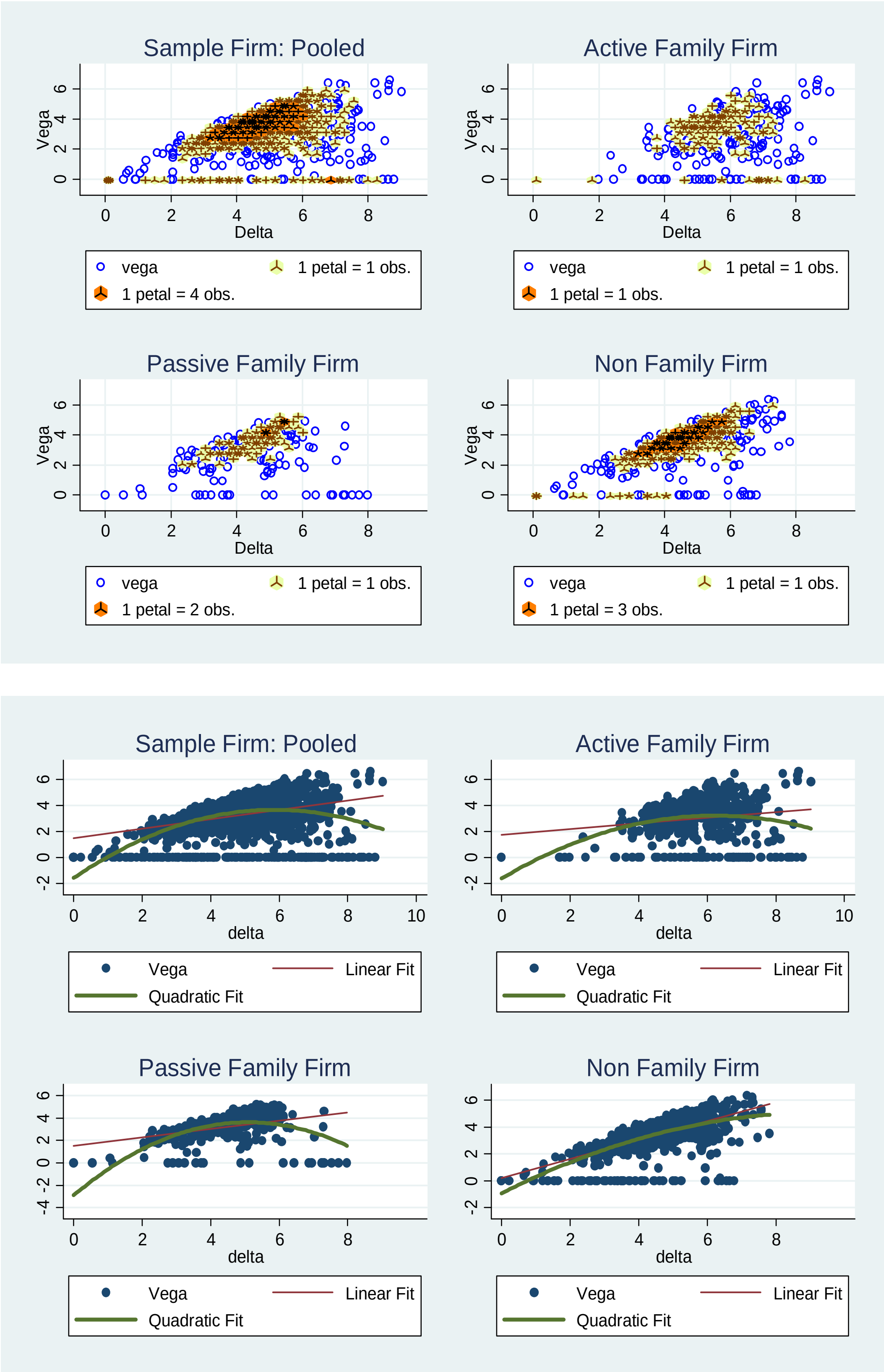

Table 1
Variable definitions (alphabetically)

Variable	Definition	Data Source
Asset tangibility ratio	Total property, plant and equipment scaled by total assets	Compustat item *ppent/at*
Board Size	Number of directors on the board	RiskMetrics Directors Directors Legacy
Capital expenditure/total assets	Capital expenditures scaled by total assets	Compsutat items *capx/at*
Cash ratio	Cash scaled by total assets	Compustat item *ch/at*
CEO duality	Binary variable that equals one when the CEO serves as company chairman	ExecuComp item *titleann*
Delta	The change in the value of the CEO's stock holding and option portfolio in response to a 1% change in the firm's stock price	
Dividend ratio	Firm's annual cash dividends scaled by total assets	Compustat item *dv/at*
Entrenchment index	Follows Bebchuk, Cohen, and Ferrell (2004)	RiskMetrics Governance Legacy items *cboard+supermajor+ppill+goldenparachute+lachtr+labylw*
Executive age	Age of the CEO	ExecuComp item *age*
Firm age	Difference between the founding year and the data year	Online sources (e.g., www.funduniverse.com)
Firm risk	Standard deviation volatility over the past 60 months	Compustat item *bs_volatility*
GIM index	Follows Gompers, Ishii, and Metrick (2003)	RiskMetrics Governance Legacy item *gindex*
Leverage ratio	Year-end long-term debt scaled by total assets	Compustat items *dltt/at*
M&A number	Firm's number of M&A deals	
M&A value ratio	Sum of the M&A deal value scaled by the firm's market value of equity	
Ownership	Percentage of CEO shareholding, including the holdings of family members, if applicable	Proxy statements
R&D expense/total assets	R&D expenditures scaled by total assets	Compsutat items *xrd/at*
Return on assets	A ratio of earnings before interest and tax scaled by total assets	Compustat items *ebit/at*
Segment HHI	Segment HHI follows the calculation of Herfindahl–Hirschman Index by using the sales of corporate segments as weights	
Segment number	Firm's number of corporate segments	
Share ownership	Percentage of executive shareholding (excluding options)	ExecuComp item *shrown_excl_opts* scaled by Compustat item *shrsout*
Tobin's Q	Market-to-book ratio, defined as total assets plus the market value of common stock less the sum of book value of common equity and balance sheet deferred taxes scaled by total assets	Compustat items (*at+csho*(prcc_f-bkvlps)-txdb)/at*
Total assets	Year-end book value of total assets	Compustat item *at*
Total sales	Annual total sales	Compustat item *sale*
Vega	The change in the value of the CEO's option portfolio in response to a 1% change in stock return volatility	

Table 2

Descriptive statistics on CEO and firm characteristics

Variable	Mean	Median	Std. dev.	Maximum	Minimum
Panel A: summary statistics for full sample (N=1,756)					
Delta	299.19	132.14	582.82	8,277.63	0.00
Vega	49.63	30.80	63.78	730.75	0.00
Ownership (%)	8.23	2.50	14.47	81.20	0.00
Share ownership (%)	3.50	0.68	7.59	62.76	0.00
Executive age	55.48	55.00	7.71	84.00	29.00
Total assets ($ millions)	602.82	471.42	485.25	3,938.50	21.00
Total sales ($ millions)	805.40	503.41	1,004.71	10,973.32	0.00
Firm age	47.35	36.00	35.01	230.00	0.00
Cash ratio	0.12	0.07	0.12	0.78	0.00
Leverage ratio	0.16	0.12	0.16	1.62	0.00
Asset tangibility ratio	0.25	0.19	0.20	0.96	0.00
Dividend ratio	0.01	0.00	0.02	0.45	0.00
Firm risk	0.55	0.51	0.21	1.53	0.18
Return on assets	0.08	0.08	0.12	0.66	-1.65
Tobin's Q	1.79	1.46	1.07	11.13	0.40
Capital expenditure/total assets	0.05	0.03	0.06	0.82	0.00
R&D expense/total assets	0.03	0.00	0.06	0.40	0.00
M&A number	0.59	0.00	1.05	9.00	0.00
M&A value ratio	0.03	0.00	0.12	2.43	0.00
Segment HHI	0.73	0.83	0.30	1.00	0.00
Segment number	2.14	2.00	1.49	9.00	0.00
GIM index	8.76	9.00	2.63	17.00	2.00
Entrenchment index	2.20	2.00	1.29	5.00	0.00
Board size	7.89	8.00	1.94	15.00	1.00
CEO duality	0.52	1.00	0.50	1.00	0.00

