CORPORATE GOVERNANCE, FAMILY FIRMS, AND INNOVATION

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Abstract

We provide a comprehensive study of how corporate governance influences innovation at family firms. Specifically, we consider productive innovation or the impact that R&D spending has on firm revenues. First, we find that family firms do indeed generate more productive innovation than non-family firms, perhaps because they are better able to have a longer-term perspective. We then show how different corporate governance mechanisms influence this relationship. In general, board ownership and CEO ownership are associated with more productive innovation at all firms. Importantly, we find that managerial entrenchment leads to more productive innovation in general, consistent with prior research; however, contrary to prior research, we do not find this result at family firms, suggesting that it's the ownership relationship, not managerial entrenchment, that drives innovation. We also find that independent boards are associated with greater innovation at family firms but not at non-family firms. Finally, we find that dual-class share structures are harmful for innovation at all firms. Our primary contributions are identifying how firms with different ownership structures focus on creating productive innovation and analyzing how ownership structures interact with different corporate governance mechanisms to allow the firm to make longer-term investments in innovation.

Keywords: Innovation, Corporate Governance, Family Firms, Investment Policy, Capital Budgeting, Ownership Structure

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1. INTRODUCTION

Investing in innovation is a complex endeavor. It's expensive, it's risky and the benefits – if there are any benefits – may not materialize for many years. During that time, public companies will regularly report earnings, which may reflect the expenses related to investing in innovation but may not directly reflect the benefits related to those investments. For corporate leaders, this obviously presents a dilemma, as their tenure in the C-suite may be determined by those reported earnings more than by the mere possibility of greater earnings in the future. Investing in innovation is further complicated by the notion that it frequently requires disruption – that is, moving from a tried-and-true technology and revenue generator to a similar-but-different technology that may or may not prove as popular and successful as the preceding technology. Coca-Cola tried this with New Coke in the 1980s with disastrous results. Toyota revolutionized the automobile industry when it introduced the first mass-produced hybrid vehicle in the late-1990s; while other automakers followed, more than 80% of all hybrids ever sold have been sold by Toyota and Lexus since the first

Prius was launched in 1997. And, Apple releases a new-and-improved iPhone every year or two; however, this practice disrupts and cannibalizes prior versions and has essentially made the iPod – which led Apple's resurgence in the early 2000s – largely obsolete.

Each of these innovations entailed enormous risk – and each required patience, leadership, and effective governance by each company. Hart (1995) suggests that a firm's corporate governance structure is a system of risk-sharing and incentives. That structure is responsible for mitigating the trade-offs between short-term investments and (potential) long-term benefits related to innovation. Manso (2011) shows that the managerial incentives necessary for innovation must be long-term compensation and option packages; Chemmanur and Tian (2018) and Sapra, Subramanian, and Subramanian (2014) propose that entrenched managers and directors are most likely to invest in innovation. Importantly, most of the corporate governance literature has found that manager and board entrenchment is negatively associated with firm performance and firm value (Gompers, Ishii, & Metrick, 2003; Bebchuk, Cohen, & Ferrell, 2009). Thus, we have a dilemma: if we assume that innovation contributes positively to firm performance and firm value, how do we reconcile the notion that manager and director entrenchment is good for innovation but bad for firm performance? Is it possible that other dynamics – such as long-term, relational investing – determine how a firm's corporate governance structure and investments in innovation are related?

In this study, we analyze this dilemma, using the unique context of family firms to better capture the ownership relationship. Shleifer and Vishny (1986) found that about one-third of fortune 500 firms were family-controlled; 35% of the firms in our study are family firms, showing that such firms comprise a substantial segment of financial markets. But are family firms different from non-family firms? Yes, they are, and not just in obvious ways, such as larger ownership blocks or longer-term ownership. Anderson and Reeb (2003) find that family firms have lower agency costs due to the more direct alignment between owner and manager interests. James (2006) argues that firms with family ownership have information advantages due to the long-term nature of their ownership of and involvement with the firm. Chan, Chen, and Hilary (2010) study stock trades by family firm CEOs and find that they earn higher profits on their trades than non-family firm CEOs, suggesting that they have an information advantage. It is the combination of these differences – alignment between owners and managers, longer-term ownership, information advantages – that may directly impact a firm's innovation strategy and a firm's innovation success.

Of course, measuring innovation is non-trivial. No academic proxy for innovation is perfect. Some studies use R&D spending (scaled by a measure of size, typically assets) as their measure of innovation; this measure is problematic both because not all firms report R&D spending and because not all R&D spending actually leads to innovation. Other studies use patents and patent citations as the measure of innovation; these measures can be problematic because not all firms file for patents on their innovation investments and because a patent activity is not uniform across industries or countries, making comparisons difficult. Further, raw or scaled counts of patents may over- or understate the impact they may have. To alleviate some of these concerns and to provide a different perspective on innovation, the primary measure of innovation in this study is *Research Quotient*, or *RQ* (Knott, 2008); *RQ* represents the output elasticity of R&D expenditures. More specifically, *RQ* represents the percentage increase in revenues from a 1% increase in R&D spending; thus, *RQ* represents a firm's ability to generate revenue from its R&D investment and its ability to capitalize on its investments in innovation. While patents and citations can be an effective proxy for innovation output and knowledge created by innovation, *RQ* directly measures whether investments in innovation generate increased revenues or firm value.

In this study, we have several novel findings that contribute to our understanding of how firm-level innovation is related to firm-level corporate governance structure, using the unique contexts of family firms and productive innovation as the critical dynamics. We find that family firms do indeed generate more productive innovation than non-family firms, perhaps as a result of the long-term perspective developed through the relationship between the family, management, and the board of directors. Note that this is true even though we find that family firms generate fewer patents and citations than non-family firms; their focus is on the value-creating outcomes of their investments in innovation. When we focus on how different corporate governance mechanisms influence this dynamic, we see that more independent boards are associated with greater productive innovation at family firms but have no impact on non-family firms. We find that board ownership and CEO ownership are associated with greater productive innovation at all firms. Importantly, we find that managerial entrenchment at family firms is associated with less productive innovation, suggesting that the ownership structure dominates the management structure. And, finally, we find that having a dual-class share structure is harmful to generating productive innovation for all firms, perhaps because such structures create short-term vs. long-term tension between managers and different classes of owners. Thus, this study contributes to unraveling the puzzle of why managerial entrenchment can be bad for firm value but good for innovation, suggesting that the key factor is how entrenched the ownership is and not merely how entrenched management is. Our findings show that corporate governance relationships need to be studied giving consideration to how ownership structures and other institutional dynamics interact with traditional corporate governance mechanisms to better understand the impact of the strategic and investment decisions that firms make.

