R&D Spending and Capital Expenditure Decisions: The Influence of Ownership Structure

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Abstract

We explore the relation between equity ownership structure and corporate investment policy by focusing on the effect, if any, of family shareholders on firms' investment decisions. Our analysis centers on two incentives, risk aversion and extended investment horizons, that potentially influence the level and type of investments that family firms undertake. Consistent with the risk-aversion based predictions, we find that family firms devote less capital to long-term investments than firms with diffuse ownership structures. When dividing long-term investment into its two components of R&D and capital expenditures, we note that family firms, relative to diffuse shareholder firms, prefer investing in physical assets relative to riskier R&D projects. An alternative explanation for this evidence is that family monitoring improves investment efficiency, thereby allowing them to commit fewer resources to R&D than diffuse shareholder firms. Additional tests indicate that family firms obtain fewer patents and receive fewer patent citations per dollar of R&D investment than diffuse shareholder firms. Moreover, we find that outside shareholders discount family firms that invest less in R&D than industry norms. Taken as a whole, the evidence is consistent with the notion that family-owner preferences affect corporate R&D spending and capital expenditures.

JEL Classification: M4, G3, L2

1. Introduction

Accounting and business literature highlight the conflicts of interests that potentially arise between large, powerful owners and the firm's other stakeholders. For instance, Fan and Wong (2002) find that large shareholders can exert a detrimental effect on the credibility of accounting earnings and thus the mapping of these earnings onto stock prices. Fama and Jensen (1985) note that large, undiversified shareholders may favor investment rules based on their own risk preferences rather than the market-based rules preferred by diffuse shareholders. Cadman and Sunder (2006) find that influential short-term owners provide managers with incentives to invest in projects that correspond to their own investment horizons while discounting the interests of other shareholders. Yet, others note that large, influential owners can mitigate agency problems amongst firm stakeholders. Bushee (1998) observes that the presence of institutional owners alleviates managerial pressure or incentives to pursue myopic investment decision. Moreover, Ali, Chen, and Radhakrishnan (2007) note that a particular class of large shareholder in U.S. firms – family owners – improves the financial disclosure process. Overall, prior literature indicates that large shareholders use their power and influence to affect corporate decision-making; in some instances, extracting private benefits from the firm and in other instances, providing benefits to the firm's other stakeholders (Shleifer and Vishny (1997)).

We explore the relation between large shareholder ownership and corporate investment policy by focusing on the effect, if any, of family shareholders on firms' investment decisions. Families constitute a prevalent and persistent class of large, concentrated shareholder in U.S publicly-traded firms. For instance, Wang (2006) reports that these owners control large stakes in about one-third of the S&P 500 firms. Anderson et al. (2009) observe that families continue to hold substantial ownership positions in nearly one-half of the largest 2,000 industrial firms in the U.S., even decades after going public. These ownership positions thus represent the holdings of long-term, concentrated investors with arguably different incentives relative to managers or shareholders in firms with diffuse equity-ownership structures. We examine two incentives that potentially lead to differences in investment policy between

controlling shareholder firms and diffuse shareholder firms; risk aversion and extended investment horizons.

Family owners represent an important type of large shareholder maintaining an undiversified or concentrated ownership stake in a single firm. Shleifer and Vishny (1986) and DeAngelo and DeAngelo (2000) observe that large, undiversified shareholders may force the firm to seek low risk projects and avoid high risk activities, thereby imposing costs on well-diversified outside shareholders. Compared to diffuse shareholder firms, we argue that family firms can have a particularly strong influence in mitigating firm risk by affecting the firm's long-term investment decisions. We focus on both components of corporate investment that investors require firms to disclose in their accounting reports, namely R&D spending and capital expenditures. Kothari et al. (2002) indicate that R&D spending has a substantially greater impact on firm risk than does capital expenditures, suggesting that it should be particularly sensitive to family risk aversion.

Yet, families' long-term and continuing commitment to their firms potentially indicates an opposing effect. The popular press and academic literature often depict these owners as maintaining long-term horizons that provide powerful incentives to commit substantial financial resources to long-term investment activities (Chen et al. (2008)). Monitoring of the firm and management by these large, influential shareholders potentially gives rise to longer investment horizons relative to diffusely-held firms. Moreover, Anderson and Reeb (2003a) indicate that family monitoring reduces asymmetric information problems between shareholders and managers, suggesting that monitoring overshadows any risk aversion tendencies the family may possess. Coupled with the family horizons, this viewpoint suggests that family firms should invest more in R&D because of the opaque nature of the R&D process and families' informational advantage in monitoring (Francis and Smith (1995). Although the risk preference perspective implies that family firms commit fewer financial resources to long-term investment activities relative to diffuse shareholder firms, the horizon argument indicates that family firms commit more resources to investing activities than diffuse shareholder firms that are controlled by unfettered, myopic

managers. We explore family owners' dominant effect – risk aversion or long investment horizon – on firm investment policy.

Using the 2,000 largest non-financial, non-utility firms in the U.S. from 2003 through 2007, we find that families hold ownership positions in over 38% of these firms – based on a minimum 5% ownership threshold. Family shareholders hold an average equity stake of nearly 26% of the firm's shares, have maintained these large positions for over 40 years, and exist in all SIC industries. Our empirical analysis indicates that family firms devote fewer financial resources to long-term investing than diffuse shareholder firms even after controlling for differences in financing constraints and industry composition. Relative to diffuse shareholder firms, we find that family firms spend about 7.41% less (as a fraction of total assets) on long-term investments. When segregating family firms into distinct sub-components of founder firms and heir firms, the results indicate no statistical or economic difference between the two groups.

The analysis further indicates that families with large equity positions exert a greater effect on firm investment policy than families with small ownership stakes; suggesting that poorly diversified, influential family owners appear to have the greatest influence in reducing firm investment levels. To further differentiate between the risk aversion and long horizon hypotheses, we examine the investment patterns in firms characterized as high- and low-risk. The results of our analysis indicate no differences in investment patterns between family firms and diffuse shareholder firms that are characterized as low risk. Amongst higher-risk firms however, we document a particularly strong propensity for family firms to limit investment spending relative to diffuse shareholder firms; providing evidence generally consistent with the risk aversion hypothesis.

Focusing on the two components comprising long-term investments, the results provide strong support to the notion that family ownership is related to the level of investment in both R&D and capital expenditures. We observe that as a fraction of total investment, family firms commit significantly less capital to R&D investments than non-family firms – about 28% percent less than diffuse shareholder

firms. Additional tests indicate that family firms commit more to capital expenditures than diffuse shareholder firms. Our empirical results generally show that family owners prefer less risky capital expenditures to riskier R&D projects. When comparing investment patterns in founder-firms to heir-firms, we note no significant differences between the two groups.

Our analysis also indicates an endogenous relation between controlling shareholder ownership and firm investments; suggesting the use of IV-2SLS to further investigate firms' investment choices. Modeling family ownership as a function of the benefits of private control using data from U.S. Census Bureau (Helwege and Packer (2009)), we again find that these controlling shareholder firms devote fewer financial resources to long-term investing than diffuse shareholder firms. Although our diagnostic tests suggest our IV-2SLS specifications mitigate endogeneity concerns regarding the relation between family ownership and corporate investment policy, we cannot rule out the notion that these controlling owners stay in the firm because of the firms' investment prospects. If family owners maintain their equity stakes because of the firm's low-risk investment patterns, our results importantly indicate that outside shareholders bear no adverse impact from the firm's investment policies. Still, these tests suggest that risk-aversion appears to be a primary force affecting family firm investment patterns (relative to diffuse shareholder firms), rather than the long horizon perspective as often articulated by the popular press.

Our finding that family firms devote fewer financial resources to R&D investments than diffuse shareholder firms provides evidence consistent with the risk aversion hypothesis. However, an alternative explanation for these findings suggests that influential-shareholder monitoring improves investment efficiency; thereby allowing family firms to spend fewer dollars on R&D projects to achieve similar outcomes. Accounting research indicates that R&D investments are particularly opaque and difficult to oversee (Aboody and Lev, (2000)). Families, as strong, committed monitors – absent in diffuse shareholder firms – may play an especially important role in overseeing and ensuring productive and efficient R&D expenditures. To investigate this proposition, we examine whether outcomes of R&D efforts differ between family firms and diffuse shareholder firms using patent and patent citation

data (Hall et al. (2005)). The analysis indicates that family firms receive fewer patents and fewer patent citations per dollar of R&D investments than diffuse shareholder firms. Further, we observe that family and diffuse shareholder firms achieve similar number of patents per R&D dollar. These results provide evidence inconsistent with the notion that greater R&D efficiency in family firms, relative to diffuse shareholder firms, allows them to invest less in R&D to obtain similar outcomes.

Our analysis thus far indicates that, on average, family firms commit fewer resources to total investing, and especially R&D activity, relative to diffuse shareholder firms. Nonetheless, these differences in investment patterns may not be indicative of conflicts of interests between these large, controlling shareholders and outside shareholders. Prior literature documents that within the S&P 500, family firms exhibit better market and accounting performance than comparable diffuse shareholder firms (Anderson and Reeb, (2003b)). Other research indicates that CEO compensation differs between family and diffuse shareholder firms (Ali et al. (2009)), potentially creating incentives for CEOs in diffuse shareholder firms to overinvest in risky projects (Clinch, (1991)). Thus, an alternative explanation suggests that diffuse shareholder firms overinvest in R&D projects while family owners, as committed monitors, promote greater investment efficiency, thereby benefiting firm shareholders. To gain further insights into this issue, we investigate the relation between investment levels in family firms (relative to diffuse shareholder firms) and firm value.

In our value investigation, we ask whether the observed, lower level of investment in family firms can be attributed to efficiency gains from family monitoring or alternatively, to families seeking to curb firm investments so as to mitigate risk levels. The monitoring perspective suggests that family oversight improves the efficacy of the investment process thus allowing family firms to allocate less to investments than diffuse shareholder firms. If so, we expect the market to positively value the reduced level of investment spending in family firms relative to diffuse shareholder firms. The risk reduction hypothesis in contrast, suggests that families seek to mitigate firm risk by allocating fewer resources to investments than diffuse shareholder firms. If so, we expect the market to negatively value the reduced

level of investment spending in family firms. Our tests indicate that outside shareholder do not positively value the reduced levels of investment spending, particularly R&D, in family firms relative to diffuse shareholder firms. Rather, the results of both a reduced form model and simultaneous equation framework suggest that the market discounts family firms that commit fewer resources to investment spending that diffuse shareholder firms; providing evidence generally consistent with the risk reduction argument.

Although Anderson and Reeb (2003a) suggest that family owners do not pursue risk reductions strategies through greater corporate diversification or less debt usage relative to non-family firms, our evidence indicates that families appear to mitigate firm risk by influencing the level and type of long-term, corporate investments.[1] In particular, the evidence suggests that families engage in risk avoidance by committing fewer resources to risky R&D investments than non-family firms. Barth et al (2001), Kothari et al (2002), and Shi (2003) observe that firms' R&D investment activities can have an especially strong influence on firm risk. Overall, our results suggest that investment patterns differ between family firms and diffuse shareholder firms. Family firms devote significantly fewer resources to total investment activity and with these investment dollars, allocate greater portions to capital expenditures and less to R&D projects than diffuse shareholder firms. These differences in investment patterns also bear a relation to shareholder value. Relative to diffuse shareholder firms, outside investors appear to not positively value family preferences of allocating greater resources to capital expenditures than diffuse shareholder firms. Although we cannot unambiguously eliminate the possibility that families maintain their equity stakes because of firm investment policies; our evidence suggests that family ownership significantly affects corporate investment policy.