	Total	Type I Firm		Type II Firm		Type III Firm	
	# of Obs.	# of Obs.	Fraction in %	# of Obs.	Fraction in %	# of Obs.	Fraction in %
Panel B							
Agriculture & Food	19	10	2.01	5	1.42	4	0.44
Mining	10	0	0.00	0	0.00	10	1.11
Construction	15	10	2.01	4	1.13	1	0.11
Oil & Petroleum	40	4	0.80	5	1.42	31	3.44
Small Scale Manufacturing	108	26	5.22	13	3.68	69	7.67
Chemicals/related manufacturing	302	78	15.66	50	14.16	174	19.33
Industrial Manufacturing	247	63	12.65	57	16.15	127	14.11
Computers & Electronic Parts	209	54	10.84	55	15.58	100	11.11
Printing & Publishing	30	13	2.61	7	1.98	10	1.11
Transportation	56	18	3.61	2	0.57	36	4.00
Telecommunication	10	5	1.00	5	1.42	0	0.00
Wholesale	126	33	6.63	42	11.90	51	5.67
Retail	116	29	5.82	25	7.08	62	6.89
Services	256	85	17.07	24	6.80	147	16.33
Software & Technology	139	44	8.84	45	12.75	50	5.56
Biotech	68	26	5.22	14	3.97	28	3.11
Sample Size	1,751	498	100.00	353	100.00	900	100.00

Variable	Type I Firm		Type II Firm		Type III Firm		p-Value of Test for Diff. in Means (Distribution)		
	Mean	Median	Mean	Median	Mean	Median	II－I	III－II	III－I
Panel C									
Delta	620.57	314.52	170.90	104.86	172.39	92.94	0	0.5939	0.2071
							(0)	(0.5788)	(0)
Vega	48.40	25.90	41.55	29.54	53.47	34.97	0.1272	0.0002	0
							(0.0873)	(0)	(0)
Ownership (%)	18.90	12.13	3.20	1.60	4.33	1.90	0	0.3132	0.0801
							(0)	(0.0828)	(0.0473)
Share ownership (%)	8.90	4.98	1.46	0.33	1.32	0.40	0	0.0082	0.003
							(0)	(0.0019)	(0)
Executive age	56.96	58.00	54.19	54.00	55.17	55.00	0	0.1228	0.17
							(0)	(0.0083)	(0.0025)
Total assets ($ millions)	546.99	416.49	607.38	424.26	631.77	512.68	0.0765	0.0344	0.0005
							(0.3558)	(0.0266)	(0)
Total sales ($ millions)	759.80	404.81	799.02	517.16	832.99	549.18	0.5441	0.5939	0.2071
							(0.0042)	(0.5788)	(0)
Firm age	35.14	28.00	45.88	35.00	54.65	45.00	0	0.0002	0
							(0.0003)	(0)	(0)
Cash ratio	0.12	0.08	0.12	0.07	0.11	0.06	0.6065	0.3132	0.0801
							(0.9176)	(0.0828)	(0.0473)
Leverage ratio	0.14	0.06	0.14	0.06	0.17	0.15	0.9697	0.0082	0.003
							(0.7467)	(0.0019)	(0)
Asset tangibility ratio	0.22	0.16	0.24	0.19	0.26	0.21	0.3577	0.0344	0.0005
							(0.1663)	(0.0266)	(0)
Dividend ratio	0.01	0.00	0.01	0.00	0.01	0.00	0.0085	0.1228	0.17
							(0)	(0.0083)	(0.0025)
Firm risk	0.60	0.58	0.54	0.50	0.52	0.48	0.0001	0.2324	0
							(0)	(0.2527)	(0)
Return on assets	0.08	0.09	0.08	0.09	0.08	0.08	0.7291	0.6213	0.8716
							(0.5539)	(0.2483)	(0.5346)
Tobin's Q	1.86	1.58	1.94	1.51	1.69	1.40	0.319	0.0002	0.0031
							(0.8048)	(0.0008)	(0.0005)
Capital exp. /total assets	0.05	0.03	0.05	0.03	0.05	0.03	0.6205	0.7586	0.3274
							(0.7087)	(0.9175)	(0.6438)
R&D expense/total assets	0.03	0.00	0.04	0.01	0.03	0.00	0.0158	0.0004	0.2536
							(0.0225)	(0.0002)	(0.12)
M&A number	0.60	0.00	0.68	0.00	0.55	0.00	0.2927	0.0338	0.3704
							(0.061)	(0.0446)	(0.8752)
M&A value ratio	0.03	0.00	0.04	0.00	0.04	0.00	0.1122	0.8115	0.075
							(0.0563)	(0.0769)	(0.7511)
Segment HHI	0.74	0.96	0.69	0.77	0.73	0.79	0.0123	0.0147	0.4931
							(0.0477)	(0.2538)	(0.0983)
Segment number	1.99	1.00	2.06	1.00	2.26	2.00	0.4755	0.0412	0.0008
							(0.9026)	(0.0015)	(0.0002)
GIM index	8.00	8.00	9.04	9.00	9.04	9.00	0	0.9961	0
							(0)	(0.7699)	(0)
Entrenchment index	1.74	2.00	2.31	2.00	2.40	2.00	0	0.3539	0
							(0)	(0.3654)	(0)
Board size	7.54	7.00	8.32	8.00	7.92	8.00	0	0.0027	0.0017
							(0)	(0.005)	(0.0004)
CEO duality	0.69	1.00	0.33	0.00	0.51	1.00	0	0	0
							(0)	(0)	(0)
# of obs.	498		353		905				

See Table 1 for variable definitions.

Panel A presents summary statistics for the variables of interest in our study. The sample consists of 1,756 firm-year observations that represent 362 unique US small firms during the period of 2001-2005.

Panel B presents industrial orientation based on SIC codes using the classification by Chidambaran and Prabhala (2003).
Panel C presents means and medians of variables in Panel A with respect to three subgroups of our sample firms. Type I firm is active founding-family firm, i.e., controlled and run by founding family; Type II firm is passive founding-family firm, i.e., controlled but not run by founding family; Type III firm is non-founding-family firm, i.e., neither controlled nor run by founding family.