The remainder of the paper proceeds as follows. Section 2 provides the literature review and develops the hypotheses for the study. Section 3 discusses the family firm, corporate governance, and innovation data used in the study. Section 4 provides the empirical analyses studying the relationships between corporate governance and innovation at family firms. And, Section 5 discusses the results and contributions, the limitations of this study, and concludes.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

We connect three strands of the research to try to better understand how they impact each other: innovation, corporate governance, and family firms. We know that innovation is a critical aspect of firm value creation (Kogan, Papanikolaou, Seru, & Stoffman, 2017). We specifically study whether different corporate governance and ownership structures have an impact on the innovation produced by a firm. With respect to the relationship between ownership and innovation, there is some evidence that it matters. When institutional ownership is high, managers are less likely to cut R&D expenditures (Bushee, 1998). Aghion, Van Reenen, and Zingales (2013) further this notion, by developing a theoretical model which shows that greater institutional ownership is associated with more innovation output (in the form of patents). And, based on a meta-analysis including studies from 42 countries, Duran, Kammerlander, Van Essen, and Zellweger (2015) argue that, while family firms may invest less in R&D than non-family firms, their investments produce greater innovation output. Feranita, Kotlar, and Massis (2017) find a similar result, highlighting the importance of collaborative innovation for family firms as a mechanism to expand beyond their traditional family firm perspectives.

Knott (2008) studied this specific dynamic, with respect to all firms, not just family firms. She suggests that the productivity of a firm's R&D investments is what is most important. It doesn't matter if a firm is investing a lot in R&D, and it may not matter if a firm is generating a lot of patents; what ultimately matters is the productivity of those R&D investments. A firm's ability to convert R&D investments into productive innovation leads it to invest more in R&D, not the reverse. To measure this, she created *Research Quotient (RQ)* as a measure of R&D investment productivity. She showed this result using a large sample of U.S. firms; to the best of our knowledge, we are the first to apply this idea to family firms.

Le Breton-Miller and Miller (2018) highlight the agency costs and benefits of family firm corporate governance structures. Chrisman, Chua, Le Bretton-Miller, Miller, and Steier (2017) detail the unique formal – and informal – governance structures that are present in family firms, and that these informal governance structures, history, and relationships are critical determinants of behavior and performance of family firms. Erdogan, Riondi, and De Massis (2019) further this line of thinking, showing that family ownership imprints semi-permanent attitudes in family firms that become informal governance structures and either facilitate or inhibit innovation. Duran et al. (2015) point out their findings concerning family firms and innovation are highly dependent on the ownership and leadership characteristics of each firm and that they are highly dependent on country-level factors. Thus, a firm's corporate governance structure is likely to be a significant moderating or determining factor in how productive a firm's R&D investments are. Manso (2011) shows that the managerial incentives necessary for innovation must be long-term compensation and option packages; Chemmanur and Tian (2018) and Sapra et al. (2014) propose that entrenched managers and directors are most likely to invest in innovation. Wang and Zhao (2015) extend the ownership perspective and find that firm ownership matters for innovation, as hedge fund ownership increases both the quantity and quality of patents and commensurately increases firm value through this innovation effect. Using dynamic estimation models that control for simultaneity bias and serial correlation, O'Connor and Rafferty (2012) use the Gompers et al. (2003) and Bebchuk et al. (2009) entrenchment indices as their measures of corporate governance and conclude that "corporate governance has little to no influence on innovative activity". However, it is important to note that their measure of "innovative activity" is R&D spending and their measures of "corporate governance" are arbitrary indices of anti-takeover provisions that do not include ownership or other governance dynamics.

Based on this review, and our expected relationships between innovation, governance, and family ownership, we have two primary hypotheses for our study:

Hypothesis 1 (H1): Family firms generate more productive innovation than non-family firms.

Hypothesis 2 (H2): Family firms with stronger corporate governance structures generate more productive innovation than non-family firms.

Further, we analyze the role that dual-class share structures have on a firm's innovation and governance. Approximately 10% of the firms in our sample have dual-class (or multiple class) share structures, typically allowing certain shareholders disproportionately large influence over corporate votes (and, in many cases, they have voting control). Dual-class share structures are disproportionately large in family firms; 26% of all family firms have dual-class share structures and 87% of dual-class firms are family firms. Jordan, Kim, and Liu (2016) show that firms with dual-class share structures face fewer short-term market pressures and are better able to focus on growth opportunities. However, Masulis, Wang, and Xie (2009) show that dual-class share structures are associated with greater agency costs and decreasing firm value when firms have dual-class structures. In family firms, these agency costs often arise through conflicting interests between family shareholders and minority shareholders, such as when owner-managers use their voting rights or the control over a firm-specific resource to take the ownership interests of other owner "hostage" (Schulze, Lubatkin, Dino, & Buchholtz, 2001). It is possible that these agency costs also lead to less productive innovation, although this may be mitigated by the founding family having a longer-term vision for the company that does lead to more innovation. Following Masulis et al. (2009), our third hypothesis is:

Hypothesis 3 (H3): Dual-class share structures generate less productive innovation than single-class share structures.

We will also build on these three primary hypotheses and test variations of them, such as how different corporate governance mechanisms influence family firm productive innovation and whether different measures of innovation produce different relationships.

3. DATA

We focus on innovation and corporate governance at large family firms in the United States from 2001 to 2010. Shleifer and Vishny (1986), Anderson, Duru and Reeb (2009) and Anderson, Reeb, and Zhao (2012) (among other studies) characterized "family firms" as firms in which the founder or a descendant currently holds a five-percent equity stake in the company (based on cash flow rights, rather than voting rights). This definition is critical to understand; and it is certainly a potential limiting factor of the study. We can only study listed public firms because we rely on corporate governance disclosures. Defining a publicly-listed family firm as one where a member of the founding family holds 5% or more of the outstanding equity gives us a heterogenous sample to study; Microsoft, Walmart, and Amazon are all classified as family firms by this definition. Approximately one-third of the firms in our sample are classified as family firms. This definition is the standard definition used in the extant literature, as established by Anderson et al. (2009) and Anderson et al. (2012). Ron Anderson provides this data on his website for the 2,000 largest U.S. firms from 2001 to 2010; in initial analyses, we use a binary variable equal to 1 if the firm is a family firm and equal to 0 otherwise. There are at least two important points that we need to make regarding this definition. First, neither the firm's CEO nor board chair needs to be a family member for the firm to be classified as a family firm, as the definition is solely about ownership level. And second, because the definition is based on ownership level, it is possible for the family's ownership level to change over time, thus a firm may be a family firm in some years of our study but not in all years of our study (about 5% of our firm-years have a change in family ownership status).