[1] In subsequent research, Anderson et al (2009) report that family firms in the S&P 500 exhibit lower expropriation tendencies than other publicly-traded family firms (relative to similar diffuse shareholder firms). Consistent with this view, in our sample of 2,000 non-utility, non-financial firms, we find that family firms employ less debt than diffuse shareholder firms, providing evidence consistent with the family risk aversion hypothesis.

2. Hypothesis Development

Classic investment theory indicates that shareholders share a common objective of maximizing current stock price. To achieve this goal, shareholders delegate investment decisions to managers and direct them to undertake all projects that earn more than the required rate of return. Economic theory consequently indicates that in perfect capital markets, firm investment decisions depend on objective market criterion – maximizing shareholder wealth; suggesting that firm investment policy bears no relation to equity ownership structure (Fisher (1930); Gordon (1960)). Yet, because of differing investment horizons or risk preferences, shareholders often intervene in firm matters to protect or promote their interests (Jensen and Meckling (1976)). We examine two conflicting arguments on the relation between family ownership and firm investment policy; risk aversion and long-term horizons.

2.1. *Family Risk Preferences*

Family-owner welfare bears a strong and direct link to firm-specific risk. Because these owners typically hold a concentrated stake in a single firm, their well-being often depends on firm survival and performance (Anderson et al. (2003)). Family owners thus potentially have substantially stronger incentives to mitigate firm risk relative to well-diversified shareholders. Differing risk tolerances suggest that family shareholders potentially do not share the same objective as well-diversified shareholder. In particular, these large, influential shareholders may be more cautious and conservative in their investment decisions than managers of diffusely-held firms (Shleifer and Vishny (1997)).

Although controlling owners can affect the firm's risk profile through several activities such as diversifying into unrelated businesses or under-utilizing debt (Anderson and Reeb (2003a)), we argue that families can have a particularly strong influence in mitigating firm risk by affecting the firm's long-term investment decisions. Firm investments in long-term projects with uncertain outcomes suggest that concentrated shareholders assume increasingly greater levels of idiosyncratic risk as the level of investment increases (Ireland (1983)). Diffuse shareholders in contrast, presumably view the risks

created by firm-specific investments as less important or unimportant because they eliminate or minimize these risks by holding a broad basket of securities (Amihud and Lev (1981)). Families affecting investment policy because of high levels of risk aversion, suggests higher discount rates relative to diffusely-held firms; thereby effectively shortening the firm's investment horizon. These firm-specific risk arguments suggest that family firms commit fewer financial resources to long-term, risky investment activities than diffuse shareholder firms. If family owners are more cautious and conservative in their investment decisions, then we expect that family firms will invest less than diffuse shareholder firms. This leads to our first hypothesis:

H1A: Family firms invest less than diffuse shareholder firms.

Our analysis so far treats long-term investment as a uniform input or decision-choice for firms. Accounting treatment segregates long-term investments into two distinct classes of expenditures: research and development (R&D) investments and capital spending. Capital expenditures are devoted to existing products and/or projects with relatively well-defined economic benefits. R&D investments in contrast, represent an investment in new technologies, products, or services with less predictable outcomes than capital expenditures (Chan, Lakonishok, and Sougannis (2001)). R&D investments differ from capital expenditures along several dimensions including, information asymmetry, project outcome uncertainty (Lev and Sougiannis (1996); Aboody and Lev (2000); Kothari et al. (2002); Shi (2003)), and flight-risk of human capital (i.e. key R&D employees leaving for other firms). Moreover, capital investments constitute assets that the firm can readily sell – relative to R&D investments – to other parties if the project fails. Capital spending also includes purchases of property that, overtime, will likely increase in value independent of firm performance. Kothari et al. (2002) underscore the riskiness of R&D investments by documenting that R&D spending exhibits a greater effect on the variability of future operating income than capital expenditures by about 30% to 70%. Generally, R&D investments expose firms and thus family shareholders to greater levels of uncertainty or idiosyncratic risk than

investments in capital expenditures (Lev and Sougiannis (1996); Aboody and Lev (2000); Shi (2003)). If these controlling shareholders seek to mitigate firm risk, then we expect family firms to devote fewer resources to R&D spending and more resources towards capital expenditures than diffuse shareholder firms. This leads to our second hypothesis:

> *H2A: Relative to diffuse shareholder firms, family firms devote more resources to capital expenditures and fewer resources to research and development.*

2.2. *Family Horizons*

Families, as committed shareholders with a long-term perspective, possess strong incentives to engage in investment activities that ensure the long-term viability and health of the firm. The long-term and continuing commitment of family owners towards their firms potentially gives rise to a long-horizon perspective that leads to consumption decisions that increase long-term investment (e.g., Chen et al. (2008); Anderson and Reeb (2003b)). Prior research also suggests that professional managers of large, publicly-traded firms have a short-term focus that influences investment decisions (Holmstrom (1999)). Porterba and Summers (1995) for instance, report that managers consciously choose short-term projects because of the belief that the stock market fails to properly reward long-term investments. Other research indicates that managers manipulate short-term earnings to maximize incentive-based compensation (Healy, (1985)); suggesting that near-term considerations play an important role in managerial decision-making.

Families, as strong monitors-in-place with large, influential ownership stakes, can intervene in firm investment decisions to mitigate or minimize myopic behavior (Stein (1988, 1989)). The presence of a large, controlling shareholder potentially alleviates demands to engage in myopic investments and rather provides the discipline for firms and management to commit resources to long-term investments (Shleifer and Vishny, (1986)). Consequently, the incentives arising from these family shareholders' long-standing commitment to the firm and their ability to monitor management suggests that family

firms commit greater financial resources to long-term investments relative to diffuse shareholder firms.[2] This leads to an alternative to H1A, stated as:

H1B: Family firms invest more than diffuse shareholder firms.

The horizon hypothesis indicates that family ownership may distinctly affect the individual components of total investment; capital expenditures and R&D expenditures. Hall (1993) and Del Monte and Papagni (2003) argue that R&D spending provides long-term benefits and these benefits often exceed those from capital spending (Zucker et al. (1998)); suggesting that family firms engage in R&D projects to protect the firm's long-term welfare. Further, as influential monitors, these powerful shareholders can mitigate myopic investment activities by firm managers. In particular, the expensing of R&D investments in the current period, while depreciating capital spending over several years, provides incentives for managers or shareholders to curtail R&D investments to meet short-term earnings targets. Families acting as strong monitors with a long-term horizon can mitigate managerial incentives to focus on short-term earnings and rather, invest for long-term value maximization. Lastly, the uncertainty associated with the future economic outcomes of R&D investments creates the potential for share mispricing and thus compounds short-term investors' incentives to curb such spending (Aboody and Lev (2000)). Family owners however, as strong monitors with extended investment horizons, potentially tolerate short-term mispricing and protect the firm from myopic investment practices. In contrast to the risk preferences argument on investment allocations (H2A), the investment horizon perspective suggests that family firms commit greater resources to R&D investments than diffuse shareholder firms. This leads to the following hypothesis:

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[2] One could also examine the pattern of cash flows that results from investments in physical assets or from R&D spending. This approach requires a subjective mapping of initial investments on to subsequent cash flows arising from the investments. A cleaner and more robust test of differing horizons amongst firms would be to compare their relative investments levels. *Ceteris paribus*, longer horizons indicate that firms employ lower discount rates in evaluating projects; resulting in greater levels of investment. In contrast, decision-makers concerned about short-term profits may be less willing to undertake investments because they severely discount the value of future payouts. Consequently, our primary analysis focuses on examining relative investment levels between controlling shareholder firms and diffuse shareholder firms.

H2B: Relative to diffuse shareholder firms, family firms devote more resources to research and development and fewer resources to capital expenditures.

3. Data, Variable Measurement and Descriptive Statistics

3.1. *Data*

For our empirical investigation, we use the 2,000 largest firms in the United States as of December 31st, 2003. To gather the sample, we extract all firms from COMPUSTAT and rank these based on market capitalization as of year-end 2003. Foreign firms, regulated public utilities (SIC codes 4812, 4813, 4911 through 4991), and financial firms (SIC codes 6020 through 6799) are excluded because government regulation potentially affects firm investment choice and equity ownership structure. We control for survivorship bias by allowing firms to exit our sample that covers the period from 2003 through 2007. Based on these criteria and our primary control variables, COMPUSTAT yields a total sample of 8,872 firm-year observations.[3]

Hall (1993) notes that a primary issue in using firm-level investment data, particularly R&D expenditures, is that firms (or COMPUSTAT) sometimes do not report R&D expense which then becomes coded into the COMPUSTAT database as missing. Of our 8,872 observations, COMPUSTAT provides R&D data for 5,842 observations or 65.85% of the sample and provides complete coverage on capital expenditure data. In section 4.2 and in Appendix 1, we discuss our treatment of missing R&D data.

We manually collect data from corporate proxy statements from 2003 through 2007 on family characteristics, including ownership levels, dual-class shares structures, generation (founder or heir), and CEO classification.

[3] Our primary control variables are net sales (Item #12), cash holdings-to-total assets (Item #1/Item #6), long-term debt-to-total assets (Item #9/Item#6), prior year return on assets (Item #13/Item #6), and 2-digit SIC codes. Because R&D expense is a variable of primary interest and firms (or COMPUSTAT) sometimes report these as missing values, we do not include these limiting factors in constructing the sample.

3.2. Variable Measurement

3.2.1. Family Firms

We define family firms as those where the founder or the founder's descendants continue to maintain a presence as either a shareholder, top-level manager (chairman, CEO, etc.), or as a director. In the empirical analysis, we examine founder-controlled and heir-controlled firms separately, and also as a combined group (family firm). To be classified as founder- or heir-controlled, the founder or heir does not necessarily need to serve as the firm's CEO, rather the classification refers to founders or heirs maintaining an equity stake in the firm.

We denote founder-controlled firms and heir-controlled firms using a binary variable that equals 1.0 when these controlling shareholders maintain a 5% or greater ownership stake (Villalonga and Amit (2006)).[4] In additional testing, we also examine family influence on investment policy using a continuous measure of ownership. The continuous measure is computed as the total number of shares held by families (and their relatives) divided by total shares outstanding. For firms with dual class share structures, we use the families' total voting power as a measure of their influence.

These large shareholders can potentially exert further control over investment choice or policy by maintaining an active role in firm management. Consequently, we subdivide family firms into actively-managed and passively-managed firms. Actively-managed family firms are those in which the founder or heir holds the CEO post. Passively-managed family firms are defined as those where an outside, professional manager (hired-hand) serves as CEO.