Figure 2
Simple illustration of baseline structural equation model

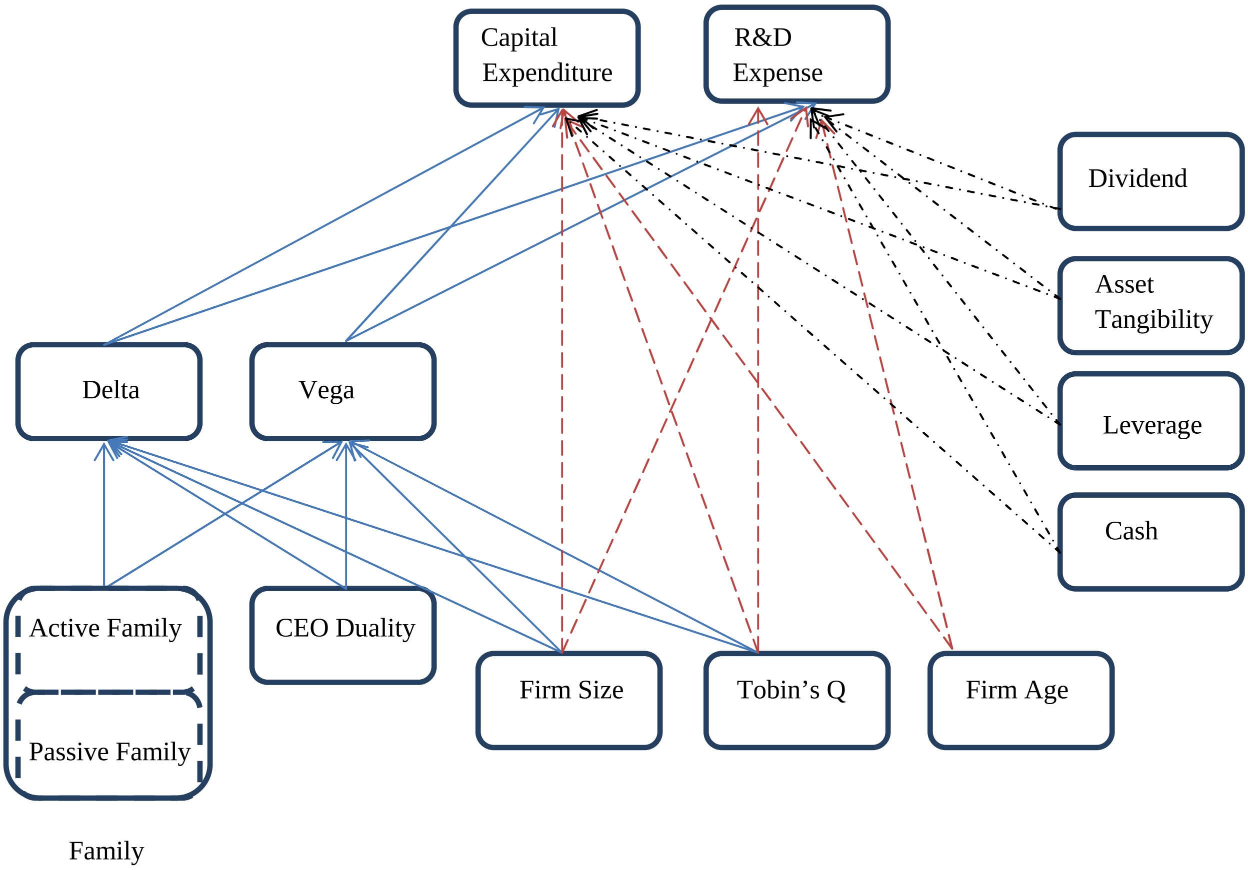

Table 3

Correlation matrix of key variables

	1.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Capital exp. /total assets	1.00																		
2. R&D expense/total assets	-0.09	1.00																	
3. Ln(1+M&A number)	-0.11	0.01	1.00																
4. Ln(1+M&A value)	-0.09	0.05	0.69	1.00															
5. Segment HHI	0.08	0.09	-0.11	-0.13	1.00														
6. Diversification	-0.06	-0.07	0.03	0.03	-0.54	1.00													
7. Family firm	0.02	0.07	0.03	0.01	-0.02	-0.09	1.00												
8. Active family firm	0.02	0.00	-0.01	-0.03	0.04	-0.05	0.65	1.00											
9. Passive family firm	0.00	0.08	0.05	0.05	-0.07	-0.05	0.52	-0.32	1.00										
10. Ln(1+delta)	0.07	-0.06	0.04	0.02	0.05	-0.07	0.26	0.42	-0.14	1.00									
11. Ln(1+vega)	-0.05	0.00	0.11	0.09	0.01	0.00	-0.12	-0.12	-0.01	0.35	1.00								
12. Ln(1+sales)	-0.03	-0.53	0.07	0.04	-0.20	0.15	-0.07	-0.09	0.02	0.12	0.17	1.00							
13. Tobin's Q	0.11	0.30	-0.02	-0.04	0.16	-0.15	0.09	0.04	0.07	0.25	0.05	-0.34	1.00						
14. Ln(1+firm age)	-0.10	-0.26	-0.05	-0.04	-0.21	0.24	-0.21	-0.20	-0.03	-0.12	0.03	0.37	-0.26	1.00					
15. Cash ratio	-0.07	0.39	-0.09	-0.07	0.14	-0.12	0.04	0.04	0.01	0.07	-0.04	-0.43	0.35	-0.25	1.00				
16. Leverage ratio	0.03	-0.22	0.07	0.11	-0.14	0.10	-0.08	-0.05	-0.04	-0.11	0.07	0.32	-0.22	0.19	-0.35	1.00			
17. Asset tangibility ratio	0.57	-0.29	-0.14	-0.09	0.02	-0.02	-0.09	-0.07	-0.03	-0.02	-0.07	0.13	-0.13	0.10	-0.29	0.28	1.00		
18. Dividend ratio	-0.06	-0.08	-0.07	-0.06	-0.01	0.07	0.00	-0.05	0.05	-0.08	-0.05	0.04	0.01	0.16	-0.07	-0.06	-0.02	1.00	
19. CEO duality	0.03	-0.14	0.00	-0.02	-0.04	0.02	0.03	0.21	-0.20	0.21	0.09	0.12	-0.05	0.10	-0.04	0.06	0.03	-0.03	1.00

See Table 1 for variable definitions.

Active family firm is controlled and run by founding family. Passive family firm is controlled but not run by founding family. Family firm consists of both active and passive family firms.

Table 4

Family influence, CEO option sensitivities, and long-term investments

	1		2		3		4		5		6	
					Below median firm risk				Above median firm risk			
	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D
Family	0.001	-0.003**			0.002	-0.002			-0.002	-0.004**		
	(0.56)	(-2.56)			(1.33)	(-1.46)			(-1.29)	(-1.98)		
Active family			0.001	-0.006**			0.004	-0.002			-0.003	-0.007**
			(0.62)	(-2.5)			(1.49)	(-1.14)			(-1.28)	(-1.97)
Passive family			-0.000	-0.000			-0.000	-0.001*			0.000	0.000
			(-0.6)	(-0.69)			(-0.3)	(-1.71)			(0.37)	(0.44)
Ln(1+delta)	0.001	-0.004**	0.001	-0.004**	0.003	-0.001	0.003	-0.001	-0.002	-0.006*	-0.002	-0.006*
	(0.79)	(-2.11)	(0.79)	(-2.11)	(1.55)	(-0.47)	(1.55)	(-0.47)	(-1.21)	(-1.93)	(-1.21)	(-1.93)
Ln(1+vega)	0.000	0.003**	0.000	0.003**	-0.001	0.003**	-0.001	0.003**	0.001	0.001	0.001	0.001
	(0.27)	(2.47)	(0.27)	(2.47)	(-0.46)	(2.03)	(-0.46)	(2.03)	(0.48)	(0.57)	(0.48)	(0.57)
Ln(1+sales)	-0.001	-0.019***	-0.001	-0.019***	-0.003	-0.008**	-0.002	-0.008**	0.000	-0.024***	0.000	-0.024***
	(-0.53)	(-6.21)	(-0.5)	(-6.3)	(-1.01)	(-2.36)	(-0.97)	(-2.37)	(0.06)	(-5.36)	(0.01)	(-5.44)
Tobin's Q	0.007***	0.006**	0.007***	0.006**	0.010***	0.009**	0.010***	0.009**	0.006***	0.005	0.006***	0.005
	(4.71)	(2.16)	(4.74)	(2.13)	(4)	(2.22)	(3.97)	(2.22)	(3.04)	(1.32)	(3.01)	(1.29)
Ln(1+firm age)	-0.005**	-0.006*	-0.005**	-0.006*	-0.002	0.002	-0.002	0.002	-0.011***	-0.001	-0.011***	-0.001
	(-2.09)	(-1.68)	(-2.09)	(-1.68)	(-0.59)	(0.84)	(-0.59)	(0.84)	(-2.96)	(-0.21)	(-2.96)	(-0.21)
Cash ratio	0.002	0.055**	0.002	0.055**	-0.033*	0.013	-0.033*	0.013	0.009	0.040	0.009	0.040
	(0.19)	(2.41)	(0.19)	(2.41)	(-1.72)	(0.45)	(-1.72)	(0.45)	(0.98)	(1.36)	(0.98)	(1.36)
Leverage ratio	-0.028***	-0.001	-0.028***	-0.001	-0.042***	-0.016	-0.042***	-0.016	-0.018*	0.010	-0.018*	0.010
	(-3.32)	(-0.04)	(-3.32)	(-0.04)	(-3.03)	(-1.09)	(-3.03)	(-1.09)	(-1.77)	(0.39)	(-1.77)	(0.39)
Asset tangibility	0.158***	-0.039***	0.158***	-0.039***	0.148***	-0.014*	0.148***	-0.014*	0.145***	-0.056***	0.145***	-0.056***
	(5.97)	(-4.05)	(5.97)	(-4.05)	(5.05)	(-1.87)	(5.05)	(-1.87)	(8.76)	(-2.63)	(8.76)	(-2.63)
Dividend ratio	-0.060	-0.202**	-0.060	-0.202**	-0.108**	-0.127**	-0.108**	-0.127**	0.149	-0.481*	0.149	-0.481*
	(-1.52)	(-2)	(-1.52)	(-2)	(-2.04)	(-2.52)	(-2.04)	(-2.52)	(0.71)	(-1.95)	(0.71)	(-1.95)
CEO duality	0.001	-0.001	0.000	-0.000	0.001	0.000	0.001	0.001	-0.001	-0.003*	-0.001	-0.002
	(0.98)	(-1.2)	(1.08)	(-0.31)	(1.24)	(0.74)	(0.97)	(1.23)	(-1.04)	(-1.7)	(-0.81)	(-1.41)
Equation-level R^2	0.411	0.393	0.411	0.393	0.409	0.281	0.409	0.282	0.510	0.391	0.510	0.391
	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)
Family	0.640***	-0.325***			0.474***	-0.466***			0.680***	-0.191		