The 5% ownership threshold used to identify family firms is certainly a potential limitation of this study. It is perhaps overly generous. And, we are studying relatively large listed public firms. This study does not include the type of firm that we may think of as a "family firm", a mom-and-pop stored run by the proprietors, and passed down through generations. Thus, any results and implications we find may not apply to small, non-listed businesses owned and controlled by the founding family. However, the 5% threshold attempts to capture some element of "family-ness", applying family-style ownership and control relationships to relatively large, listed firms. The results and implications we find apply to these firms only, yet they may provide guidance on the effects of such "family-ness" on large, listed firms.

With the family firm sample as our foundation, we use Compustat for financial statement data, CRSP for stock price data, Execucomp for compensation data, and ISS for corporate governance data. Our primary measure of innovation is *RQ* or the percentage increase in revenues from a 1% increase in R&D expenditures; thus, *RQ* is estimated from financial data available from Compustat.

For robustness, we use the patent and citations measures from Trajtenberg, Henderson, and Jaffe (1997), Hall, Jaffe, and Trajtenberg (2002), Hall (2005), and Wang and Zhao (2015). The variable *Patents* is the total number of patents filed for by a firm (and ultimately granted) in a calendar year. Then, to correct for truncation bias in our timeline, *Patents* is further divided by the average number of patents applied for across all firms in the same application year and the same U.S. Patent and Trademark Office (USPTO) technological class to create the variable $Patents_{TN}$ to correct for the truncation bias in patent grants. The truncation bias arises as patents have on average a two-year lag from application to grant date, and some patents that have been applied for may not have yet entered into the sample. The variable *Citations* is the total number of lifetime citations received by all patents applied for and ultimately received in a given application year; and, the variable $Citations_{TN}$ corrects for truncation bias. All innovation, governance, and control variables are defined in Appendix, Table 1.

Table 2 (see Appendix) provides descriptive statistics for our primary variables. Consistent with prior studies, approximately 34% of the sample firms are family firms and 10% have dual-class share structures; 26% of all family firms have dual-class share structures and 87% of dual-class firms are family firms, showing that family firms are more likely to use dual-class share structures to create different ownership structures or benefits. Seventy-one percent of directors are independent and the average director owns $2.09 million worth of stock (the average independent director owns $1.61 million worth of stock); this is considerably less than the $6.78 million that the average CEO owns. Fifty-eight percent of the CEOs also serve as board chair. The average time on board is 10.38 years for all directors (9.65 for independent directors only), while 21% of all directors have served on the board for more than 15 years and 20% of all directors have served for fewer than 5 years. Nine percent of the directors serve on more than three other boards, with the average director serving on just less than 1 other board.

In terms of innovation statistics, Table 2 presents both *RQ* and patent data. The average *RQ* is 0.11%, representing that the average firm increases revenues by 0.11% for each 1% increase in R&D investment. The most effective firm increases revenues by 1.09% for each 1% increase in R&D investment while the least effective firm loses 1.06% in revenues for each 1% increase in R&D investment. The patent and citation data are notably highly skewed; while more than half of all firms do not have any patents or citations, a small number of firms generate a disproportionately large number of patents, even when adjusted for truncation bias. This skewed distribution is another reason to use *RQ* as the measure of innovation so as to better capture the intention of investments in R&D – to increase revenues and not just log patents.

Finally, the control variables show, as expected, that our sample includes large firms, with an average asset base of $7.9 billion and an average market capitalization of $9.1 billion. More than half of the firms are less than 20 years old, with the average firm being 27 years old (the average family firm is slightly older at 33 years). The values for leverage, liquidity, performance, and compensation in our sample are similar to values in prior studies.

4. EMPIRICAL ANALYSES

The two hypotheses that we study relate to whether family firms are more productive with their investments in innovation than non-family firms are and how a firm's corporate governance structure may affect this relationship. Thus, we have a relatively simple model for our empirical analyses:

$$Innovation_{i,t+1} = \alpha + \beta_1 Family\ Firm_{i,t} + \beta_2 Governance_{i,t} + \theta Controls_{i,t} + \varepsilon \quad (1)$$

We initially use OLS estimation. We use a one-year lag between the time of the explanatory variables and the measurement of the firm's innovation to allow for the time it may take for an ownership or governance structure to impact a firm's innovation productivity (this may also mitigate simultaneity bias). We use firm, industry, and year fixed-effects to capture unobservable, time-invariant firm and industry dynamics outside of our primary governance-innovation relationships, and the standard errors are adjusted based on the Huber-White sandwich estimate and are clustered by firm.

4.1. Impact of family firm ownership on innovation

The results from our analysis on the impact of family firm ownership on innovation are in Table 3 (see Appendix); Panel A presents the results with *RQ* as the measure of innovation and Panel B presents the results with $Patents_{TN}$ and $Citations_{TN}$ as the measures of innovation.

In Panel A, we see a positive and significant coefficient on the *Family Firm* variable, indicating that firms with greater than 5% ownership by a founding family are better at creating productive innovation, or innovation that leads to increased revenue. When we include the *Dual-Class* dummy variable and a *Family Firm x Dual-Class* interactive term to assess how this choice of ownership structure by the family influences a firm's innovation productivity, we see that dual-class firms, by themselves, produce less productive innovation than firms with a single class of stock; and, we see that the interactive term is negative and significant, suggesting that the productive innovation that family firms generate comes from those family firms that do not employ a multiple class share structure (or in spite of such a structure). Thus, we conclude that *H1* holds: family firms do generate more productive innovation than non-family firms, using *RQ* as the measure of innovation. This result is moderated when the family firms choose to employ a dual-class share structure. This also suggests that *H3* holds, that dual-class share structures are a hindrance to firms creating productive innovation, possibly because they insulate the firms from a market discipline that might generate more impactful innovation.

This result, that dual-class share structures are a hindrance to firms creating productive innovation, is quite important. Many firms establish dual-class share structures to protect founders' voting rights, usually at the expense of common stockholders. In our case, we overlay this choice of dual-class share structures in family firms, where the structure may be protecting the founding family's control. In all cases, we find this is detrimental to creating productive innovation. This is consistent with prior research that has identified certain value-destroying effects of dual-class share structures; see, for example, Masulis et al. (2009). The practical implication is that firms should reconsider having dual-class share structures if they seek to create more innovation and growth, and shareholders would be wise to be aware of the potential constraints on innovation and growth as they look to invest in firms that have dual-class share structures. Further, this result may not be inconsistent with Jordan et al. (2016) who found that dual-class share structures lead to more growth, as we find that the family firm ownership structure dominates the dual-class structure. The common theme is that in order to generate innovation, firms need to have long-term governance structures, which are embedded in family firms.