To ascertain family ownership and their involvement, we examine corporate proxy statements and company histories for each firm in our sample to determine the founder, their subsequent lineage,

[4] When using a binary variable at a minimum ownership level of 1% to denote family firms, our empirical analyses generally yield the same signs on the coefficient estimates but with a lower level of statistical significance (≈10%) relative to a 5% minimum ownership threshold. We interpret this to suggest that the level of family ownership – i.e., 10%, 15%, 30% -- rather than simply the presence of these controlling shareholders exert an effect on firm investment policy. Consistent with this interpretation, Anderson et al. (2003) find that the agency costs of debt are also related to both the presence and level of family ownership.

and their involvement with the firm. Corporate histories for each firm in our sample come from Gale Business Resources, Hoovers, and from individual companies. In our analysis, we compare founder-controlled and heir-controlled firms against diffusely-owned, manager-controlled firms (the omitted variable which we label as diffuse shareholder firms or diffusely-held firms).

3.2.2. Long-term Investments and Firm Performance

Long-term investment is measured as the sum of R&D spending (Compustat item #46) and capital expenditures (Compustat item #128), respectively. We compute long-term investment as a fraction of total assets; normalizing by total assets allows us to compare over time and across firms. For additional tests, we also examine R&D spending as fraction of total investment by dividing R&D by the sum of R&D spending and capital expenditures.

We measure firm performance using a proxy for Tobin's Q. Following earlier studies, Tobin's Q is calculated as the market value of total assets divided by the book value of total assets. We develop a proxy for the market value of total assets by summing the market value of equity, plus the book value of preferred stock, and the book value of debt.[5] For firms with multiple-share classes, we calculate the market value of equity as the total number of shares of all classes by the share price of the tradable class. If a share class does not trade, we use the share price of the tradable class as a proxy for its price.

3.2.3. Control Variables

We control for factors that potentially affect firm investment decisions (e.g. Blundell et al. (1999)). To account for potential differences in investment activities due to firm scale or size, we use the natural logarithm of firm net sales. Differences in firm's liquidity or ability to internally fund investments

[5] Whited (2000) notes that none of the available algorithms for estimating Tobin's Q improves measurement quality beyond this estimate produced directly from accounting data. However, we acknowledge that using Tobin's Q as a dependable variable with R&D variable as an explanatory variable may create a potential for spurious correlation. To show that our results are not driven by spurious correlation, we also investigate the family investment efficiency by examining the outcomes of R&D process using patent data.

potentially affect the level of capital resources allocated to R&D and capital expenditures. We measure liquidity as the sum of cash and cash equivalents to total assets. Prior firm performance also affects firm investment choices. We capture prior performance as return on assets from the prior year (t-1); computed as earnings before interests, tax, depreciation and amortization (EBITDA) divided by total assets from the prior year (t-1). Firms further along their life cycles arguably have different investment alternatives; younger firms potentially expend more on R&D while older, more mature firms spend more on capital expenditures. We capture firm age as the natural logarithm of the number of years since the firm's inception. Data on firm age is garnered from Hoovers, Gale Business Resources and firm-level sources. A firm's existing debt level may also affect its ability to obtain financing for investments. Firm leverage is the ratio of long-term debt divided by total assets. We measure firm risk using return volatility which is calculated as the standard deviation of monthly stock returns for the prior 36 months. Finally, we include dummy variables for each 2-digit SIC code to account for industry effects and year dummy variables to capture time effects.

3.3. *Descriptive Statistics*

Table I presents three panels of summary statistics for our sample of firms. Panel A shows means, medians, standard deviations, minimum, and maximum values for our key variables and Panel B presents differences of means tests between family firms and diffuse shareholders firms. Panel C provides a correlation matrix for the key variables in the sample.

The sample comprises the 2,000 largest U.S. firms as of year-end 2003 and spans from 2003 through 2007 yielding 8,872 firm-year observations. Based on our five-percent ownership threshold to denote family firms, 3,407 observations (38.40%) are classified as family firms. On average, families own 25.88% of their firm's shares. Heir-controlled firms account for 1,736 (19.57%) observations, founder-led firms account for 1,671 (18.83%) observations, and diffuse shareholder firms represent the remaining

5,465 (61.60%) observations. On average, heir-controlled firms hold 27.06% of the firm's equity and founder-led firms have an equity stake of 24.51%.

Table I, Panel A also reveals that firm size (average total sales) in the sample has a mean of nearly $4.44 billion and a corresponding median of $920 million. Minimum and maximum values for total sales are $0.0 million and $375 billion, respectively. Average firm performance, measured using return on assets with EBITDA as the numerator is 10.69 percent. We find that the average firm is 46.15 years old, with the minimum and maximum firm age being zero and 263 years, respectively. Total investment – measured as the sum of R&D and capital expenditures divided by total assets – has a mean value of 9.66%. Breaking total investment into its two individual components indicates that capital expenditures account for 67.98% of firm investment with R&D representing the remaining 32.02% of investment. Tobin's Q has a mean value of 1.79 with a minimum and maximum value of 0.01 and 7.94.

Panel B of Table 1 presents differences of means tests for our variables between family firms and diffuse shareholder firms. Family firms, on average, are smaller, younger, and less leveraged than diffuse shareholder firms. Specifically, the average total sales for family (diffuse shareholder) firms are $2.92 ($5.38) billion. Average age for family (diffuse) firms is 41.30 (48.98) years and average debt ratio is 16.68% (19.21%). The univariate analysis also indicates that these controlling shareholder firms devote fewer financial resources to long-term investment than diffusely held firms. Specifically, we note that families commit 9.30% of assets to total investment while diffuse shareholder firms devote 9.88%. The composition of total investment also appears to vary considerably between controlling and non-controlling shareholder firms; family firms place greater portions of total investment in capital expenditures than diffuse shareholder firms (73.82% versus 64.33%) and less in R&D investments (26.18% versus 35.67%). However, on average, we find that family and non-family firms exhibit no significant differences in risk (12.2% versus 12.0%) and Tobin's Q (1.81 versus 1.78).

Finally, Panel C presents a correlation matrix for some of the key variables in the sample. We note a positive relation between family ownership and capital expenditures but a negative relation

between the ownership stake of these controlling shareholders and R&D spending and total investment. Because firm size, age and other attributes likely affect investment policies, we examine our main hypotheses using a multivariate framework.

4. Empirical Results

4.1 *Family Ownership and Total Investments*

The risk aversion hypothesis posits that as concentrated-undiversified shareholders, families hold strong incentives to devote less capital to investment projects with uncertain outcomes. Yet, the horizon hypothesis suggests that incentives arising from these controlling shareholders' long-standing commitment to the firm and their ability to monitor management potentially bolster long-term investments relative to diffuse shareholder firms. To determine the dominant effect between these perspectives, we estimate the following regression model:

$$\begin{aligned} \textit{Long-term Investments} = {} & \beta_0 + \beta_1 (\textit{Family Firm}) + \beta_2 (\textit{Control Variables}) + \\ & \beta_3 (\textit{Industry Controls}) + \beta_4 (\textit{Year Controls}) + \varepsilon \end{aligned} \qquad (1)$$

Where;

Long-term Investments = The natural log of the sum of capital expenditures and R&D expense normalized by total assets.

Family Firm = A binary variable that equals one when families hold 5% or more of the firm's equity; or the fractional ownership level of families.

Control Variables = Natural logarithm of net sales; cash-to-assets (cash plus cash equivalents divided by total assets); ROA_{t-1} (EBITDA divided by total assets); firm age (natural logarithm of the number of years since the firm's inception); debt ratio (long-term debt divided by total assets).[6]

Two-Digit SIC Code = one for each two-digit SIC code in our sample.

Year Dummy Variables = one for each year of our sample.

We control for serial correlation and heteroskedasticity using the Huber-White Sandwich estimator (clustered on firm level identifier) for variance (White (1980)).[7]

[6]We control for the same factors as in Anderson and Reeb (2003) except for board independence and outside blockholdings which they find to be insignificant in their model.

[7] A potential concern arises with the measurement of our total investment variable because of the large number of zero observations associated with R&D expense in the COMPUSTAT database. Heckman two-stage regression

Table 2, columns 1 through 4, present the primary results. In column 1, we use a binary variable to denote family firms (founders and heirs). Column 2 uses a continuous measure of family ownership, defined as the number of shares held by these controlling shareholders divided by total shares outstanding. In column 3, we introduce two binary variables to denote high- and low- levels of family ownership. Column 4 decomposes the continuous measure of family ownership into two subcomponents; founder-led firm ownership and heir-controlled firm ownership. Diffuse shareholder firms are the omitted variable in the regression analyses.

Consistent with the risk aversion argument, we find that family presence and/or ownership exhibits a negative relation to long-term investment. The results, using either a binary variable to denote family presence (column 1) or a continuous measure of ownership (column 2), indicate that these controlling shareholder firms devote less capital to long-term investments than diffuse shareholder firms. Based on the results in column 1 using a binary variable to denote family ownership, we find that these firms commit 7.41% less capital (as a percent of total assets) to long-term investment than diffuse shareholder firms.[8]

4.1.1 *The Level of Family Ownership*

To provide further insight into our hypotheses, we examine the relation between high- and low-levels of family ownership and firm investment policy. From the perspective of the risk argument, families with high ownership levels (relative to low ownership levels) possess the strongest incentives and greatest influence to diminish firm investment levels so as to mitigate firm specific risk. The horizon argument in contrast, suggests an opposing effect for high-ownership families. Specifically, families' long-term perspectives provide strong incentives to commit financial resources to investing activities that

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techniques provide similar statistical and economic inferences. In the next section, we more fully examine the effects of zero R&D values on our empirical results.

[8] We calculate this difference as $(e^{\beta x} -1)*100.0\% = (e^{(-0.077)*(1.0)} - 1) * 100.0\% = -7.41\%$.

ensure the long-term health and viability of the firm; suggesting that families with high-ownership levels commit greater resources to investment activities than families with low-ownership levels. The results in column 3 of Table 2 provide support to the risk hypothesis. In the analysis, we denote low-ownership family firms as those falling in the bottom tertile of family ownership (<=12.23% of outstanding shares). High-ownership family firms are those in the top tertile of family ownership (>=30.875% of outstanding shares).[9] The results indicate that families with high-ownership levels exert a large and significantly negative effect on firm investment levels. The coefficient estimate on families with low-ownership levels however, is not significantly related to firm investment levels; suggesting that low-ownership family firms commit similar levels of resources to investments as diffuse shareholder firms. In an F-test examining the equality of coefficient estimates on low-ownership family firms and high-ownership family firms, we reject the null (F=7.20, p=0.01) and conclude that low- and high-ownership family firms exhibit significantly different investment patterns.[10]

4.1.2 *Founder-led Firms and Heir-led Firms*

Our analysis thus far lumps both founders and heirs together as family shareholders; arguing that these owners uniquely differ from other investors because of their long-term commitment to the firm or the undiversified nature of their holdings. Questions arise however, as to whether founder-led firms are similar or the same as heir-controlled firms (Morck, Shleifer, and Vishny (1988); Anderson and Reeb (2003b)). For instance, founder-controlled firms may systematically differ from heir firms because of the

[9] We drop the mid-tertile of family ownership (12.23% < outstanding shares < 30.87%) from the analysis and thus have 7,736 firm-year observations for the regression. Similar results are obtained with the inclusion of the mid-tertile in the regression analysis.