	(6.21)	(-2.92)			(3.15)	(-2.98)			(5.85)	(-1.59)		
Active family			1.157***	-0.431***			1.091***	-0.547**			1.130***	-0.262*
			(9.89)	(-2.97)			(5.54)	(-2.35)			(8.87)	(-1.75)
Passive family			-0.069	-0.180			-0.145	-0.384**			-0.070	-0.071
			(-0.63)	(-1.41)			(-0.96)	(-2.23)			(-0.57)	(-0.53)
Ln(1+sales)	0.269***	0.252***	0.312***	0.243***	0.396***	0.373***	0.430***	0.368***	0.225***	0.128**	0.258***	0.123**
	(5.81)	(5.03)	(7.29)	(4.83)	(4.08)	(3.98)	(4.91)	(3.89)	(4.18)	(2.37)	(5.15)	(2.3)
Tobin's Q	0.384***	0.168***	0.403***	0.164***	0.512***	0.270***	0.513***	0.270***	0.357***	0.103**	0.382***	0.099**
	(7.11)	(3.3)	(7.55)	(3.18)	(5.73)	(3.92)	(6.13)	(3.9)	(8.18)	(2.14)	(9.39)	(2.03)
CEO duality	0.517***	0.223**	0.301***	0.267**	0.423***	0.237	0.252*	0.260*	0.614***	0.180	0.358***	0.221*
	(5.28)	(2.11)	(3.4)	(2.5)	(2.94)	(1.61)	(1.94)	(1.78)	(5.51)	(1.59)	(3.59)	(1.95)
Equation-level R^2	0.211	0.063	0.306	0.066	0.186	0.109	0.271	0.110	0.300	0.035	0.418	0.039
Dummies for 1-digit SIC and Year	Yes		Yes		Yes		Yes		Yes		Yes	
Model R^2	0.730		0.764		0.685		0.719		0.793		0.829	
# of obs.	1,756		1,756		839		839		838		838	

See Table 1 for variable definitions.

This table reports structural equation model estimates (total effects) of long-term corporate investments (measured as the two ratios of capital expenditure and R&D spending to total assets, respectively) on founding-family CEO pay sensitivities/presence. The sample consists of 1,756 firm-year observations that represent 362 unique US small firms during the period of 2001-2005. Active family firm is controlled and run by founding family. Passive family firm is controlled but not run by founding family. Family firm consists of both active and passive family firms. Z-Values are in parentheses and are corrected for serial correlation and heteroskedasticity by clustering on the firm-level identifier. The symbols *, **, and *** represent statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 5
Family influence, CEO option sensitivities, and other corporate investments

Panel A: M&A activities

	1		2		3		4		5		6	
					Below median firm risk				Above median firm risk			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Family	-0.005	-0.013			-0.006	-0.006			0.007	-0.007		
	(-0.54)	(-0.58)			(-0.5)	(-0.16)			(0.49)	(-0.18)		
Active family			-0.005	-0.013			-0.007	0.010			0.014	-0.006
			(-0.31)	(-0.34)			(-0.33)	(0.15)			(0.64)	(-0.1)
Passive family			-0.005	-0.013			-0.005	-0.022			-0.005	-0.008
			(-1.32)	(-1.23)			(-0.87)	(-1.13)			(-0.59)	(-0.52)
Ln(1+delta)	0.006	0.014	0.006	0.014	-0.000	0.032	-0.000	0.032	0.022	0.017	0.022	0.017
	(0.53)	(0.46)	(0.53)	(0.46)	(-0.01)	(0.68)	(-0.01)	(0.68)	(1.29)	(0.34)	(1.29)	(0.34)
Ln(1+vega)	0.027***	0.069**	0.027***	0.069**	0.013	0.046	0.013	0.046	0.044**	0.095*	0.044**	0.095*
	(2.67)	(2.32)	(2.67)	(2.32)	(0.86)	(0.93)	(0.86)	(0.93)	(2.43)	(1.68)	(2.43)	(1.68)
Ln(1+sales)	0.038**	0.044	0.038**	0.044	0.012	0.094	0.012	0.095	0.050**	0.011	0.051**	0.011
	(2.04)	(0.89)	(2.05)	(0.89)	(0.34)	(0.91)	(0.34)	(0.92)	(2.45)	(0.19)	(2.47)	(0.19)
Tobin's Q	0.008	-0.010	0.008	-0.010	-0.003	-0.018	-0.003	-0.018	0.017	-0.030	0.018	-0.030
	(0.66)	(-0.26)	(0.66)	(-0.25)	(-0.15)	(-0.23)	(-0.15)	(-0.23)	(0.93)	(-0.52)	(0.95)	(-0.52)
Ln(1+firm age)	-0.051*	-0.166**	-0.051*	-0.166**	-0.062	-0.136	-0.062	-0.136	-0.088**	-0.245*	-0.088**	-0.245*
	(-1.88)	(-2.09)	(-1.88)	(-2.09)	(-1.5)	(-1.04)	(-1.5)	(-1.04)	(-2.32)	(-1.87)	(-2.32)	(-1.87)
Cash ratio	-0.499***	-1.017***	-0.499***	-1.017***	-1.093***	-1.798**	-1.093***	-1.798**	-0.323**	-0.834*	-0.323**	-0.834*
	(-4.19)	(-2.9)	(-4.19)	(-2.9)	(-5.06)	(-2.51)	(-5.06)	(-2.51)	(-2.21)	(-1.88)	(-2.21)	(-1.88)
Leverage ratio	0.213**	1.243***	0.213**	1.243***	0.323*	1.596***	0.323*	1.596***	0.061	0.700	0.061	0.700
	(2.08)	(3.62)	(2.08)	(3.62)	(1.88)	(2.81)	(1.88)	(2.81)	(0.45)	(1.31)	(0.45)	(1.31)
Asset tangibility	-0.435***	-1.193***	-0.435***	-1.193***	-0.521***	-1.224***	-0.521***	-1.224***	-0.508***	-1.390**	-0.508***	-1.390**
	(-3.74)	(-3.88)	(-3.74)	(-3.88)	(-3.64)	(-2.97)	(-3.64)	(-2.97)	(-2.75)	(-2.53)	(-2.75)	(-2.53)
Dividend ratio	-1.362***	-3.641***	-1.362***	-3.641***	-1.773***	-4.891***	-1.773***	-4.891***	-2.668**	-6.159	-2.668**	-6.159
	(-3.96)	(-3.35)	(-3.96)	(-3.35)	(-3.59)	(-2.99)	(-3.59)	(-2.99)	(-2.27)	(-1.52)	(-2.27)	(-1.52)
CEO duality	0.009	0.023	0.009*	0.023	0.003	0.025	0.003	0.020	0.022*	0.028	0.018*	0.027
	(1.38)	(1.2)	(1.79)	(1.55)	(0.42)	(1.16)	(0.64)	(1.19)	(1.73)	(0.77)	(1.88)	(1.02)
Equation-level R^2	0.075	0.046	0.075	0.046	0.101	0.068	0.101	0.068	0.101	0.054	0.101	0.053
Model R^2	0.321		0.405		0.363		0.431		0.398		0.502	
# of obs.	1,756		1,756		839		839		838		838	