The results in Panel A further show the relationships between the control variables and *RQ*. Larger firms generate more productive innovation than smaller firms, as do older firms. There is not a significant relationship between past performance, as measured by Tobin's Q, and *RQ*. There is not a significant relationship between institutional ownership and *RQ*, suggesting that the institutions have a shorter-term perspective than the founding families do. When executives have a greater share of their compensation in long-term equity, firms have higher *RQ*.

In Panel B, we see negative and weakly significant relationships between both $Patents_{TN}$ and $Citations_{TN}$ and *Family Firm* structures. This would be consistent with the notion that family firms are more concerned with the impact of their innovations than they are with obtaining patents or citations that do not lead to increased revenues or firm value. Our findings suggest that family firms are more focused on long-term value creation than non-family firms, which may be conditioned to focus on short-run financial results. At the margin, family owners are likely to have greater concern about passing on the firm and their legacy to the next generation, while non-family owners will not have such concerns. This leads to very different long-term vs. short-term priorities; and we believe this partially explains why family firms are able to create more productive innovation that leads to the long-term sustainability of the business. Of course, this is not to say that obtaining patents and citations is necessarily a bad goal for firms, as those investments may create a culture of innovation that would not otherwise develop; this merely suggests that family firms are not as focused on patents and citations as non-family firms. This is consistent with Knott (2008), who finds that there is a negative relationship between *RQ* and patents. And the combined results in Panel A and B are aligned with Duran et al. (2015) that family firms invest less in innovation projects than do non-family firms but use the resources to turn innovation input into innovation output efficiently.

4.2. Impact of corporate governance on family firm-innovation relationship

The results in Table 4 (see Appendix) show how the relationship between family firms and innovation can be augmented or moderated by different corporate governance mechanisms. In these regressions, we keep the same structure as in *Family Firm-Innovation* models in Table 3, continuing to include the dual-class share variable, and add on different corporate governance mechanisms and interact them with *Family Firm*. In all Table 4 models, the measure of innovation is *RQ*, following from the significant results in Table 3, Panel A. For conciseness, we only show the primary *Family Firm* and *Governance* variables and exclude the results for the control variables; in all models, we use the same control variables as in Table 3 and the results are available upon request.

In Panel A, the corporate governance variable is Board Independence or the percentage of directors on the board. More independent boards produce slightly more productive innovation than boards with fewer independent directors, but only in family firms, where the impact of independent, outside directors perhaps serves to balance the inside directors and traditional perspective of the founding and owning family. Given the focus from regulators and practitioners have had on board independent over the past 20 years, this is a critical finding that warrants greater explanation. From its inception, a family firm may utilize a board that is dominated by family members. As the firm evolves, they will likely add several independent directors. But the family influence remains. Thus, when family firms add independent directors, the incremental impact of wider experience and complementary perspectives is significant. While the family board members may be more conservative and focused on their legacy, fresh perspectives from independent directors can provide new visions on technology, competition, and innovation that contribute beneficial synergy with the family's long-term perspectives. That is, bringing in independent directors with truly diverse and unique perspectives creates value in family firms, especially with respect to innovation. This is consistent with the argument in Feranita et al. (2017) family firms need to seek collaborative innovation as a mechanism to expand beyond their traditional family firm perspectives.

In Panel B, the corporate governance variable is *Director Ownership* or the median dollar value of common stock owned by the individual members of the board of directors (Bhagat & Bolton, 2008, 2013). Boards that own more stock are associated with higher *RQ*, both in family firms and in non-family firms.

In Panel C, the corporate governance variable is *CEO Ownership* or the dollar amount of stock owned by the CEO (regardless of whether he or she is a member of the founding family). In general, there is no relationship between *CEO Ownership* and *RQ*, except for a weakly positive relationship in family firms.

In Panel D, the corporate governance variable is *CEO-Chair Duality*, or a dummy equal to 1 if the CEO is also the board chair and zero otherwise. *CEO-Chair Duality* is normally associated with lower firm value and worse firm performance as it allows for conflicts of interest and consolidated control. The results in Panel D show that *CEO-Chair Duality* is negatively related to *RQ* at all firms, as expected; however, when we include the *CEO-Chair Duality x Family Firm* interactive variable, we see that the negative relationship is most profound at family firms. This suggests that that the improved level of *RQ* at family firms is a result of the family influence and not a result of entrenched management.

In Panel E, the corporate governance variable is the Gompers et al. (2003) *G-Index* of anti-takeover provisions. This is a managerial entrenchment index and has been associated with lower firm value. With respect to all firms, our findings show a positive relationship between the *G-Index* and *RQ*. This suggests that having anti-takeover provisions that may insulate firms from (short-term) market whims, allowing the company to focus on longer-term investments, such as innovation. However, when we include the *G-Index x Family Firm* interactive variable, we see that there is a negative relationship between this variable and *RQ*. This suggests that the innovation benefits we see coming from overall entrenchment are a function of the ownership dynamic and not of entrenched management. This result, along with the results in Panel D, may shed some light on why entrenchment appears to be beneficial for innovation (Chemmanur & Tian, 2018; Sapra et al., 2014), even though we know it destroys firm value (Gompers et al., 2003). The relationship between managers and owners is what matters. In untabulated results, we also consider the Bebchuk et al. (2009) *E-Index*, which only considers 6 anti-takeover provisions instead of 24, and we find qualitatively similar results.) This is a critical finding, as it helps us peel back how different layers of corporate governance impact firm decision-making; firms with family ownership naturally generate productive innovation independent of whether the firm's management is entrenched, which may have other consequences.

In Panel F, the corporate governance variable is the average *Number of Other Boards* that each director serves on, besides the sample firm. This is a measure of director busyness and is usually associated with worse firm performance and lower firm value. Our results show that it is also associated with less productive innovation, both in family firms and in non-family firms.

Summarizing the results in Table 4, we (expectedly) see a mix of results. A firm's corporate governance structure can have a substantial effect on whether a firm is able to generate productive innovation, but this depends on what aspect of the governance structure we are looking at. In most cases, there is not a significant difference between how the governance structure impact innovation in family and non-family firms; one major exception to this is in considering at *Board Independence*, where the perspective of independent outsiders on the board perhaps is able to balance the family firm owners' long-term perspective of what is best for the firm. The other major exception is how ownership structure interacts with managerial entrenchment. Importantly, in Panels D and E, when we include proxies for entrenchment as our governance variables, we see that entrenchment is beneficial for innovation at all firms, which is

consistent with prior research, but not at family firms, suggesting that it is the relational benefits of the family ownership and/or leadership that creates productive innovation. Thus, we see mixed evidence with respect to *H2*, as we do indeed see different dynamics from certain corporate governance variables between family firms and non-family firms.