[10] Divergences in family ownership and control rights through the use of dual-class share structures (with superior voting rights) can further enhance family influence in firms' investment policies. When segregating family firms into dual- and single- class firms, we find that both types of firms commit significantly fewer resources to total investments relative to diffuse shareholder firms. However, the analysis indicates that dual-class firms devote significantly fewer resources to investing activities than single-class family firms; suggesting that controlling-enhancing mechanisms permit families to further exert their preferences on firm investment policies. We also assess whether a curvilinear relation better explains the association between firm investment and ownership. Our results indicate that the relation between firm investment and controlling shareholder ownership does not appear to be curvilinear.

founders' entrepreneurial talent and leadership abilities (Shleifer and Vishny (1986)). In contrast, heir control frequently arises because of family ties rather than merit, suggesting heir-controlled firms potentially do not possess the same talent and abilities as non-family firms or founder firms (Wang (2006), Anderson et al. (2009)). Consequently, we compare and contrast these two types of controlling shareholders relative to one another and to non-family firms. When decomposing family ownership into separate components of founder-led firms and heir-controlled firms (column 4), we observe that both categories exhibit a significant and negative relation to long-term investment; suggesting that both founder- and heir-controlled firms devote fewer financial resources to investment than diffuse shareholder firms. In an F-test examining the equality of the coefficient estimate on founder-led firms and heir-controlled firms ($\beta_4 = \beta_5$), we fail to reject the null hypothesis (F=0.11, p=0.74) and thus, cannot conclude that founder-led firms pursue different investment policies than heir-led firms.[11]

4.1.3 *Additional Tests on the Risk Aversion and Horizon Hypotheses*

In an additional test to differentiate between the risk and horizon hypotheses, we examine family investment decisions as a function of firm risk. If family owners seek to mitigate firm risk through lower investment levels (relative to diffuse shareholders firms), the risk aversion hypothesis suggests that this effect may be the most pronounced in firms bearing high-level of risk. In firms bearing low levels of risk however, family shareholders may have few incentives to affect the level of firm investment. Alternatively, if family horizon incentives dominate their investment preferences, these shareholders may commit similar or greater levels of resources to firm investment activities versus diffuse shareholder firms, irrespective of the level of firm risk.

[11] Family firms can also differ depending on whether these controlling shareholders maintain an active management role or source external managers to run the business (Shleifer and Vishny (1986), Burkart et al. (1997), Bennedsen et al. (2007)). In additional analysis we include variables for founder CEO, descendant CEO, and professional CEO and find that – beyond the family ownership effect – CEO type appears not to affect the level of firm total investment.

Table 2, columns 5 and 6, provides the results of this risk analysis, based on the standard deviation of stock returns for the prior 36-months. Column 5 shows the results on family investment levels for firms experiencing low-levels of risk (bottom tertile, $\sigma<=0.0859$) and column 6 shows the results for firms experiencing high-levels of risk (top tertile, $\sigma>=0.1316$). For firms experiencing low-risk levels, we do not find any relation between firm investment levels and family ownership. In high risk firms however, we find that family ownership exhibits a negative and significant relation to total investment. We note a word of caution in interpreting these results. Specifically, our test suggests that the firm's existing risk profile potentially influences current investment levels. Causality however, also runs in the opposite direction with current investment affecting the firm's risk profile. Yet, by comparing firms in the same risk tertile (i.e, holding risk constant), we can provide insights on whether risk influences family investment decisions. The results generally suggest a relation between the level of family investment and firm risk; in particular, higher firm risk appears to be associated with lower family firm investment levels.[12]

4.2 *Family Ownership and Components of Investments*

The results indicate that family firms, on average, devote fewer resources to investment than diffuse shareholder firms. Total investment however, comprises two major components: R&D spending and capital expenditures. Prior literature indicates that R&D projects expose firms to greater levels of idiosyncratic risk than capital expenditures (Aboody and Lev (2000)); suggesting that if founders or heirs seek to mitigate firm risk, then these owners will devote fewer financial resources to R&D than diffuse

[12] We conduct an additional test to provide further evidence to differentiate our hypotheses by examining whether the relation between short-term performance and R&D investments differ between family firms and diffuse shareholder firms. The risk aversion hypothesis suggests that if families seek to minimize idiosyncratic risk, then they should be less willing to accept variability in short-term profitability due to R&D investments than diffuse shareholder firms. Alternatively, given their long-term commitment to the firm, families may be willing to tolerate greater variability in short-term performance arising from R&D spending relative to diffusely held firms. Although an indirect test, we find that family owners appear to be less willing to tolerate variability in short-term performance from investments in R&D than diffuse shareholders. Overall, the results of this test provide support for the risk-reduction hypothesis.

shareholder firms. Yet, as long-term investors, these controlling owners potentially possess strong incentives to engage in R&D activities that ensure long-term firm viability. To empirically examine these propositions, we re-estimate equation (1) using the ratio of R&D spending to total investment as the dependent variable. We note that the construction of the dependent variable differs from the prior regression specification in that we use R&D divided by the sum of R&D plus capital expenditures. This construction allows us to ascertain the portion of total investment devoted to R&D spending (for instance, 30%) while the remainder reflects the portion devoted to capital spending (i.e., 70%).

An important concern arises in this investigation however, because of the large number of missing R&D observations in the COMPUSTAT database. In our sample of 8,872 firm-year observations, COMPUSTAT provides data on 5,842 observation or about 66% of the sample. We follow two avenues to address this issue.[13] First, following prior studies, we set the missing data points to a zero value for R&D (e.g., Aboody and Lev (2000)). In setting the missing observations to zero, we assume that these firms do not engage in R&D efforts. The large cluster of zero observations thus indicates the use of Tobit regressions for this empirical analysis. Missing R&D data however, may be non-random. Specifically, the firm's level of R&D expenditures and the firm's likelihood to report R&D spending may be determined by a common set of unobservable factors (jointly determined). If so, a self-selection bias arises with Tobit regressions that yield inconsistent and inefficient estimators (Heckman (1979)). Thus, in our second method to investigate the relation between R&D investment and controlling shareholder ownership, we employ Heckman's (1979) two-stage regression technique. In the first step, we estimate the inverse Mills' ratios (IMRs) and in the second stage, the R&D model includes the IMRs as a control for the effects of self-selection (Appendix 1 provides details of the Heckman model).

Table 3 presents the results for the Tobit regressions and the Heckman model. Column 1 shows a regression specification using a binary variable to denote family ownership or presence. Column 2

[13] In other robustness tests, we also restrict our analysis to firms that report R&D expenditures and where possible, we use a model that assumes that the logarithm of R&D expenditures evolves as a random walk to interpolate a missing value.

segregates these controlling shareholder firms into founder-led and heir-led firms. Column 3 breaks family firms into actively- versus passively-managed. Across all of the specifications, the results indicate that family ownership, as a group or individually (founders and heirs), bears a negative and significant relation to the portion of total investment devoted to R&D spending; suggesting that these controlling shareholder firms appear to commit fewer (more) resources to R&D projects (capital spending) than diffuse shareholder firms. The results from column 1 indicate that family firms spend about 28.1% less (as a fraction of total investment) on R&D than diffuse shareholder firms. We compute this difference as the family coefficient estimate divided by the average R&D-to-total investment for the full sample (i.e., -0.090/0.3202 = -28.11%). The construction of the dependent variable thus indicates that family firms allocate greater resources to capital expenditures – on average, 13.2% more – than diffuse shareholder firms. Again, we calculate this difference as the coefficient estimate on family firms divided by the average capital expenditure-to-total investment for the full sample (0.090/0.6798=13.24%). Column 2 shows the results of a Tobit regression that includes ownership levels in founder-led firms and heir-controlled firms. The analysis indicates that both founder-led and heir-controlled firms devote fewer financial resources to R&D spending than diffuse shareholder firms. An F-test (F=0.13, p=0.71) indicates that the coefficient estimate on founder-led firms does not significantly differ from heir-controlled firms and thus, we cannot conclude that founder-led firm differ in their investment decisions from heir-led firms.[14]

The Heckman self-selection models in columns 4, 5, and 6 (with details in appendix 1) provide qualitatively similar results and the same inferences as the Tobit regressions. We note however, that the selectivity correction terms (IMRs) bear significant coefficient estimates suggesting a self-selection bias in

[14] CEO type (column 3) appears to affect R&D spending. Specifically, we note that family firms with descendant CEOs appear to devote significantly less to R&D spending than either founder CEOs or professional-manager CEOs. In additional testing, we examine the equality of coefficient estimates on founder CEO versus professional manager CEO (F=3.23, p=0.07), founder CEO versus heir CEO (F=5.80, p=0.02), and heir CEO versus professional manager CEO (F=14.08, p=0.00) and conclude that heir CEOs devote the least amount to R&D, followed by founders and then with professional managers committing the most to R&D.

firm's reporting R&D expenditures (Hall et al. (2005)). Taken together, and consistent with *H2A*, our results suggest that family firms invest fewer (more) financial resources in R&D projects (capital expenditures) than diffuse shareholder firms; providing support to the risk aversion hypothesis.

4.3 *Robustness Tests on the Risk Aversion and Horizon Hypotheses*

4.3.1 Endogeneity Between Controlling Shareholder Ownership and Investment

The risk aversion and horizon arguments imply that long-term investment policy flows from family ownership or presence. Founder or heir ownership however, could instead be a function of corporate investment policy with these controlling shareholders choosing to remain in firms because of specific capital expenditure or R&D policies. Importantly, our hypotheses regarding horizons and risk aversion would continue to indicate similar empirical relations between investment levels and controlling shareholder ownership regardless of the direction of causality. The intuition underlying the empirical relations however would differ assuming investment policies form family decisions to remain in the firm. The risk aversion hypothesis would then indicate that high R&D, risky firms would be less suitable candidates for family investments; suggesting a negative relation between family ownership and R&D spending. Alternatively, the horizon argument would suggest that firms facing investments with long effective maturities may be strong candidates for families with long-investment horizons; again indicating a positive relation between these controlling shareholders and long-term investments.

To provide further insights into endogeneity concerns, we use an instrumental variable two-stage least squares (IV-2SLS) approach to estimate the relation between firm investments and family ownership. Our primary concern rests on the notion that these influential owners garner private benefits of control – at the expense of outside shareholders – by affecting firm investment policy. Family shareholders' capacity to extract private benefits from the firm partially depends on outside investors' ability to detect and understand their actions (Anderson et al. 2009). Outside investors with greater levels of financial sophistication or affluence can better understand corporate insider actions than

investors with less financial awareness. Because corporate headquarters are the center of information exchange between the firm and investors (Davis and Henderson, 2004; Pirinsky and Wang, 2006), local area investors with greater financial sophistication arguably better understand and limit insiders' self-serving actions than local area investors with less sophistication. Accordingly, we model family ownership or their ability to extract private benefits as a function of the financial sophistication of local area investors. To proxy for financial awareness of local-area investors, we use the median income of the population of the county where the firm maintains its headquarters. Data on the location of each firm's headquarter county (and state) comes from COMPUSTAT. Data on the median income of the county's population (for years 2003 through 2007) comes from the U.S. Census Bureau.