Panel B: corporate segments												
	1		2		3		4		5		6	
					Below median firm risk				Above median firm risk			
	HHI	Diver.	HHI	Diver.	HHI	Diver.	HHI	Diver.	HHI	Diver.	HHI	Diver.
Family	-0.004	-0.007			-0.010	-0.007			0.008	-0.035*		
	(-0.4)	(-0.49)			(-0.79)	(-0.39)			(0.68)	(-1.83)		
Active family			-0.005	-0.013			-0.013	-0.010			0.015	-0.059*
			(-0.31)	(-0.56)			(-0.6)	(-0.3)			(0.76)	(-1.95)
Passive family			-0.002	0.002			-0.007	-0.005			-0.002	0.005
			(-0.86)	(0.57)			(-1.04)	(-0.54)			(-0.56)	(0.58)
Ln(1+delta)	0.001	-0.013	0.001	-0.013	-0.002	-0.002	-0.002	-0.002	0.017	-0.057**	0.017	-0.057**
	(0.05)	(-0.78)	(0.05)	(-0.78)	(-0.17)	(-0.11)	(-0.17)	(-0.11)	(1.1)	(-2.36)	(1.1)	(-2.36)
Ln(1+vega)	0.012	-0.005	0.012	-0.005	0.019	0.013	0.019	0.013	0.018	-0.021	0.018	-0.021
	(1.18)	(-0.35)	(1.18)	(-0.35)	(1.17)	(0.56)	(1.17)	(0.56)	(1.14)	(-0.86)	(1.14)	(-0.86)
Ln(1+sales)	-0.048***	0.051**	-0.048***	0.051**	-0.076***	0.056	-0.076***	0.056	-0.036**	0.024	-0.036*	0.023
	(-2.88)	(2)	(-2.88)	(1.98)	(-2.77)	(1.37)	(-2.77)	(1.37)	(-1.97)	(0.74)	(-1.94)	(0.69)
Tobin's Q	0.016	-0.032	0.016	-0.033	0.045**	-0.079**	0.045**	-0.079**	0.000	-0.013	0.000	-0.014
	(1.26)	(-1.56)	(1.26)	(-1.57)	(2.33)	(-2.19)	(2.33)	(-2.19)	(0.01)	(-0.58)	(0.03)	(-0.64)
Ln(1+firm age)	-0.051**	0.126***	-0.051**	0.126***	-0.020	0.040	-0.020	0.040	-0.078**	0.179***	-0.078**	0.179***
	(-2.29)	(3.56)	(-2.29)	(3.56)	(-0.65)	(0.81)	(-0.65)	(0.81)	(-2.14)	(3.23)	(-2.14)	(3.23)
Cash ratio	0.134	-0.237	0.134	-0.237	0.170	-0.239	0.170	-0.239	0.079	-0.095	0.079	-0.095
	(1.28)	(-1.23)	(1.28)	(-1.23)	(0.93)	(-0.7)	(0.93)	(-0.7)	(0.69)	(-0.45)	(0.69)	(-0.45)
Leverage ratio	-0.097	0.016	-0.097	0.016	0.082	-0.165	0.082	-0.165	-0.315***	0.252	-0.315***	0.252
	(-1.11)	(0.12)	(-1.11)	(0.12)	(0.72)	(-0.89)	(0.72)	(-0.89)	(-2.65)	(1.23)	(-2.65)	(1.23)
Asset tangibility	0.104	-0.159	0.104	-0.159	0.073	-0.111	0.073	-0.111	0.142	-0.294	0.142	-0.294
	(1.31)	(-1.17)	(1.31)	(-1.17)	(0.74)	(-0.63)	(0.74)	(-0.63)	(1.13)	(-1.4)	(1.13)	(-1.4)
Dividend ratio	0.446	0.464	0.446	0.464	0.044	0.967	0.044	0.967	2.344*	-3.371	2.344*	-3.371
	(1.38)	(0.62)	(1.38)	(0.62)	(0.11)	(1.29)	(0.11)	(1.29)	(1.85)	(-1.25)	(1.85)	(-1.25)
CEO duality	0.003	-0.008	0.003	-0.005	0.003	0.002	0.004	0.003	0.014	-0.039**	0.010*	-0.025**
	(0.62)	(-0.98)	(1.07)	(-1.01)	(0.59)	(0.23)	(0.96)	(0.41)	(1.46)	(-2.25)	(1.66)	(-2.15)
Equation-level R^2	0.111	0.129	0.111	0.130	0.143	0.162	0.143	0.162	0.121	0.118	0.121	0.118
Model R^2	0.385		0.461		0.432		0.493		0.433		0.531	
# of obs.	1,756		1,756		839		839		838		838	

See Table 1 for variable definitions.

This table reports structural equation model estimates (total effects) of M&A activities (Panel A) and corporate segments (Panel B) on founding-family CEO pay sensitivities/presence. M&A activities are measured as ln(1+M&A number) and ln(1+M&A value), respectively. Corporate segments are measured as the binary variable of corporate diversification and the segment HHI, respectively. The sample consists of 1,756 firm-year observations that represent 362 unique US small firms during the period of 2001-2005. Active family firm is controlled and run by founding family. Passive family firm is controlled but not run by founding family. Family firm consists of both active and passive family firms. Z-Values are in parentheses and are corrected for serial correlation and heteroskedasticity by clustering on the firm-level identifier. All specifications control for industry (1-digit SIC codes) and year fixed effects. The symbols *, **, and *** represent statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 6
Family ownership, CEO option sensitivities, and long-term investments