4.3. Controls for endogeneity

Endogeneity is a common concern with most corporate governance studies, as the study may be biased by reverse causality. We initially consider the impact of family firm status on a firm's innovation; reverse causality should not be biasing our results, as it is illogical that a firm's innovation productivity would determine whether a firm is designated a family firm. At the margin, it is possible that a family could increase its ownership from less than 5% to more than 5% as a result of the firm's innovation, or vice versa, but these situations should be extremely rare. Further, we include a one-year lag between the explanatory (family firm status and corporate governance) and control variables and the innovation variables; that lag should moderate any simultaneity concerns. In untabulated results, we also include two-year and three-year lags; those results are qualitatively similar to the results in Tables 3 and 4. We also include firm, industry, and year fixed-effects in all models, which should mitigate endogeneity concerns related to any unobserved variables or measurement error. Finally, following Grieser and Hadlock (2019), we test for strict exogeneity of the family firm – innovation relationship; specifically, we test whether future family firm status is a function of current or past innovation level. We find that future family firm status is not a function of current or past innovation level, thus suggesting that that the relationship between current family firm status and future innovation is indeed strictly exogenous.

4.4. Robustness tests

We perform a number of additional tests to understand how robust our primary results are. As mentioned above, our primary results include a one-year lag between the explanatory and control variables and the dependent variables; when we include two-year and three-year lags, the results are qualitatively similar to those in Tables 3 and 4. In Table 4 analyses, we perform analyses with different corporate governance mechanisms that could have correlations or interactions with each other (e.g. it's possible that independent directors own more stock than non-independent directors). Thus, we perform Table 4 regressions in a stepwise manner, variably including multiple corporate governance mechanisms in each regression and interacting different corporate governance mechanisms. We also consider all of our Table 3 and Table 4 models excluding *Dual-Class Shares* as an explanatory variable. Finally, given that *RQ* is a measure of the elasticity of R&D spending on revenues, we perform the Table 3 and Table 4 analyses only considering those firms that report R&D spending. While some of our primary relationships are slightly weaker when we include additional explanatory variables, none of these relationships lose their significance nor change the overall tenor of our findings: family firms produce more productive innovation than non-family firms, independent boards are especially beneficial for innovation at family firms, greater director ownership leads to greater innovation, entrenchment can be good for innovation and dual-class share structures lead to less productive innovation.

5. CONCLUSION

In this study, we analyze the impact family firm ownership has on a firm's productive innovation and consider how different corporate governance mechanisms might moderate or accentuate that relationship. Family firms are unique in that they have had – and typically still have – longstanding ownership and influence by a single group of owners. This special type of relational investing might bring different perspectives and strategies to the firm. We specifically study a firm's innovation strategy. Our focus is on a firm's productive innovation. There are a number of proxies for innovation – patents, citations, R&D spending; we focus on the outcome of R&D spending, or the impact that R&D spending has on a firm's revenues, using the *Research Quotient* measured introduced by Knott (2008). We have several key findings:

- *RQ* is different from other measures of innovation, such as patents and citations; that is, the different proxies are indeed measuring different dynamics.
- *Family Firms* do generate more productive innovation than non-family firms do.
- *Dual-Class* share structures are associated with lower levels of productive innovation.
- Strong corporate governance structures do influence innovation, both at family firms and non-family firms, but not always in the expected ways. *Board Independence* and *Director Ownership* are associated with more innovation, while *CEO-Chair Duality* and *Number of Other Boards* are associated with less innovation, as might be predicted.
- However, entrenchment, measured with the Gompers et al. (2003) *G-Index*, which has been associated with worse firm performance and lower firm value, leads to greater productive innovation, but not at family firms. Other research has found that entrenchment is good for innovation; we are the first to consider the ownership structure in this dynamic. This suggests that the long-term family relationship, and not merely entrenched management, is what leads to productive innovation.
- *Board Independence* has a disproportionately greater impact on productive innovation at family firms relative to the influence it has at non-family firms; this is perhaps due to the different perspectives that independent, outside directors bring to a family firm and push it to consider investments and strategies that balance long-term and short-term impact.

These findings are important because they shed light on the structural and institutional trade-offs that firms need to make in order to achieve long-term success. We have long known that there is no "one-size-fits-all" corporate governance structure, but we can identify best practices that will make a difference at the margin for many firms.

To the best of our knowledge, we are the first to study the unique effect that corporate governance structures have on innovation at family firms relative to non-family firms. Prior research has governance and innovation or family firms and governance; thus, we felt it critical to analyze the combined effects of these three dynamics. Chemmanur and Tian (2018) and Sapra et al. (2014) found that entrenched governance structures create more innovation; this result was confounding to many, given that most prior governance research had found that entrenched governance structures destroyed firm value (Gompers et al., 2003; Bebchuk et al., 2009). As such, we looked to family firms – and the unique tangible and intangible aspects of family firm ownership structures – to see if we could disentangle this puzzle. Duran et al. (2015) argue that, while family firms may invest less in R&D than non-family firms, their investments produce greater innovation output. And, when we combine these two literature streams, we are able to see what is driving the different results. We are the first to combine these streams, which produces the unique result that the long-term perspective of family-firms (or family-ness) leads to using governance structures to invest in innovation that matters. As innovation is a long-term investment, having a governance structure with a long-term perspective is critical. Future research should look to further understand this dynamic, possibly by digging deeper into the specific corporate governance structures and incentives within family firms that create this unique long-term perspective.

There are, however, a number of limitations associated with this study. First, we are using a sample of relatively large, listed firms to study family-ness or family-style relationships. Many of the "family firms" in our sample do not seem to fit our image of what a family firm is. We define a firm as a family firm if the founding family (or descendants) controls at least 5% of the outstanding equity, as established in the literature (Anderson et al., 2012). We need to establish some threshold to define a family firm, and this definition has been shown to be both rigorous and robust; however, it may be overly generous in identifying firms as family firms that may not seem to be true family firms. Further, by not studying private, non-listed firms, we are ignoring many firms that truly are family-owned and controlled firms, where we might see the most information regarding the impact of family relationships and structures in generating productive innovation. Of course, we cannot study such firms in a large-sample study because the corporate governance data is not available. Further, we have chosen to focus on research quotient, or the percentage change in revenues due to a one-percent increase in research and development spending, as our measure of innovation. This is based on the work by Knott (2008) showing that this variable is a superior measure of innovation relative to patents and citations. However, it is only one measure of innovation; patents, citations, R&D spending, cultural innovation, marketing innovation, and other forms of innovation can be quite significant for many firms. We are not directly capturing such innovation. Our measure, *RQ*, identifies the productive output of innovation-related investments, and not the innovation-related inputs or any other measures of innovation. For our purposes, we believe this is the right measure; but it is only one measure of innovation. Finally, our study uses data from 2001 to 2010; unfortunately, due to data availability, we cannot use more current data. It is certainly possible that governance relationships and dynamics have changed since 2010 and the implications we have identified are no longer meaningful. As always, managers, investors, and policymakers should use our results with consideration to their specific situations only.