We conduct two preliminary tests to evaluate our IV-2SLS procedure. First, we conduct an endogeneity test which investigates whether OLS and IV-2SLS provide similar estimates. A rejection of the null indicates an endogeneous regressor (family ownership) and thus the need for instrumental variable techniques (Hausman (1978)). Using the Wu-Hausman test statistic ($F=51.72$, $p=0.00$), we reject the null and conclude that family ownership is endogeneous and thus proceed with 2SLS. Second, we perform a partial F-test which examines the power of our instrument to predict family ownership in the first-stage regression. The test examines whether the instrument (median income of county of the firm's headquarters) significantly differs from zero in predicting family ownership. The partial F-statistic ($F=24.86$, $p=0.00$) indicates rejection of the null and we thus conclude that our instrument exhibits sufficient power in explaining family ownership.

Table 4 provides the IV-2SLS results. Columns 1 and 2 provide the first- and second- stage regression results for family ownership. Similarly, columns 3 and 4 show the results for founder ownership and columns 5 and 6 for heir ownership. The IV-2SLS regression estimates bear the same sign and general levels of significance as the estimates derived from ordinary-least squares techniques shown in Table 2. Specifically, we continue to find a negative relation between the predicted value of founder and heir ownership (individually or combined) and long-term investment; suggesting that after

controlling for endogeneity concerns, family firms commit fewer financial resources to investments than diffuse shareholder firms.

5. Additional Analyses: Family Investment Efficiency and Risk Aversion

Our results indicate, on average, that family firms commit fewer resources to total investing activity than diffuse shareholder firms. In addition, when segregating investments into R&D and capital expenditures, we document that family firms devote fewer financial resources to R&D investments and greater resources to capital projects than diffuse shareholder firms. These results generally support the notion that risk aversion dominates horizon considerations in family preferences for firm investment policies.[15] Other than risk aversion however, an equally plausible argument based on investment efficiency potentially explains our findings of lower investment activity in family firms. In particular, prior literature suggests that family shareholders act as strong, influential monitors that can potentially improve the efficiency of the investment process; thereby allowing family firms to commit fewer resources to investment activities (than diffuse shareholder firms) and still achieve similar outcomes. For instance, the business media often cites Apple Inc (a founder-led firm) as possessing an efficient R&D process that allows the firm to spend less on R&D projects than their competitors (*Wall Street Journal*, June 13, 2009). We investigate this family investment efficiency hypothesis by examining the outcomes of the R&D process and the performance implications of investment in family firms and diffuse shareholder firms.

[15] We note that families' long-standing presence in the firm suggests that these shareholders – although risk averse – could still maintain longer investment horizons than managers of diffuse shareholder firms. To provide some insights into families' investment horizons relative to diffuse shareholder firms, we investigate the length of the depreciation periods of capital investments in an earlier version of the paper. We find that the depreciation period of capital investments is greater for family firms than non-family firms and conclude that family firms appear to purchase assets that hold their value longer than diffuse shareholder firms. Because we focus on the impact of families' risk-aversion on investment policy, we drop this analysis in the current version of the paper.

5.1 *Family Investment Efficiency and R&D Outcomes*

The investment efficiency argument suggests that family owners' access to private information, their incentives to collect information, and their power to monitor managers improves the efficacy of the R&D process (Biddle et al. (2008)). R&D investments represent inputs to the creative process while shareholders arguably have concerns about the outputs of the R&D process. The investment efficiency hypothesis implies that family firms commit fewer resources to R&D spending (than diffuse shareholder firms) and achieve similar number of patents, patent citations, and/or patents per dollar of R&D spending. In contrast, the risk aversion hypothesis suggests that family owners simply seek to mitigate risk levels by committing fewer resources to R&D projects relative to diffuse shareholder firms. Consequently, the risk aversion hypothesis indicates fewer patents and patent citations in family firms than in diffuse shareholder firms.

Research in economics supports the notion that R&D spending serves as a material input in the inventive process and that creation of patents and the generation of patent citations serves as an indicator of firm R&D efficiency and output (e.g., Jaffe et al. (1993); Trajtenberg (1990); Hall et al. (2005)). We garner patent and patent citation data from Bronwyn Hall's database (http://emlab.berkeley.edu/users/bhhall/patents.html), who has engaged in an extensive project to match this patent data to COMPUSTAT firm-level identification information. The matching project is an on-going effort and thus not all firms available through COMPUSTAT yet have matching patent data (Hall et al. (2005)). Because patents (similar to published research papers) need time in the public domain to accrue citations, we examine firm patents and patent citations for the period 1992 through 1999. Patents granted earlier in the period likely have larger numbers of citations simply because these patents have existed longer than patents granted later in the period. Based on the existing firm-level identification information and the time period 1992 through 1999, our patent (patent citation) sample consists of 5,451 firm-year observations; consisting of 2,138 (39.2%) family observations and 3,313

(60.8%) diffuse shareholder firm observations.[16] We examine the relation between R&D efficacy and family influence with the following specification;

$$R\&D\ Efficiency = \beta_0 + \beta_1 (Family\ Firm) + \beta_2 (Control\ Variables) + \beta_3 (Industry\ Controls) + \beta_4 (Year\ Controls) + \varepsilon \quad (2)$$

Where;

R&D Efficiency = logarithm of number of patents, logarithm of number of patents divided by R&D spending and logarithm of number of citations divided by R&D investment.

Control Variables = Natural logarithm of net sales; cash-to-assets (cash plus cash equivalents divided by total assets); firm age (natural logarithm of the number of years since the firm's inception); debt ratio (long-term debt divided by total assets).

Table 5 presents the results from estimating equation (2). The investment efficiency hypothesis suggests that family firms achieve similar outcomes with fewer dollars spent (i.e. family firms have greater R&D efficiency); suggesting family firms should produce similar numbers of patents and patent citations as diffuse shareholder firms. Column 1 shows that family firms generate fewer patents than diffuse shareholder firms as we observe a negative and significant relation between the number of patents generated and the family firm binary variable. The analysis indicates that these controlling shareholder firms generate about 12.1% fewer patents than diffuse shareholders firms; providing evidence inconsistent with the family investment efficiency explanation.[17] The investment efficiency hypothesis also suggests that when we control for the level of R&D spending, family firms should receive greater numbers of patents than diffuse shareholder firms. Column 2 shows that once we control for the level of R&D investment, no significant difference exists in the number of patents generated by family firms and diffuse shareholder firms.

Finally, column 3 examines the number of patent citations that controlling shareholder and diffuse shareholder firms receive from their R&D efforts. Hall et al. (2005) note that citations can be a useful indicator of the knowledge creation associated with individual patents, thus providing a gauge of a

[16] For each firm in our patent sub-sample, we use proxy statements to trace back through the period 1992-1999 to ascertain family ownership or involvement. This sub-sample consists of (year/founder and heir firms/diffuse shareholder firms); 1992/193/350; 1993/196/358; 1994/221/375; 1995/255/407; 1996/274/437; 1997/294/445; 1998/346/494/; 1999/359/522.

[17] We calculate this difference as $(e^{\beta x} - 1)*100.0\% = (e^{(-0.129)*(1.0)} - 1) * 100.0\% = -12.10\%$.

patent's value. Surprisingly, inconsistent with family monitoring efficiency, our analysis indicates that patents from family firms receive significantly fewer citations per R&D dollar than patents from diffuse shareholder firms. Overall, we find no evidence that investment efficiency allows family firms to spend less on R&D to garner the same outcomes as diffuse shareholder firms. Instead, we find that family firms receive fewer patents and receive fewer patent citations per dollar of R&D spending.

5.2 *Family Investment Efficiency and Firm Performance*

The analysis indicates that family firms commit fewer resources to investing activity than diffuse shareholder firms. These differences in investment patterns however, may not be indicative of conflicts between family owners and outside shareholders. Rather, greater investment by diffuse shareholder firms (relative to family firms) could suggest uncontrolled or myopic managers pursuing projects to increase compensation, pursue pet projects or generally, to unprofitably grow the firm (Shleifer and Vishny (1997); Bens et al. (2002); Ali et al. (2009)). Prior literature moreover, documents better earnings quality, disclosure, and performance in family firms (relative to non-family firms) amongst S&P 500 and Fortune 500 firms (Anderson and Reeb, (2003b); Wang, (2006), Ali et al. (2007), Chen et al. (2008)); suggesting that family monitoring of investment decisions potentially benefits outside shareholders.[18]

In evaluating the effect of family investment preferences on outside shareholders, we ask whether the observed lower level of investment spending in family firms can be attributed to efficiency gains from family monitoring or alternatively, to families seeking to curb investments so as to mitigate risk. The family-investment efficiency hypothesis suggests that family monitoring improves the efficacy of the investment process thus allowing family firms to allocate or spend fewer resources on investments than diffuse shareholder firms. If so, we expect outside shareholder to positively value the (incremental)

[18] Firms in the S&P 500 and Fortune 500 Indices are, by design, the largest firms in the US. Outside of these large, less risky firms, prior research indicates that family ownership negatively influences corporate transparency and shareholder value. For instance, in the largest 2,000 industrial firms in the U.S., Anderson et al. (2009) report family ownership exhibits a negative relation to performance in all but the most transparent firms.

reduced level of investment spending in family firms relative to diffuse shareholder firms. The risk aversion hypothesis in contrast, indicates that families' investment decisions reflect their preferences to mitigate firm risk by committing fewer resources to investment relative to diffuse shareholder firms. Under this perspective, we expect outside investors to negatively value the (incremental) reduced level of investment spending in family firms relative to diffuse shareholder firm.

For our primary performance analysis, we use a reduced form model (relative to structural models) to examine the investment-ownership-value relation. Reduced form models provide a manageable technique for estimating equations that are fragile to variable choice (Larcker and Rusticus, 2007). Most importantly, Whited (2006) observes that reduced form models provide a tractable solution for embedding theoretical investment relations when the primary interest centers on the sign of the coefficient estimate. Because our key concerns rests in whether risk aversion or investment efficiency explain the differences in investment levels between family and diffuse shareholder firms, we estimate the following reduced form model.

$$\begin{aligned} \textit{Performance} = {} & \beta_0 + \beta_1 (\textit{Family Firm}) + \beta_2 (|\textit{Industry Adjusted Investment}|) + \\ & \beta_3 (\textit{Family Firm} * |\textit{Industry Adjusted Investment}|) + \beta_4 (\textit{Control Variables}) + \varepsilon \quad (3) \end{aligned}$$

Where:

Performance = Tobin's Q

Industry Adjusted Investment = |Firm Investment – Industry Median Investment|

Firm Investment = capital expenditures/total assets, or R&D/total assets, or R&D/total assets.

Industry Median Investment = median of capital expenditures/total assets, or R&D/total assets, or R&D/total assets, for all firms in the same 2-digit SIC code.

Control Variables = as defined earlier.

To account for the potential simultaneity/endogeneity between ownership, investment, and performance, following, Klein (1998), and Wintoki, Linck, and Netter (2008), we introduce lagged Tobin's Q as a control variable. The inclusion of the firm's historic performance allows for the likelihood that past performance affects current investment and/or ownership structure (simultaneity). In addition, the inclusion of historical performance controls for potential reverse causality amongst our variables of interest (Hayashi and Inoue (1991)). Although we focus on reduced form models in our

primary analysis, a simultaneity issue arises amongst ownership, investment and corporate value (Cho, 1998; Anderson and Reeb, 2003a); indicating the use of a system of simultaneous equations to examine the ownership-investment-value relation. Analogous to Whited and Erikson (2000), appendix 2 provides the results of the simultaneous equation system which provide similar inferences as the reduced form model.