	1		2		3		4		5		6	
					Below median firm risk				Above median firm risk			
	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D	CAPEX	R&D
Ln(ownership)	0.001	-0.003**			0.002	-0.001			-0.002	-0.004*		
	(0.65)	(-2.36)			(1.56)	(-0.77)			(-1.28)	(-1.95)		
Ln(active family ownership)			0.001	-0.002***			0.002	-0.001			-0.001	-0.003*
			(0.57)	(-2.59)			(1.49)	(-1.23)			(-1.31)	(-1.96)
Ln(passive family ownership)			0.000	-0.002*			0.001	-0.001			-0.001	-0.002
			(0.52)	(-1.85)			(1.46)	(-1.17)			(-1.24)	(-1.46)
Ln(1+delta)	0.001	-0.004**	0.001	-0.004**	0.003	-0.001	0.003	-0.001	-0.002	-0.006*	-0.002	-0.006*
	(0.79)	(-2.11)	(0.79)	(-2.11)	(1.55)	(-0.47)	(1.55)	(-0.47)	(-1.21)	(-1.93)	(-1.21)	(-1.93)
Ln(1+vega)	0.000	0.003**	0.000	0.003**	-0.001	0.003**	-0.001	0.003**	0.001	0.001	0.001	0.001
	(0.27)	(2.47)	(0.27)	(2.47)	(-0.46)	(2.03)	(-0.46)	(2.03)	(0.48)	(0.57)	(0.48)	(0.57)
Ln(1+sales)	-0.001	-0.020***	-0.001	-0.020***	-0.002	-0.008**	-0.002	-0.008**	-0.000	-0.024***	-0.000	-0.024***
	(-0.49)	(-6.3)	(-0.5)	(-6.33)	(-0.89)	(-2.39)	(-0.92)	(-2.4)	(-0.03)	(-5.46)	(-0.01)	(-5.46)
Tobin's Q	0.007***	0.006**	0.007***	0.006**	0.010***	0.009**	0.010***	0.009**	0.006***	0.005	0.006***	0.005
	(4.77)	(2.1)	(4.72)	(2.15)	(4.04)	(2.19)	(4)	(2.22)	(3)	(1.28)	(3.04)	(1.31)
Ln(1+firm age)	-0.005**	-0.006*	-0.005**	-0.006*	-0.002	0.002	-0.002	0.002	-0.011***	-0.001	-0.011***	-0.001
	(-2.09)	(-1.68)	(-2.09)	(-1.68)	(-0.59)	(0.84)	(-0.59)	(0.84)	(-2.96)	(-0.21)	(-2.96)	(-0.21)
Cash ratio	0.002	0.055**	0.002	0.055**	-0.033*	0.013	-0.033*	0.013	0.009	0.040	0.009	0.040
	(0.19)	(2.41)	(0.19)	(2.41)	(-1.72)	(0.45)	(-1.72)	(0.45)	(0.98)	(1.36)	(0.98)	(1.36)
Leverage ratio	-0.028***	-0.001	-0.028***	-0.001	-0.042***	-0.016	-0.042***	-0.016	-0.018*	0.010	-0.018*	0.010
	(-3.32)	(-0.04)	(-3.32)	(-0.04)	(-3.03)	(-1.09)	(-3.03)	(-1.09)	(-1.77)	(0.39)	(-1.77)	(0.39)
Asset tangibility	0.158***	-0.039***	0.158***	-0.039***	0.148***	-0.014*	0.148***	-0.014*	0.145***	-0.056***	0.145***	-0.056***
	(5.97)	(-4.05)	(5.97)	(-4.05)	(5.05)	(-1.87)	(5.05)	(-1.87)	(8.76)	(-2.63)	(8.76)	(-2.63)
Dividend ratio	-0.060	-0.202**	-0.060	-0.202**	-0.108**	-0.127**	-0.108**	-0.127**	0.149	-0.481*	0.149	-0.481*
	(-1.52)	(-2)	(-1.52)	(-2)	(-2.04)	(-2.52)	(-2.04)	(-2.52)	(0.71)	(-1.95)	(0.71)	(-1.95)
CEO duality	0.000	0.000	0.001	-0.000	0.000	0.001	0.001	0.001	-0.001	-0.002	-0.001	-0.002
	(1.05)	(0.3)	(1.08)	(-0.51)	(0.36)	(1.54)	(1.04)	(1.31)	(-0.79)	(-1.47)	(-0.85)	(-1.53)
Equation-level R^2	0.411	0.394	0.411	0.394	0.411	0.282	0.411	0.282	0.509	0.393	0.510	0.391
	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)	Ln(1+delta)	Ln(1+vega)
Ln(ownership)	0.675***	-0.211***			0.657***	-0.121			0.708***	-0.182**		
	(9.93)	(-3.09)			(6.44)	(-1.18)			(10.16)	(-2.49)		
Ln(active family ownership)			0.475***	-0.240***			0.422***	-0.241***			0.516***	-0.180***
			(9.61)	(-4.52)			(4.96)	(-2.81)			(10.95)	(-2.98)
Ln(passive family ownership)			0.334***	-0.204			0.395***	-0.238			0.245**	-0.158
			(3.71)	(-1.41)			(3.71)	(-1.42)			(2.47)	(-1.03)
Ln(1+sales)	0.334***	0.234***	0.324***	0.225***	0.499***	0.359***	0.465***	0.336***	0.283***	0.113**	0.271***	0.113**

	(9.12)	(4.62)	(8.15)	(4.51)	(6.18)	(3.68)	(5.46)	(3.47)	(7.92)	(2.14)	(5.9)	(2.19)
Tobin's Q	0.415***	0.154***	0.392***	0.165***	0.536***	0.256***	0.512***	0.266***	0.387***	0.095**	0.367***	0.105**
	(7.6)	(3.1)	(7.58)	(3.29)	(6.46)	(3.55)	(5.98)	(3.88)	(9.29)	(2)	(9.41)	(2.19)
CEO duality	0.235***	0.306***	0.368***	0.293***	0.117	0.293*	0.308**	0.302**	0.356***	0.245**	0.416***	0.240**
	(2.99)	(2.81)	(4.42)	(2.85)	(1.04)	(1.86)	(2.38)	(2.07)	(4.14)	(2.27)	(4.87)	(2.18)
Equation-level R^2	0.421	0.073	0.343	0.095	0.392	0.086	0.292	0.126	0.563	0.055	0.495	0.069
Dummies for 1-digit SIC and Year	Yes		Yes		Yes		Yes		Yes		Yes	
Model R^2	0.804		0.783		0.759		0.733		0.873		0.856	
# of obs.	1,756		1,756		839		839		838		838	

See Table 1 for variable definitions.

This table reports structural equation model estimates (total effects) of long-term corporate investments (measured as the two ratios of capital expenditure and R&D spending to total assets, respectively) on founding-family CEO pay sensitivities/ownership. The sample consists of 1,756 firm-year observations that represent 362 unique US small firms during the period of 2001-2005. Active family firm is controlled and run by founding family. Passive family firm is controlled but not run by founding family. Family firm consists of both active and passive family firms. Z-Values are in parentheses and are corrected for serial correlation and heteroskedasticity by clustering on the firm-level identifier. The symbols *, **, and *** represent statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

Figure 3

Contour plots of family ownership, CEO vega, and R&D in three types of family firms