Nevertheless, despite these limitations, our findings in this study should provide some guidance for owners, directors, and leaders at family firms as to what they need to do to generate the most productive innovation and what corporate governance mechanisms they need to choose as they pursue long-term success. It is essential to study a complete model of corporate governance, giving full consideration to how ownership structures and other institutional dynamics interact with traditional corporate governance mechanisms as we work to better understand the impact of the strategic and investment decisions that firms make.

REFERENCES

1. Aghion, P., Van Reenen, J., & Zingales, L. (2013). Innovation and institutional ownership. *American Economic Review, 103*(1), 277-304. https://doi.org/10.1257/aer.103.1.277
2. Anderson, R. C., & Reeb, D. M. (2003). Founding-family ownership and firm performance: Evidence from the S&P 500. *The Journal of Finance, 58*(3), 1301-1328. https://doi.org/10.1111/1540-6261.00567
3. Anderson, R. C., & Duru, A., & Reeb, D. M. (2009). Founders, heirs and corporate opacity in the United States. *Journal of Financial Economics, 92*(2), 205-222. https://doi.org/10.1016/j.jfineco.2008.04.006
4. Anderson, R. C., Reeb, D. M., & Zhao, W. (2012). Family-controlled firms and informed trading: Evidence from short-sales. *The Journal of Finance, 67*(1), 351-385. https://doi.org/10.1111/j.1540-6261.2011.01714.x
5. Balsmeier, B., Fleming, L., & Manso, G. (2017). Independent boards and innovation. *Journal of Financial Economics, 123*(3), 536-557. https://doi.org/10.1016/j.jfineco.2016.12.005
6. Bebchuk, L., Cohen, A., & Ferrell, A. (2009). What matters in corporate governance? *The Review of Financial Studies, 22*(2), 783-827. https://doi.org/10.1093/rfs/hhn099
7. Bhagat, S., & Bolton, B. (2008). Corporate governance and firm performance. *Journal of Corporate Finance, 14*(3), 257-273. https://doi.org/10.1016/j.jcorpfin.2008.03.006
8. Bhagat, S., & Bolton, B. (2013). Director ownership, governance, and performance. *Journal of Financial and Quantitative Analysis, 48*(1), 105-135. https://doi.org/10.1017/S0022109013000045
9. Bushee, B. J. (1998). The influence of institutional investors on myopic R&D investment behavior. *The Accounting Review, 73*(3), 305-353. Retrieved from https://www.jstor.org/stable/248542
10. Chan, L. H., Chen, T.-Y., & Hilary, G. (2010). *Insider trading and family firms* (Working Paper, University of Hong Kong). Retrieved from https://core.ac.uk/download/pdf/37952266.pdf