Table 6 presents the regression results of the reduced form model. We capture the level of firm investment relative to the median firm in the same 2-digit SIC industry. Columns 1, 3, and 5 of Table 6 present the results for firms that devote fewer financial resources to total investment, R&D, and capital expenditures relative to the median firm in their industry. Columns 2, 4 and 6 show the results for firms that commit more resources to total investment, R&D, and capital expenditures relative to the median firm in their industry. The differences in firm investment levels (relative to the industry) are measured as absolute values for ease of interpretation. The regression equation includes an interaction term between family firms and industry-adjusted total investment (or R&D or capital expenditures) to capture the marginal influence of investment decisions in family firms on Tobin's Q.

The investment efficiency hypothesis indicates that family monitoring improves the efficacy of the investment process thus allowing family firms to allocate fewer resources to investments than non-family firms. Columns 1, 3, and 5 of Table 6 present the results for firms that devote fewer resources to total investment, R&D, and capital expenditures than the median firm in their industry. The analysis does not generally support the investment efficiency hypothesis. Beginning with the stand-alone terms for total investment and R&D, we find that outside investors appear to discount all firms – family and non-family that devote fewer financial resources to total investment and R&D investment. The analysis moreover indicates that outside investors appear to place an incrementally larger discount on family firms (than non-family firms) that place less into total investment and R&D. In particular, we note negative and significant coefficient estimates on the interaction terms between family firm and total

investment (β_5) and family firm and R&D investment (β_6); indicating that outside investors place larger discounts on family firms that commit less to long-term investments relative to non-family firms.[19]

Although not the focus of the investment efficiency hypothesis, we also examine firms that commit more resources to investment activities than the median firm in the industry. The results presented in columns 2, 4, and 6 of Table 6 indicate that outside investors appear to place valuation premiums on all firms – family and non-family – that devote greater resources to total investment and R&D investment than their industry peers. Specifically, the stand-alone terms for total investment and R&D investment exhibit significant and positive coefficient estimates. The interaction terms however, between family firm and total investment (and R&D and capital expenditures) are not significant at conventional levels. We interpret this to suggest that outside investors do not place additional valuation premiums on family firms (relative to non-family firms) that commit more to investment than the median firm in the industry. The evidence does not lend support to the notion that family ownership improves the efficacy of firms' investment activities. Overall, we interpret our results to suggest that differential investment policies in family firms relative to diffuse shareholder firms appears not to be an outcome of family monitoring efficiency but rather family incentives to mitigate firm risk.

6. Summary and Conclusion

Investment theory indicates that shareholders share a mutual goal of maximizing current stock price. Yet, because of differing preferences arising from risk aversion or investment horizons, large, influential shareholders potentially influence firm investments to promote their individual needs. Using the 2,000 largest, publicly-traded U.S. firms from 2003 through 2007, we investigate the effect of family shareholders on corporate investment policy.

[19] F-test reported at the bottom of Table 6 test the joint probability that the value effect of investment in family firms equals zero. For example, in columns 1 and 2, we test: $\beta_2 + \beta_5 = 0$.

We find that family owners hold over one-quarter of the firm's equity in 38% of these large, public firms. The analysis indicates that family ownership and/or presence bears a strong relation to firm investment policy. Specifically, we observe that these controlling shareholders commit fewer financial resources to long-term investment than diffuse shareholder firms – about 7.41% less (as a fraction of total assets). We provide evidence to suggest that this investment policy appears to be driven by families with high ownership levels and families experiencing high levels of firm risk. When segregating long-term investment into R&D spending and capital expenditures, we document that family firms devote greater financial resources (about 13.24% more as a fraction of total investment) to capital expenditures than diffuse shareholder firms. However, family owners appear to restrict R&D spending. Relative to diffusely-held firms, family firms commit about 28.11% less capital to R&D investments. The segregation of family firms into founder-led or heir-controlled does not affect the relation to total long-term investments, capital expenditures, or R&D investments. Both founder- and heir-controlled firms commit fewer financial resources to long-term investment and less (more) capital to R&D (capital expenditures) than diffuse shareholder firms.

Prior studies (e.g., Jensen and Meckling (1976); Shleifer and Vishny (1986)) argue that differing investment horizons, risk preferences or informational advantages can compel shareholders to affect firm investment policy. Our results provide empirical support to this hypothesis by finding that concentrated and committed ownership influences investment policy. Specifically, our results imply that concentrated or undiversified investors prefer investments in the form of capital expenditures over R&D investments. To control for potential endogeneity concerns, we develop an instrument for family ownership that proxies for the private benefits of control and use IV-2SLS regressions to examine our primary arguments. We again find that these controlling shareholders commit fewer financial resources to long-term investments than diffuse shareholder firms. Further testing indicates that family firms receive fewer patents than diffuse shareholder firms and receive similar numbers of patents per dollar invested in R&D; suggesting that family monitoring does not explain the lower R&D spending

associated with family ownership. Moreover, our analysis appears to indicate that outside shareholders discount family firms that have low R&D investments relative to diffuse shareholder firms in the same industry. Overall, our analysis indicates that families' strong incentive to reduce firm risk due to the undiversified nature of their holdings dominates the long-term horizon attributes of their ownership stake.

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Table 1
Descriptive Statistics on Firm Characteristics

Panel A: Summary Statistics for Full Sample (n=8,872)

Variable	*Mean*	*Median*	*Std. Dev.*	*Minimum*	*Maximum*
Family Firm Binary Variable at 5.0%	38.40	-	-	-	-
Family Ownership% – continuous (all firms)	9.94	0.00	17.49	0.00	96.77
Family Ownership% – continuous (founder and heir firms only)	25.88	20.10	19.61	5.20	96.77
Founder-Controlled Firms Binary Variable	18.83	-	-	-	-
Founder-Controlled Firm Ownership% – continuous	24.51	18.90	19.20	5.23	96.40
Heir-Controlled Firms Binary Variable	19.57	-	-	-	-
Heir-Controlled Firm Ownership% – continuous	27.06	21.13	19.87	5.20	96.77
Total Assets ($ millions)	4,982	971	24,036	0.699	795,377
Total Sales	4,436	920	16,158	0.00	375,376
Cash-to-Assets (%)	20.50	12.29	21.54	0	99.51
Return on Assets$_{t-1}$(%)	10.69	12.31	16.54	-362.99	89.66
Firm Age	46.15	31.00	38.97	0.00	263
Debt Ratio	18.24	14.53	19.93	0.00	84.23
Total Investment/Total Assets (%)	9.66	6.85	10.04	0.03	190.01
R&D Expense/Total Investment (%)	32.02	12.63	36.06	0.00	1.00
Capital Exp./Total Investment (%)	67.98	87.37	36.06	0.00	1.00
Return Volatility (Firm Risk)	0.12	0.11	0.07	0.02	0.38
Tobin's Q	1.79	1.44	1.19	0.01	7.94

Panel B: Difference of Means Tests for Key Variables

Variable	*Diffuse Shareholder Firms*	*Family Firms (5% Binary Variable)*	*t-statistic*
Number of Observations	5,465	3,407	-
Family Ownership	0.00	25.88	35.49***
Total Assets ($ millions)	6,239	2,965	3.37***
Total Sales ($ millions)	5,381	2,921	3.84***
Cash-to-Assets	20.36	20.73	0.39
Return on Assets $_{t-1}$	10.19	11.51	1.90*
Firm Age	48.98	41.3	4.12***
Debt Ratio	19.21	16.68	2.98***
Total Investment/Total Assets (%)	9.88	9.30	1.33
R&D /Total Investment (%)	35.67	26.18	5.74***
Capital Exp./Total Investment (%)	64.33	73.82	5.74***
Return Volatility (Firm Risk)	0.120	0.122	0.85
Tobin's Q	1.78	1.81	0.73

Note: t-statistics adjusted for serial correlation.

Table 1 (continued)

Panel C: Correlation Matrix of Key Variables (n=8,872)								
	Total Inv./Asset	*R&D/ Tot Inv.*	*CapEx/ Tot Inv.*	*Family Own.*	*Ln (Sales)*	*Cash-to-Asset*	*Return on Assets $_{t-1}$*	*Debt Ratio*
Total Inv./Assets	1.000							
R&D/Total Inv.	0.439	1.000						
CapEx/Total Inv.	-0.439	-1.000	1.000					
Family Own.	-0.067	-0.163	0.163	1.000				
Ln (Sales)	-0.428	-0.426	0.426	-0.095	1.000			
Cash-to-Asset	0.399	0.593	-0.593	-0.010	-0.559	1.000		
Return on Assets $_{t-1}$	-0.401	-0.395	0.395	0.038	0.456	-0.410	1.000	
Debt Ratio	-0.015	-0.188	0.188	-0.006	0.108	-0.267	-0.082	1.000
Ln (Firm Age)	-0.265	-0.268	0.268	-0.012	0.430	-0.358	0.247	0.044

Panels A, B, and C provide summary statistics for the data employed in our analysis. The data set comprises the 2,000 largest U.S. firms (based on total assets) as of December 31st, 2003 and covers 2003, 2004, and 2005. For Panel B, the difference of means tests is based on the 5% minimum family ownership binary variable. *Family, Founder-Controlled and Heir-Controlled Ownership,* respectively, are the fractional ownership levels of each group. Total assets are the firm's year-end book value of total assets. We proxy for firm size with the natural logarithm of sales measured as firm year-end net sales. *Cash-to-*Assets is the sum of cash and cash equivalents divided by total assets. Prior performance is *ROA $_{t-1}$* which we measure as earnings before interests, tax, depreciation and amortization (EBITDA) divided by total assets from the prior year. *Firm age* is the number of years since the firm's inception. The *Debt Ratio* controls for firm leverage and is measured as the total long-term debt divided by total assets. *Total investment / Total Assets* is the sum of R&D expenditures plus capital expenditures divided by the book value of total assets. *R&D / Total Investment* is R&D expenditures divided by the sum of R&D expenditures and capital expenditures. *Capital Exp./Total Investment* is capital expenditures divided by the sum of R&D expenditures and capital expenditures. We measure *firm risk* using *return volatility* which is calculated as the standard deviation of monthly stock returns for the prior 36 months. T-statistics corrected for serial correlation. *, **, and *** - Denotes significance at the 10%, 5%, and 1% level, respectively.