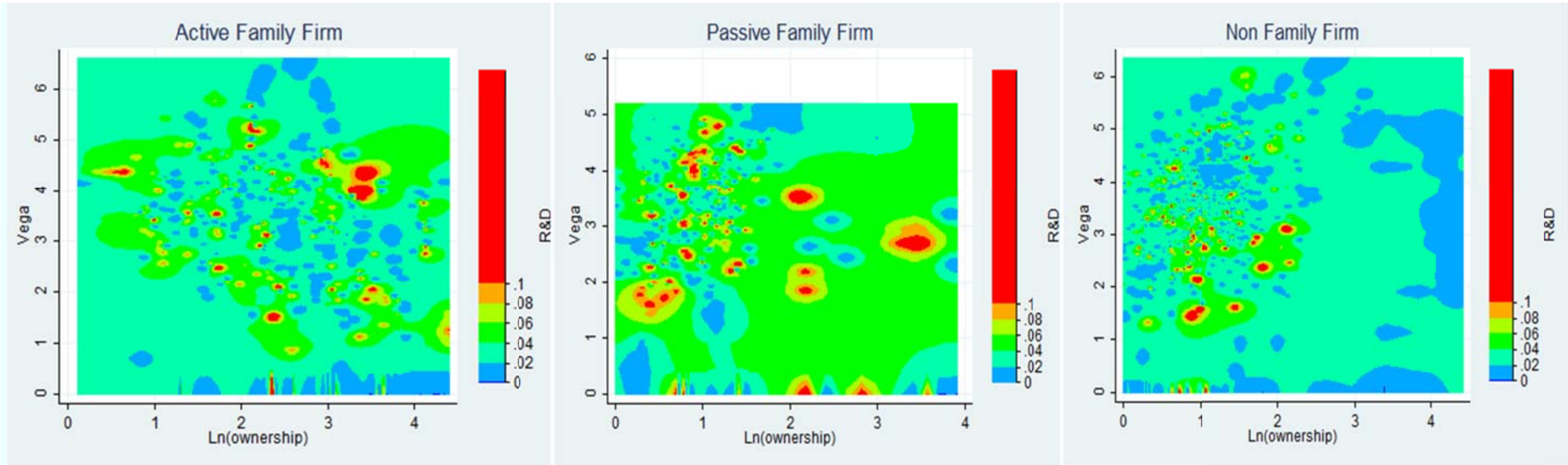

Figure 4

Sunflower and scatter plots of family ownership and CEO vega

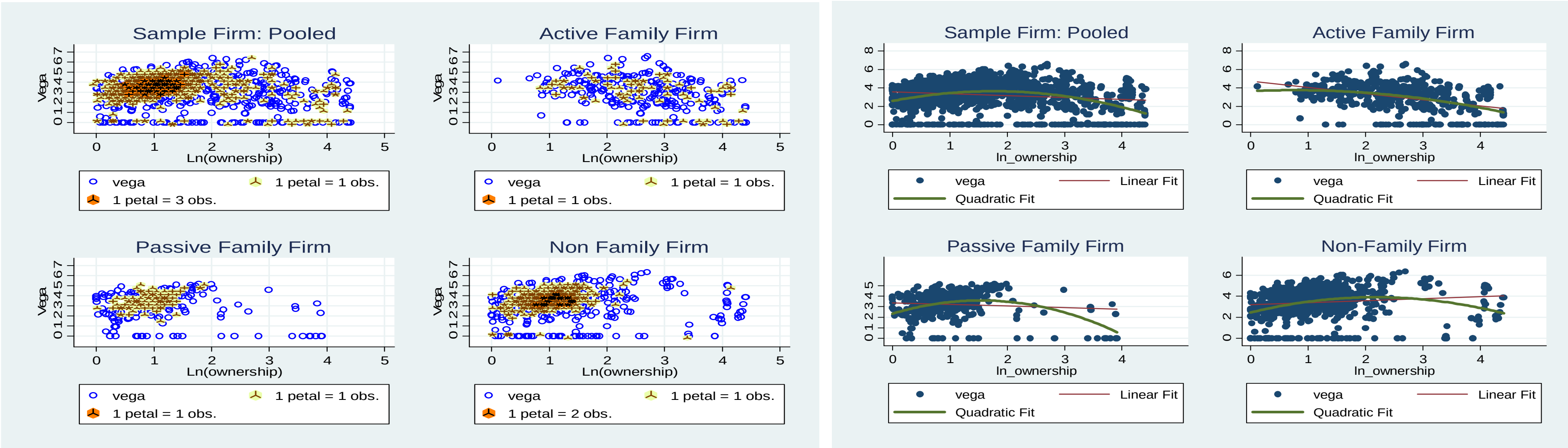

Figure 5

Sunflower and scatter plots of family ownership and R&D

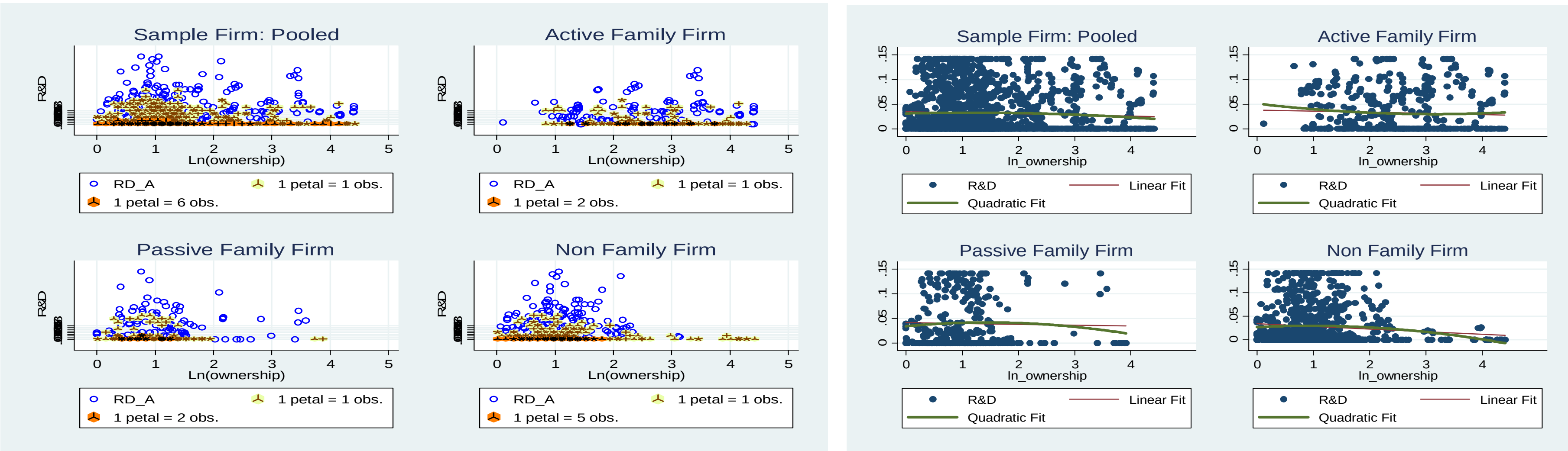

Table 7
Robustness: Family influence, CEO option sensitivities, and R&D investments

	Dependent variable = R&D								
	OLS regression			Tobit regression			Heckman model (control for self-selection)		
	1	2	3	4	5	6	7	8	9
Ln(1+delta)	-0.004**	-0.002	-0.003*	-0.008**	-0.005	-0.006*	-0.006***	-0.005**	-0.006***
	(-2.07)	(-1.51)	(-1.66)	(-2.44)	(-1.58)	(-1.74)	(-3.54)	(-2.47)	(-3.11)
Ln(1+vega)	0.003**	0.003*	0.003**	0.007**	0.006**	0.007**	0.003*	0.002	0.002
	(2.11)	(1.97)	(2.04)	(2.26)	(2.06)	(2.24)	(1.7)	(1.46)	(1.43)
Ln(1+vega)*Family	0.001			0.002			0.000		
	(0.45)			(1.06)			(0.34)		
Ln(1+vega)*Active family		-0.001			-0.002			-0.002	
		(-0.72)			(-0.57)			(-1.33)	
Ln(1+vega)*Passive family		0.002			0.006**			0.002*	
		(1.37)			(2.36)			(1.75)	
Ln(1+vega)*Active family ownership			-0.000			-0.001			0.000
			(-0.51)			(-0.54)			(0.25)
Ln(1+vega)*Passive family ownership			0.001			0.003*			0.002**
			(1.15)			(1.69)			(2.02)
Ln(1+sales)	-0.019***	-0.020***	-0.020***	-0.029***	-0.031***	-0.030***	-0.019***	-0.020***	-0.019***
	(-5.94)	(-6.27)	(-6.08)	(-5.92)	(-6.3)	(-5.99)	(-3.62)	(-3.72)	(-3.52)
Tobin's Q	0.006**	0.006**	0.006**	0.012***	0.010***	0.011***	0.007***	0.006***	0.007***
	(2.28)	(2.09)	(2.17)	(3.03)	(2.69)	(2.86)	(4.08)	(3.72)	(3.98)
Ln(1+firm age)	-0.006*	-0.006*	-0.006*	-0.009	-0.010	-0.010	-0.012***	-0.013***	-0.013***
	(-1.66)	(-1.75)	(-1.78)	(-1.35)	(-1.46)	(-1.58)	(-3.18)	(-3.37)	(-3.3)
Cash ratio	0.054**	0.052**	0.052**	0.052	0.046	0.047	0.040**	0.037**	0.039**
	(2.32)	(2.26)	(2.26)	(1.53)	(1.4)	(1.42)	(2.56)	(2.41)	(2.48)
Leverage ratio	-0.000	0.002	0.000	-0.016	-0.008	-0.012	0.007	0.012	0.008
	(-0.02)	(0.1)	(0)	(-0.67)	(-0.35)	(-0.53)	(0.59)	(0.97)	(0.68)
Asset tangibility	-0.039***	-0.041***	-0.040***	-0.103***	-0.107***	-0.106***	-0.087***	-0.085***	-0.087***
	(-3.97)	(-4.07)	(-4.05)	(-3.95)	(-4.11)	(-4.06)	(-3.79)	(-3.71)	(-3.78)
Dividend ratio	-0.205*	-0.211*	-0.202*	-0.344	-0.352	-0.335	-0.116	-0.101	-0.109
	(-1.97)	(-1.96)	(-1.96)	(-1.55)	(-1.53)	(-1.52)	(-1.2)	(-1.06)	(-1.14)
CEO duality							-0.010***	-0.009**	-0.010***
							(-2.74)	(-2.36)	(-2.61)
Dummies for 1-digit SIC and Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Model R^2	0.3937	0.3979	0.3959						
F-test				13.97***	13.30***	13.38***			

Mill’s lambda							0.007	0.004	0.005
							(0.43)	(0.24)	(0.28)
Wald Chi^2							159.39***	167.35***	164.44***
# of obs.	1,756	1,756	1,756	1,756	1,756	1,756	1,756	1,756	1,756

See Table 1 for variable definitions.