11. Chang, X., Hilary, G., Kang, J.-K., & Zhang, W. (2015). Innovation, managerial myopia, and financial reporting (INSEAD Working Paper No. 213/35/AC). https://doi.org/10.2139/ssrn.2189938
12. Chemmanur, T. J., & Tian, X. (2018). Do anti-takeover provisions spur corporate innovation? A regression discontinuity analysis. *Journal of Financial and Quantitative Analysis, 53*(3), 1163-1194. https://doi.org/10.1017/S0022109018000029
13. Chrisman, J. J., Chua, J. H., Le Bretton-Miller, I., Miller, D., & Steier, L. S. (2017). Governance mechanisms and family firms. *Entrepreneurship Theory and Practice, 42*(2), 171-186. https://doi.org/10.1177/1042258717748650
14. Coles, J. L., Daniel, N. D., & Naveen, L. (2008). Boards: Does one size fit all? *Journal of Financial Economics, 87*(2), 329-356. https://doi.org/10.1016/j.jfineco.2006.08.008
15. Duran, P., Kammerlander, N., Van Essen, M., & Zellweger, T. (2015). Doing more with less: Innovation input and output in family firms. *Academy of Management Journal, 59*(4), 1224-1264. https://doi.org/10.5465/amj.2014.0424
16. Erdogan, I., Rondi, E., & De Massis, A. (2019). Managing the tradition and innovation paradox in family firms: A family imprinting perspective. *Entrepreneurship Theory and Practice, 44*(1), 20-54. https://doi.org/10.1177/1042258719839712
17. Feranita, F., Kotlar, J., & De Massis, A. (2017). Collaborative innovation in family firms: Past research, current debates and agenda for future research. *Journal of Family Business Strategy, 8*(3), 137-156. https://doi.org/10.1016/j.jfbs.2017.07.001
18. Ferris, S. P., Jagannathan, M., & Pritchard, A. C. (2003). Too busy to mind the business? Monitoring by directors with multiple board appointments. *The Journal of Finance, 58*(3), 1087-1112. https://doi.org/10.1111/1540-6261.00559
19. Fich, E. M., & Shivdasani, A. (2006). Are busy boards effective monitors? *The Journal of Finance, 61*(2), 689-724. https://doi.org/10.1111/j.1540-6261.2006.00852.x
20. Gompers, P., Ishii, J., & Metrick, A. (2003). Corporate governance and equity prices. *The Quarterly Journal of Economics, 118*(1), 107-156. https://doi.org/10.1162/00335530360535162
21. Grieser, W. D., & Hadlock, C. J. (2019). Panel data estimation in finance: Testable implications and parameter (in)consistency. *Journal of Financial and Quantitative Analysis, 54*(1), 1-29. https://doi.org/10.1017/S0022109018000996
22. Hall, B. H. (2005). A note on the bias in Herfindahl-type measures based on count data. *Revue d'Économie Industrielle, 110*(2), 149-156. https://doi.org/10.3406/rei.2005.3076
23. Hall, B. H., Jaffe, A. B., & Trajtenberg, M. (2002). *The NBER patent citations data file: Lessons, insights and methodological tools* (NBER Working Paper No. 8498). https://doi.org/10.3386/w8498
24. Hall, B. H., Jaffe, A. B., & Trajtenberg, M. (2005). Market value and patent citations. *RAND Journal of Economics, 36*(1), 16-38. Retrieved from https://eml.berkeley.edu//~bhhall/papers/HallJaffeTrajtenberg_RJEjan04.pdf
25. Hart, O. (1995). Corporate governance: Some theory and implications. *The Economic Journal, 105*(430), 678-689. https://doi.org/10.2307/2235027
26. James, H. S. (2006). *Family capitalism.* Cambridge, MA: Belknap Press.
27. Jiraporn, P., Kim, Y. S., & Davidson, W. N. (2008). Multiple directorships and corporate diversification. *Journal of Empirical Finance, 15*(3), 418-435. https://doi.org/10.1016/j.jempfin.2007.07.002
28. Jordan, B. D., Kim, S., & Liu, M. H. (2016). Growth opportunities, short-term market pressure, and dual-class share structure. *Journal of Corporate Finance, 41*, 304-328. https://doi.org/10.1016/j.jcorpfin.2016.10.003
29. Knyazeva, A., Knyazeva, D., & Masulis, R. W. (2013). The supply of corporate directors and board independence. *The Review of Financial Studies, 26*(6), 1561-1605. https://doi.org/10.1093/rfs/hht020
30. Knott, A. M. (2008). R&D/returns causality: Absorptive capacity or organizational IQ. *Management Science, 54*(12), 2054-2067. https://doi.org/10.1287/mnsc.1080.0933
31. Kogan, L., Papanikolaou, D., Seru, A., & Stoffman, N. (2017). Technological innovation, resource allocation, and growth. *The Quarterly Journal of Economics, 132*(2), 665-712. https://doi.org/10.1093/qje/qjw040
32. Larcker, D. F., So, E. C., & Wang, C. C. Y. (2013). Boardroom centrality and firm performance. *Journal of Accounting and Economics, 55*(2-3), 225-250. https://doi.org/10.1016/j.jacceco.2013.01.006
33. Le Breton-Miller, I., & Miller, D. (2018). Looking back at and forward from: 'Family governance and firm performance: Agency, stewardship and capabilities'. *Family Business Review, 31*(2), 229-237. https://doi.org/10.1177/0894486518773850
34. Manso, G. (2011). Motivating innovation. *The Journal of Finance, 66*(5), 1823-1860. https://doi.org/10.1111/j.1540-6261.2011.01688.x
35. Masulis, R. W., Wang, C., & Xie, F. (2009). Agency problems at dual-class companies. *The Journal of Finance, 64*(4), 1697-1727. https://doi.org/10.1111/j.1540-6261.2009.01477.x
36. O'Connor, M., & Rafferty, M. (2012). Corporate governance and innovation. *Journal of Financial and Quantitative Analysis, 47*(2), 397-413. https://doi.org/10.1017/S002210901200004X
37. Sapra, H., Subramanian, A., & Subramanian, K. V. (2014). Corporate governance and innovation: Theory and evidence. *Journal of Financial and Quantitative Analysis, 49*(4), 957-1003. https://doi.org/10.1017/S002210901400060X
38. Schulze, W. S., Lubatkin, M. H., Dino, R. N., & Buchholtz, A. K. (2001). Agency relationships in family firms: Theory and evidence. *Organization Science, 12*(2), 99-116. https://doi.org/10.1287/orsc.12.2.99.10114
39. Shleifer, A., & Vishny, R. W. (1986). Large shareholders and corporate control. *Journal of Political Economy, 94*(3), 461-488. https://doi.org/10.1086/261385
40. Trajtenberg, M. (1990). A penny for your quotes: Patent citations and the value of innovations. *RAND Journal of Economics, 21*(1), 172-187. https://doi.org/10.2307/2555502
41. Trajtenberg, M., Henderson, R., & Jaffe, A. B. (1997). University versus corporate patents: A window on the basicness of invention. *Economics of Innovation and New Technology, 5*(1), 19-50. https://doi.org/10.1080/10438599700000006
42. Wang, Y., & Zhao, J. (2015). Hedge funds and corporate innovation. *Financial Management, 44*(2), 353-385. https://doi.org/10.1111/fima.12059
43. Wintoki, M. B. (2007). Corporate boards and regulation: The effect of the Sarbanes-Oxley Act and the exchange listing requirements on firm value. *Journal of Corporate Finance, 13*(2-3), 229-250. https://doi.org/10.1016/j.jcorpfin.2007.03.001

APPENDIX

Table 1. Variable definitions

Variable	*Definition*
Innovation variables in year t+1:	
Research Quotient (RQ)	Output elasticity of R&D expenditures, or the percentage increase in revenues from a 1% increase in R&D expenditures.
Patents	The total number of patents filed by (and ultimately granted to) a firm in year t+1.
$Patents_{TN}$	Equals patents are divided by the average number of patents filed across all firms in the same application year and the same U.S. Patent and Trademark Office technological class.
Citations	Total future citations received in life on all patents filed by (and ultimately granted to) a firm in year t+1.
$Citations_{TN}$	Equals cites are divided by the total number of citations received on all patents filed in the same USPTO class for the same application year.
Board governance variables in year t:	
Family Firm	= 1 if a founding family or descendants own 5% of more of the common stock (cash flow rights, not voting rights)
Dual-Class Shares	= 1 if the firm has more than 1 class of common stock, and 0 otherwise
Busy Directors	The percentage of directors who are on three or more other boards.
No. of Other Boards	The average number of other boards that directors serve on.
Time on Board	The average time served by directors on the board.
Tenure > 15 Yrs	The percentage of directors with tenure on the board of 15 years or more.
Tenure < 5 Yrs	The percentage of directors with tenure on the board of less than 5 years.
BCF E-Index	The sum of six anti-takeover provisions as in Bebchuk et al. (2009), including staggered board, poison pill, supermajority to approve mergers, limits to amend bylaws, limits to amend charters, and golden parachutes.
GIM G-Index	The anti-takeover provisions index from Gompers et al. (2003).
CEO-Chair Duality	= 1 if the firm has a dual CEO-Chair position, and zero otherwise.
Director Age	The average age of directors on the board.
Board Independence	The percentage of directors who are independent.
Director Ownership	The median dollar value of director ownership.
CEO Ownership	The dollar value of common stock owned by the CEO.
Firm-specific control variables in year t:	
Assets	Total assets of firm (No. 6)
Revenues	Net revenues (No. 12)
Market Value	Market value of equity (No. 25 x No. 199)
R&D Expense	Annual research & development expense (No. 46)
ROA	Return on assets, operating income before depreciation/Total Assets (No. 13/No. 6)
Debt/Assets	Long-term debt/Total assets ((No. 9 + No. 34)/No. 6)
Cash/Assets	Cash/Assets (No. 1/No. 6)
Tobin's Q	Market value of assets over book value of assets [(No. 6 – No. 60 + abs(No. 25 * No. 199))/No. 6]
Firm Age	Natural logarithm of one plus firm age, measured as the number of years listed on CRSP.
Institutional Ownership	Percentage of common stock owned by institutional investors.
Equity/Total Pay	The total value of new restricted stock and stock options granted as a percentage of annual total pay for the top five executives.