Table 2
Family Influence and Total Investment

	Dependent Variable = Ln(Total Investment/Total Assets)					
	1	*2*	*3*	*4*	*5*	*6*
					Bottom- tertile of Firm Risk	*Top-tertile of FirmRisk*
β_0 (Intercept)	2.515***	2.537***	2.505***	2.524***	1.348***	2.879***
	(23.95)	(24.29)	(24.25)	(24.13)	(7.56)	(18.68)
β_1 (Family Firm Dummy)	-0.077***	-	-	-	0.021	-0.133***
	(2.32)				(0.46)	(2.71)
β_2 (Family Ownership)	-	-0.405***	-	-	-	-
		(4.13)				
β_3 (Bottom Tertile of Fam Own.)	-	-	-0.021	-	-	-
			(0.43)			
β_4 (Top Tertile of Fam. Own.)	-	-	-0.200***	-	-	-
			(3.83)			
β_5 (Founder-Led Firm Own.)	-	-	-	-0.330***	-	-
				(2.25)		
β_6 (Heir-Controlled Firm Own.)	-	-	-	-0.387***	-	-
				(3.38)		
β_7 (Ln (sales))	-0.069***	-0.072***	-0.069***	-0.071***	0.004	-0.080***
	(5.96)	(6.23)	(6.03)	(6.14)	(0.24)	(4.53)
β_8 (Cash-to-Assets)	0.852***	0.854***	0.860***	0.853***	0.310	0.689***
	(8.35)	(8.40)	(8.46)	(8.34)	(1.56)	(5.58)
β_9 (ROA_{t-1})	0.028	0.058	0.038	0.048	2.401***	-0.374***
	(0.21)	(0.43)	(0.28)	(0.35)	(5.76)	(2.45)
β_{10} (Ln(firm age))	-0.101***	-0.099***	-0.098***	-0.098***	-0.043*	-0.163***
	(4.74)	(4.67)	(4.65)	(4.59)	(1.68)	(4.70)
β_{11} (Debt Ratio)	-0.342***	-0.348***	-0.336***	-0.346***	-0.510***	-0.190
	(3.64)	(3.70)	(3.58)	(3.68)	(3.37)	(1.60)
Dummies for 2-digit SIC and Yr	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.397	0.396	0.395	0.395	0.419	0.413
Observations	8,872	8,872	8,872	8,872	2,957	2,958

This table reports multivariate OLS regression results of long-term investments on family ownership/presence. *Family Firm Binary Variable* is a binary variable that equals one when families maintain a 5% or greater equity stake. *Family Ownership* is the fractional equity ownership of the group. *Bottom Tertile of Fam. Own* is a binary variable that equals 1.0 when family ownership is in the bottom one-third (<=12.23%) of the family ownership distribution, and zero otherwise. *Top Tertile of Fam. Own* is a binary variable that equals 1.0 when family ownership is in the top one-third (>=30.87%) of the family ownership distribution, and zero otherwise. We proxy for firm size with the natural logarithm of sales *(Ln(sales))*. *Cash-to-*Assets is cash and cash equivalents divided by total assets. The *Debt Ratio* controls for firm leverage and is measured as the total long-term debt divided by total assets. We measure ROA_{t-1} as earnings before interests, tax, depreciation and amortization (EBITDA) divided by total assets from the prior year. *Firm age* is the number of years since firm inception. We proxy for long-term investments using the sum of R&D expense and capital expenditures divided by total assets. We measure firm risk using return volatility which is calculated as the standard deviation of monthly stock returns for the prior 36 months. T-values are in parentheses and are corrected for serial correlation and heteroskedasticity. *, **, and *** - Denotes significance at the 10%, 5%, and 1% level, respectively.

Table 3
Family Influence and R&D Investment-to-Total Investment (n=8,872)

	Dependent Variable = (R&D Investment / Total Investment)					
	Tobit Regression			*Heckman Model (control for self-selection bias)*		
	1	*2*	*3*	*4*	*5*	*6*
β_0 (Intercept)	-0.064	-0.030	-0.042	0.896***	0.808***	0.836***
	(0.38)	(0.17)	(0.25)	(13.95)	(12.47)	(13.55)
β_1 (Family Firm Binary Variable)	-0.090***	-	-	-0.014**	-	-
	(4.92)			(2.13)		
β_2 (Family Ownership)	-	-	-0.276***	-	-	-0.005
			(3.51)			(0.20)
β_3 (Founder-Led Firm Ownership)	-	-0.345***	-	-	-0.076**	-
		(3.81)			(2.65)	
β_4 (Heir-Controlled Firm Ownership)	-	-0.305***	-	-	-0.065**	-
		(4.40)			(2.68)	
β_5 (Professional Manager CEO)	-	-	0.037	-	-	-0.022**
			(1.29)			(2.33)
β_6 (Founder CEO)	-	-	-0.023	-	-	-0.018**
			(0.77)			(2.00)
β_7 (Descendant CEO)	-	-	-0.120***	-	-	-0.042***
			(3.26)			(3.77)
β_8 (Ln (sales))	-0.004	-0.005	-0.007	-0.005**	-0.005**	-0.005**
	(0.70)	(0.92)	(1.23)	(2.18)	(2.44)	(2.65)
β_9 (Cash-to-Assets)	0.642***	0.637***	0.627***	0.332***	0.341***	0.350***
	(13.79)	(13.78)	(13.71)	(16.08)	(17.62)	(19.06)
β_{10} (ROA_{t-1})	-0.269***	-0.265***	-0.263***	-0.185***	-0.188***	-0.190***
	(4.90)	(5.08)	(4.98)	(9.17)	(9.97)	(10.50)
β_{11} (Ln(firm age))	-0.030**	-0.029**	-0.025*	-0.026***	-0.026***	-0.026***
	(2.66)	(2.51)	(2.19)	(6.62)	(6.86)	(7.07)
β_{12} (Debt Ratio)	-0.107***	-0.102***	-0.107***	0.013	0.010	0.002
	(2.79)	(2.69)	(2.81)	(0.78)	(0.66)	(0.10)
Dummies for 2-digit SIC and Yr	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.645	0.649	0.654	-	-	-
Mill's Lambda	-	-	-	-0.226***	-0.210***	-0.177***
				(8.87)	(8.82)	(7.68)

This table reports Tobit multivariate regression results of long-term investments (measured as the ratio of R&D spending to total investments) on Family ownership/presence. *Family Firm Binary Variable* is a binary variable that equals one when this controlling group maintains a 5% or greater ownership stake. *Family Ownership* is the fractional equity ownership of the group. *Professional Manager CEO* equals one when a professional managers holds the CEO post in a family firm. *Founder CEO* equals one when a founder holds the CEO post in a family firm. *Descendant CEO* equals one when a descendant of the founder holds the CEO post. We proxy for firm size with the natural logarithm of sales *(Ln(sales))*. *Cash-to-*Assets is cash and cash equivalents divided by total assets. The *Debt Ratio* controls for firm leverage and is measured as the total long-term debt divided by total assets. We measure ROA_{t-1} as earnings before interests, tax, depreciation and amortization (EBITDA) divided by total assets of prior year. *Firm age* is the number of years since firm inception. We proxy for long-term investments using research and development expenses divided by total assets (*R&D Investment/Total Investment*) is the R&D expense divided by the sum of R&D expense and capital expenditures. *Mill's Lambda* is the inverse Mill's ratio of the R&D reporting firms. Z-values are in parentheses and are corrected for serial correlation and heteroskedasticity. *, **, and *** - Denotes significance at the 10%, 5%, and 1% level, respectively.

Table 4
Endogeneity Between Family Ownership and Investment Policy:
Instrumental Variable (2SLS) Regressions of Investments and Family Ownership

	1	2	3	4	5	6
	1st Stage Regression	*2nd Stage Regression*	*1st Stage Regression*	*2nd Stage Regression*	*1st Stage Regression*	*2nd Stage Regression*
Dependent Variable	*Family Ownership*	*Total Invest /TA*	*Founder Ownership*	*Total Invest /TA*	*Heir Ownership*	*Total Invest /TA*
β_0 (Intercept)	0.748***	4.620***	0.449***	6.738***	0.555***	3.302***
	(8.27)	(3.46)	(5.84)	(3.06)	(6.59)	(8.67)
β_1 (Instr. Family Own.)	-	-7.111**	-	-	-	-
		(1.99)				
β_2 (Instr. Founder Own.)	-	-	-	-16.197**	-	-
				(2.22)		
β_3 (Instr. Heir Own.)	-	-	-	-	-	-6.991***
						(4.01)
β_4 (Ln (sales))	-0.018***	-0.195***	-0.012***	-0.268***	-0.012***	-0.140***
	(13.69)	(2.87)	(10.94)	(2.95)	(9.86)	(5.58)
β_5 (Cash-to-Assets)	-0.005	0.827***	0.023***	1.313***	-0.048***	0.628***
	(0.46)	(4.12)	(2.46)	(5.68)	(4.22)	(4.45)
β_6 (ROA_{t-1})	0.076***	0.497	0.087***	1.339**	0.015	-0.018
	(5.92)	(1.06)	(8.06)	(1.98)	(1.19)	(0.08)
β_7 (Ln (Firm Age))	0.001	-0.080	-0.016***	-0.338***	0.016***	0.017
	(0.37)	(1.90)*	(7.99)	(2.87)	(6.86)	(0.52)
β_8 (Debt Ratio)	-0.026***	-0.352*	-0.031***	-0.640**	-0.018*	-0.387***
	(2.65)	(1.73)	(3.73)	(2.30)	(1.90)	(5.02)
β_9 (Ln (Median County Income))	-0.041***	-	-0.017***	-	-0.039***	-
	(4.98)		(2.42)		(5.06)	
2-digit SIC and Yr Dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.135	-	0.107	-	0.173	-
Partial F-test	24.86***	-	6.08**	-	25.56***	-
Wu-Hausman F-test	-	51.72***	-	38.64***	-	40.13***

This table reports IV-2SLS multivariate regression results of long-term investments on family ownership. Family *Ownership* is a continuous variable that equals the fractional ownership of the controlling shareholder group. We proxy for firm size with the natural logarithm of sales *(Ln(sales))*. *Cash-to-*Assets is cash and cash equivalents divided by total assets. The *Debt Ratio* is measured as total long-term debt divided by total assets. We measure ROA_{t-1} as earnings before interests, tax, depreciation and amortization (EBITDA) divided by total assets of prior year. *Firm age* is the number of years since firm inception. We proxy for long-term investments using the sum of R&D expense and capital expenditures divided by total assets. The first stage regression uses *median county income* which proxies for financial awareness of local area investors. *Instr. Family, Founder and Heir Own* is the instrumented variable from the first stage regressions. T-values are in parentheses and are corrected for serial correlation and heteroskedasticity. *, **, and *** - Denotes significance at the 10%, 5%, and 1% level, respectively.

Table 5
Family Ownership and R&D Effectiveness

	Dependent Variable = Ln (Number of Patents)	*Dependent Variable = Ln (Number of Patents/R&D Inv.)*	*Dependent Variable = Ln(Number of Citations/R&D Inv.)*
	1	*2*	*3*
β_0 (Intercept)	-3.573***	-0.289***	-0.967***
	(18.95)	(14.06)	(17.95)
β_1 (Family Firm Binary Variable)	-0.129**	-0.002	-0.048***
	(2.15)	(0.22)	(2.59)
β_2 (Ln (sales))	0.477***	0.032***	0.109***
	(22.68)	(14.80)	(18.47)
β_3 (Cash-to-Assets)	1.601***	0.155***	0.355***
	(9.81)	(8.03)	(6.80)
β_4 (ROA_{t-1})	-1.289***	-0.111***	-0.265***
	(8.82)	(6.43)	(5.69)
β_5 (Debt Ratio)	-1.017***	-0.096***	-0.292***
	(5.68)	(4.58)	(5.17)
Dummies for 2-digit SIC and Yr	Yes	Yes	Yes
Adjusted R^2	0.071	0.026	0.031

This table reports Tobit multivariate regression results of R&D Effectiveness (patents and patent citations) on family ownership/presence. *Family Firm Binary Variable* is a binary variable that equals one when this controlling group is present in the firm. We proxy for firm size with the natural logarithm of sales *(Ln(sales))*. *Cash-to-*Assets is cash and cash equivalents divided by total assets. The *Debt Ratio* controls for firm leverage and is measured as the total long-term debt divided by total assets. We measure ROA_{t-1} as earnings before interests, tax, depreciation and amortization (EBITDA) divided by total assets of prior year. *Firm age* is the number of years since firm inception. Number of Patents represents the number of patents granted to the firm during the fiscal year. R&D Inv. is R&D expense for the fiscal year. Number of patent citations is the aggregated number of citations that each firm received for its patents. Z-values are in parentheses and are corrected for serial correlation and heteroskedasticity. *, **, and *** - Denotes significance at the 10%, 5%, and 1% level, respectively.