This table reports three alternative model regression results of long-term corporate investments (measured as the ratio of R&D spending to total assets) on founding-family CEO pay sensitivities/presence. The sample consists of 1,756 firm-year observations that represent 362 unique US small firms during the period of 2001-2005. Active family firm is controlled and run by founding family. Passive family firm is controlled but not run by founding family. Family firm consists of both active and passive family firms. T-Values (Z-Values for the Heckman models) are in parentheses and are corrected for serial correlation and heteroskedasticity by clustering on the firm-level identifier (except for the three Heckman models). The symbols *, **, and *** represent statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 8

Endogeneity between active family ownership and R&D: Instrumental variable regressions

	Dependent variable = R&D											
	2-SLS		Tobit		2-SLS		Tobit		2-SLS		Tobit	
	1	2	3	4	5	6	7	8	9	10	11	12
	1st stage: Family	2nd stage: R&D	1st stage: Family	2nd stage: R&D	1st stage: Family	2nd stage: R&D	1st stage: Family	2nd stage: R&D	1st stage: Family	2nd stage: R&D	1st stage: Family	2nd stage: R&D
Ln(1+vega)*		-0.010**		-0.017***								
Family ownership		(-2.06)		(-3.53)								
Ln(1+vega)*						-0.007**		-0.012***				
Active family ownership						(-2.33)		(-3.96)				
Ln(1+vega)*										0.027*		0.045***
Passive family ownership										(1.93)		(3.38)
Ln(1+vega)	0.673***	0.009**	0.673***	0.017***	0.464***	0.006***	0.464***	0.011***	0.209***	-0.003	0.209***	-0.004
	(5.95)	(2.4)	(9.59)	(4.33)	(4.22)	(2.65)	(6.59)	(4.8)	(3.91)	(-1.09)	(6.62)	(-1.25)
Ln(1+sales)	-0.403*	-0.024***	-0.403***	-0.038***	-0.380*	-0.023***	-0.380***	-0.036***	-0.023	-0.019***	-0.023	-0.030***
	(-1.89)	(-5.36)	(-3.56)	(-11.03)	(-1.78)	(-6.02)	(-3.35)	(-12.79)	(-0.28)	(-5.47)	(-0.45)	(-9.55)
Tobin's Q	0.094	0.006**	0.094	0.011***	0.040	0.006**	0.040	0.009***	0.055	0.004	0.055	0.006**
	(0.65)	(2.31)	(0.99)	(4.34)	(0.26)	(2.08)	(0.41)	(4.51)	(0.82)	(1.06)	(1.27)	(2.39)
Ln(1+firm age)	-0.896***	-0.014**	-0.896***	-0.023***	-0.899***	-0.012**	-0.899***	-0.018***	0.003	-0.005	0.003	-0.008*
	(-3.29)	(-2.22)	(-6.1)	(-4.02)	(-3.43)	(-2.32)	(-6.1)	(-4.27)	(0.03)	(-1.13)	(0.04)	(-1.81)
Cash ratio	-2.264	0.029	-2.264**	0.011	-2.440	0.034	-2.440***	0.020	0.176	0.048**	0.176	0.041*
	(-1.46)	(1.01)	(-2.55)	(0.46)	(-1.53)	(1.37)	(-2.74)	(0.96)	(0.3)	(1.98)	(0.44)	(1.72)
Leverage ratio	-0.706	-0.003	-0.706	-0.016	-0.932	-0.003	-0.932	-0.015	0.226	-0.002	0.226	-0.013
	(-0.62)	(-0.16)	(-1.12)	(-0.99)	(-0.79)	(-0.16)	(-1.48)	(-1)	(0.56)	(-0.1)	(0.8)	(-0.76)
Asset tangibility	0.854	-0.031**	0.854	-0.089***	0.223	-0.039***	0.223	-0.101***	0.631	-0.057***	0.631**	-0.135***
	(0.72)	(-2.03)	(1.49)	(-4.99)	(0.19)	(-2.98)	(0.39)	(-6.31)	(1.39)	(-2.94)	(2.44)	(-6.71)
Dividend ratio	-0.165	-0.204*	-0.165	-0.329***	-0.281	-0.204**	-0.281	-0.329***	0.117	-0.205*	0.117	-0.333***
	(-0.03)	(-1.96)	(-0.04)	(-2.82)	(-0.06)	(-1.97)	(-0.06)	(-3.18)	(0.08)	(-1.72)	(0.06)	(-2.68)
CEO duality	0.999***		0.999***		1.381***		1.381***		-0.382**		-0.382***	
	(3.01)		(5.47)		(4.06)		(7.53)		(-2.57)		(-4.64)	
Dummies for 1-digit SIC and Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.1240		0.1240		0.1046		0.1046		0.0368		0.0368	
F-test	37.04***		12.29***		34.87***		10.32***		4.75***		4.05***	
Wald Chi^2		553.22***		561.17***		805.46***		686.20***		814.42***		512.71***

Wald test of exogeneity				17.76***				14.68***				17.40***
# of obs.	1,756	1,756	1,756	1,756	1,756	1,756	1,756	1,756	1,756	1,756	1,756	1,756

See Table 1 for variable definitions.

This table reports IV-2SLS and IV-Tobit regression results of long-term corporate investments (measured as the ratio of R&D spending to total assets) on founding-family CEO pay sensitivities/presence. The sample consists of 1,756 firm-year observations that represent 362 unique US small firms during the period of 2001-2005. Active family firm is controlled and run by founding family. Passive family firm is controlled but not run by founding family. Family firm consists of both active and passive family firms. t-Values (for the first stage estimates) and Z-Values (for the second stage estimates) are in parentheses and are corrected for serial correlation and heteroskedasticity by clustering on the firm-level identifier (except for the Tobit models). The symbols *, **, and *** represent statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

Figure 6

Contour plots of firm age, family ownership, and vega in three types of family firms

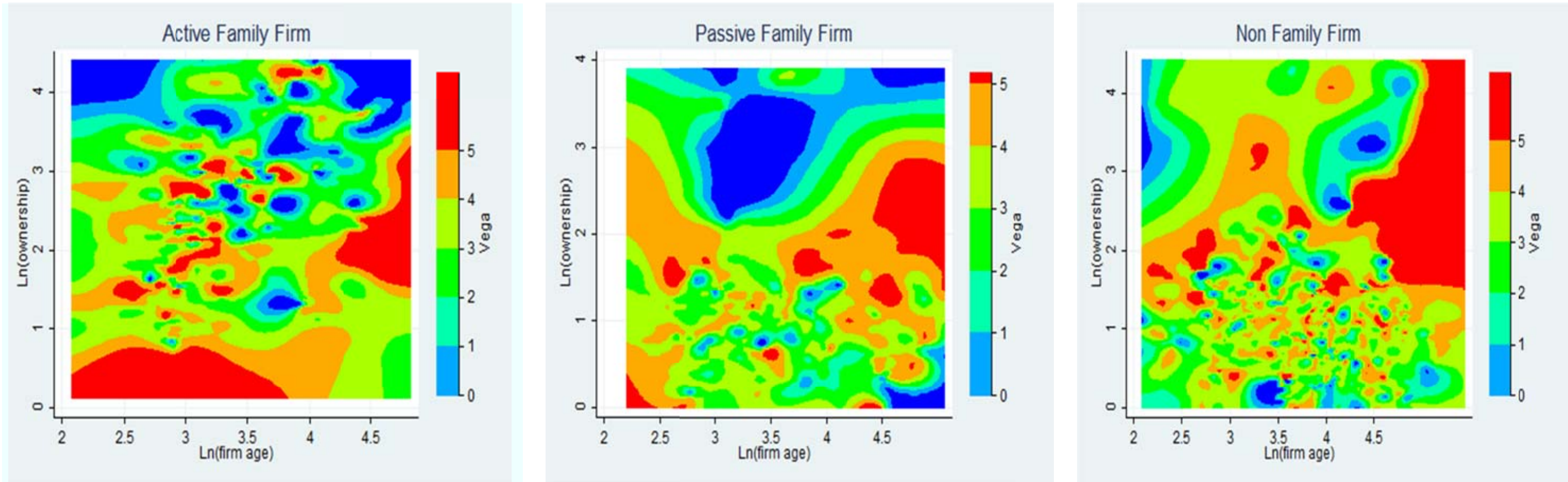

Figure 7
Sunflower and scatter plots of firm age and family ownership