Table 6
Family Influence on Investment Value (n=8,872)

	Dependent Variable = Tobin's Q					
	Ind. Adj. Tot. Invest		Ind. Adj. R&D		Ind. Adj. Cap. Ex.	
	<=0.00	>0.00	<=0.00	>0.00	<=0.00	>0.00
	1	*2*	*3*	*4*	*5*	*6*
β_0 (Intercept)	0.850***	1.171***	0.872***	1.356***	1.130***	1.206***
	(8.47)	(9.69)	(9.13)	(7.49)	(10.53)	(10.85)
β_1 (Family Firm)	0.052*	0.051	-0.009	0.120*	0.029	-0.015
	(1.80)	(1.37)	(0.44)	(1.85)	(0.91)	(0.51)
β_2 (|Ind. Adj. Tot. Inv.|)	-1.305***	1.410***	-	-	-	-
	(3.16)	(2.98)				
β_3 (|Ind. Adj. R&D|)	-	-	-1.853*	2.188***	-	-
			(1.70)	(2.51)		
β_4 (|Ind. Adj. Cap. Ex.|)	-	-	-	-	-0.501	0.417
					(0.87)	(0.86)
β_5 (Family Firm * (|Ind. Adj. Tot. Inv.|)	-1.326**	-1.105	-	-	-	-
	(2.24)	(1.64)				
β_6 (Family Firm * (|Ind. Adj. R&D|)	-	-	-1.343**	0.430	-	-
			(2.10)	(0.34)		
β_7 (Family Firm * (|Ind. Adj. Cap. Ex.|)	-	-	-	-	-1.222	-0.778
					(1.10)	(1.33)
β_8 (Tobin Q $_{t-1}$)	0.711***	0.694***	0.695***	0.586***	0.663***	0.721***
	(29.09)	(36.14)	(35.35)	(21.92)	(29.58)	(41.62)
β_9 (Ln (sales))	-0.016**	-0.018	-0.015*	0.016	-0.031***	-0.032***
	(2.17)	(1.62)	(1.72)	(1.06)	(3.21)	(3.60)
β_{10} (Ln(firm age))	0.014	-0.010	0.014	-0.065***	-0.012	-0.016
	(1.32)	(0.61)	(1.26)	(2.42)	(0.83)	(1.17)
β_{11} (Debt Ratio)	-0.273***	-0.537***	-0.385***	-0.681***	-0.303***	-0.504***
	(4.64)	(5.83)	(6.34)	(5.15)	(4.11)	(6.40)
β_{12} (Return Volatility)	0.004	-0.021	0.070	-0.071	0.360	0.069
	(0.01)	(0.07)	(0.26)	(0.17)	(1.27)	(0.24)
Dummies for 2-digit SIC and Yr	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.651	0.641	0.695	0.611	0.595	0.658
F-test /p-value	15.92/0.00	0.35/0.55	7.20/0.01	5.76/0.02	2.39/0.12	0.92/0.34

This table reports multivariate regression results of a proxy for Tobin's q on founder and heir ownership/presence. Tobin's Q (and lag Tobin's Q from *t-1*) is calculated as sum of the market value of common stock plus the book value of preferred stock plus the book value of long-term debt, all divided by the book value of total assets. Family Firm is a binary variable that equals one when the family has a 5% or greater ownership stake. Ind. Adj. Tot. Inv. (or R&D or Cap. Ex.) is the absolute value of the difference between firm level total investment (or R&D or Cap. Ex.) less the median total investment (or R&D or Cap. Ex) of all firms in the same 2-digit SIC code. Total investment, R&D, and capital expenditures at the firm and industry level are normalized by dividing by total assets. We proxy for firm size with the natural log of sales *(Ln(sales))*. We measure *Return Volatility* as the standard deviation of monthly stock returns for the previous 36 months. The *Debt Ratio* control for firm leverage and is measured as the total long-term debt divided by total assets. *Firm age* is the number of years since firm inception. T-values are in parentheses and are corrected for serial correlation and heteroskedasticity. *, **, and *** - Denotes significance at the 10%, 5%, and 1% level, respectively.

Appendix 1

Missing Values of R&D: Controlling for self-selection bias using the Heckman model

The two-step regression model consists of the following three equations:

$$REPORT_t^* = Z\beta - \varepsilon_t, \quad (1)$$

$$R\&D_{Mt} = X_M \lambda_M + \omega_{Mt}, \quad (2)$$

$$R\&D_{Nt} = X_N \lambda_N + \omega_{Nt}, \quad (3)$$

For these equations, REPORT is the measure of whether a firm reports R&D or not; R&D is R&D expense normalized by total assets; β, λ_M , and λ_N are vectors of coefficients; M denotes firms that report R&D; and N denotes firms that fail to do so.

If there is a self-selection bias, the errors ω_{Mt} and ω_{Nt} will be correlated with ε_t and lead to biased estimators in the OLS regression of R&D investments. Assuming that ω_{Mt}, ω_{Nt}, and ε_t have a trivariate normal distribution with mean vector 0, Heckman (1979) suggests computing a selectivity correction term (i.e., inverse Mills ratio) for each group to correct the potential bias. In our case, the inverse Mills ratio is $\left[-\frac{\phi(Z\beta)}{\Phi(Z\beta)}\right]$ for the REPORT behavior and $\left[\frac{\phi(Z\beta)}{1-\Phi(Z\beta)}\right]$ for non-REPORT behavior, where Φ denotes the cumulative distribution of the standard normal function, and φ denotes its density function. We include the inverse Mills ratios in the OLS models. If a self-selection bias for reporting versus non-reporting firms exists, the estimated coefficients of the model with the selectivity correction term included should be significant. If there is no difference, by definition, there is no bias. If a self-selection bias exists, we must correct for the standard errors in the OLS model to make inferences regarding whether family ownership impacts R&D investments.

To account for the potential effect of a self-selection bias, we estimate the following probit model (Equation 4) for the whole sample in the first stage and then calculate the inverse Mills ratios for each firm-year observation. In the second stage, we add the inverse Mill's ratio to the R&D model for the reporting firms (Equation 5):

$$Prob\ (REPORT = 1) = \beta_0 + \beta_1\ (Family\ Firm) + \beta_2\ (Control\ Variables) + \beta_3\ (Industry\ Controls) + \beta_4\ (Year\ Controls) + \beta_5\ (Instruments) + \varepsilon_t. \quad (4)$$

$$R\&D_{M,t} = \sigma_{M0} + \sigma_{M1}\ (Family\ Firm) + \sigma_{M2}\ (Control\ Variables) + \sigma_{M3}\ (Industry\ Controls) + \sigma_{M4}\ (Year\ Controls) + \sigma_{M5}\ Inv.\ Mill's\ Ratio + U_{Mt}. \quad (5)$$

Where;

Family Firm = A binary variable that equals one when families hold 5% or more of the firm's equity; or the fractional level of their ownership; or binary variables that equal one when the firm's founder serves as CEO, when a founder's heir serves as CEO, or when a professional manager serves as CEO.

Control Variables = Natural logarithm of net sales; cash-to-assets (cash plus cash equivalents divided by total assets); ROA_{t-1} (EBITDA divided by total assets); firm age (natural logarithm of the number of years since the firm's inception); debt ratio (long-term debt divided by total assets).

Four-Digit SIC Code = one for each four-digit SIC code in our sample.

Year Dummy Variables = one for each year of our sample.

Instruments = Visibility (measured as membership in S&P 500 or traded on the NYSE); Uniqueness (measured as log of one plus percentage of firms in the same 2-digit SIC code industry that report R&D expenditures.

Our choice of instruments is based on variables that are correlated with the decision to report R&D spending but uncorrelated with the firm's desired level of R&D expenditure. The visibility of a firm is a good candidate because the more visible a firm the less likely it is for the firm to contravene the accounting rule that requires US firms to report R&D spending. Also, we posit that the less unique a firm (based on the percentage of R&D reporting firms in the firm's 2-digit SIC code industry), the less likely it is for the firm to choose not to report R&D spending.

Appendix 2
Simultaneous Equation Model of Family Ownership, Investment, and Firm Value (n=8,872)

	Dependent Variable =		
	Family Ownership	*Industry-Adjusted R&D/Total Invest.*	*Tobin's Q*
	1	*2*	*3*
β_0 (Intercept)	0.318***	1.434***	-6.352***
	(3.22)	(4.26)	(2.65)
β_1 (Family Ownership)	-	-5.330***	25.400***
		(3.46)	(3.43)
β_2 (Tobin's Q)	0.031***	0.149*	-
	(6.70)	(1.68)	
β_3 (Industry-Adj R&D/Total Invest)	-0.146***	-	4.826***
	(6.61)		(7.96)
β_4 (ROA_{t-1})	-	-	0.799
			(0.92)
β_5 (Ln (sales))	-0.015***	-0.084***	0.364***
	(10.36)	(3.99)	(2.62)
β_6 (Ln(firm age))	0.002	0.002	-
	(0.63)	(0.14)	
β_7 (Debt Ratio)	-0.041***	-0.232***	1.076***
	(3.90)	(3.24)	(2.60)
β_8 (Ln (Median County Income))	-0.006*	-	-
	(1.66)		
Dummies for 2-digit SIC and Yr	Yes	Yes	Yes

Notes to Appendix 2:
This table reports two-stage least square (2SLS) results of a simultaneous system of equations investigating the relation between family ownership, firm investment, and firm value. Tobin's Q is calculated as sum of the market value of common stock plus the book value of preferred stock plus the book value of long-term debt, all divided by the book value of total assets. Family ownership is the fractional level of equity held by the founding family. Total investment/Assets is the sum of R&D expenditures and capital expenditures divided by total assets. We proxy for firm size with the natural log of sales *(Ln(sales))*. We measure ROA_{t-1} as earnings before interests, tax, depreciation and amortization (EBITDA) divided by total assets of prior year. *Firm age* is the number of years since firm inception. The *Debt Ratio* is measured as total long-term debt divided by total assets. M*edian county income* is our instrument for family ownership from Table 4 and proxies for financial awareness of local area investors. T-values are in parentheses and are corrected for serial correlation and heteroskedasticity. *, **, and *** - Denotes significance at the 10%, 5%, and 1% level, respectively.