Table 2. Summary statistics

Variable	*N*	*Mean*	*Std dev*	*Min*	*P25*	*Median*	*P75*	*Max*
Panel A: Innovation variables in year t+1 (2002-2011)								
Research Quotient (RQ)	7,637	0.11	0.12	-1.06	0.07	0.12	0.16	1.09
Patents	7,637	25.28	160.36	0.00	0.00	0.00	3.00	4,422.00
Patents$_{TN}$	7,637	4.78	25.74	0.00	0.00	0.00	0.68	671.36
Citations	7,637	186.37	1,897.14	0.00	0.00	0.00	2.00	95,000.00
Citations$_{TN}$	7,637	26.31	167.55	0.00	0.00	0.00	1.62	4,298.37
Cites per Patent	7,637	1.51	5.31	0.00	0.00	0.00	0.49	157.00
Cites$_{TN}$ *per Patent*	7,637	0.36	0.88	0.00	0.00	0.00	0.41	20.00
Panel B: Board governance variables in year t (2001-2010)								
Family Firm	7,637	0.34	0.48	0.00	0.00	0.00	1.00	1.00
Dual-Class Shares	7,637	0.10	0.31	0.00	0.00	0.00	0.00	1.00
Busy Directors	7,637	0.09	0.10	0.00	0.00	0.11	0.19	0.42
No. of Other Boards	7,637	0.85	0.51	0.00	0.55	0.77	1.21	2.18
Director Tenure	7,637	10.38	4.02	3.10	7.46	9.80	12.68	22.67
Tenure > 15 Yrs	7,637	0.21	0.21	0.00	0.11	0.21	0.34	0.71
Tenure < 5 Yrs	7,637	0.20	0.19	0.00	0.09	0.20	0.33	0.78
BCF E-Index	7,637	1.58	1.10	0.00	1.00	2.00	2.00	4.00
GIM G-Index	7,637	9.44	2.51	4.00	8.00	9.00	11.00	15.00
CEO-Chair Duality	7,637	0.58	0.51	0.00	0.00	1.00	1.00	1.00
Director Age	7,637	60.30	4.36	49.00	56.95	60.20	62.97	70.00
Board Independence	7,637	0.71	0.16	0.33	0.61	0.70	0.83	1.00
Director Ownership ($mm)	7,637	2.09	3.11	0.00	0.46	1.12	2.28	19.67
CEO Ownership ($mm)	7,637	6.78	18.25	0.00	1.93	4.81	13.42	394.00
Panel C: Control variables in year t (2001-2010)								
Assets ($mn)	7,637	7,928.47	23,523.19	11.52	727.18	2,136.44	6,374.40	480,000.00
Revenues ($mn)	7,637	6,452343	21,732.44	0.25	698.46	1,989.76	5,524.20	421,000.00
Market Value ($mn)	7,637	9,145.59	27,825.49	8.02	803.15	2,308.60	6,792.18	485,000.00
R&D Expense ($mn)	7,637	151.25	681.44	0.00	0.00	0.00	54.68	11,528.50
R&D/Assets	7,637	0.03	0.06	0.00	0.00	0.00	0.05	0.48
CapEx/Assets	7,637	0.06	0.05	0.00	0.02	0.05	0.08	0.29
ROA	7,637	0.13	0.11	-0.52	0.08	0.13	0.21	0.42
Debt/Assets	7,637	0.23	0.19	0.00	0.08	0.21	0.34	0.90
Cash/Assets	7,637	0.14	0.18	0.00	0.02	0.07	0.19	0.89
Tobin's Q	7,637	1.98	1.43	0.78	1.24	1.55	2.34	8.58
Firm Age	7,637	27.41	21.68	0.00	10.00	20.00	38.00	82.00
Institutional Ownership	7,637	0.62	0.37	0.00	0.47	0.72	0.86	1.00
Equity/Total Pay	7,637	0.55	0.29	0.00	0.35	0.60	0.74	0.93

Note: This table provides summary statistics on the key variables. All except binary variables are winsorized at the upper and lower 1% level. Variables are defined in Appendix, Table 1.

Table 3. Regressions of innovation on family firm ownership

Panel A: Research Quotient (RQ) as measure of innovation			
	RQ	***RQ***	***RQ***
Family Firm	1.837***	1.902***	2.137***
	(2.86)	(2.93)	(2.69)
Dual-Class Shares	-	-0.638*	-0.706*
	-	(-1.76)	(-1.66)
Family Firm x Dual-Class Shares	-	-	-0.422**
	-	-	(-2.13)
Ln (Assets)	0.062*	0.058*	0.059*
	(1.77)	(1.78)	(1.70)
R&D/Assets	-0.327	-0.341	-0.338
	(-0.83)	(-0.89)	(-0.82)
CapEx/Assets	0.243*	0.268*	0.257
	(1.71)	(1.70)	(1.62)
Tobin's Q	0.101	0.108	0.107
	(0.98)	(0.92)	(0.95)
Debt/Assets	-0.037	-0.044	-0.046
	(0.89)	(0.82)	(0.80)
Cash/Assets	0.236*	0.240*	0.241*
	(1.83)	(1.81)	(1.86)
Institutional Ownership	0.074	0.071	0.072
	(1.34)	(1.31)	(1.30)
Equity/Total Pay	0.143**	0.142**	0.148**
	(2.13)	(2.19)	(2.24)
Firm Age	0.487***	0.475***	0.472***
	(3.24)	(3.08)	(3.01)
Constant	-1.371***	-1.682***	-1.736***
	(-2.73)	(-2.79)	(-2.82)
Observations	5,836	5,836	5,836
R-squared	0.257	0.263	0.268
Firm, industry & year FE	Yes	Yes	Yes
Panel B: Patents$_{TN}$ as measure of innovation			
	Patents$_{TN}$	***Patents$_{TN}$***	***Patents$_{TN}$***
Family Firm	-0.371*	-0.392*	-0.404*
	(1.82)	(1.77)	(1.74)
Dual-Class Shares	-	-0.439**	-0.402**
	-	(-2.26)	(-2.20)
Family Firm x Dual-Class Shares	-	-	-0.721*
	-	-	(-1.91)
All other control variables included, but not tabulated for brevity			
Observations	5,836	5,836	5,836
R-squared	0.284	0.295	0.301
Firm, industry & year FE	Yes	Yes	Yes
Panel C: Citations$_{TN}$ as measure of innovation			
	Citations$_{TN}$	***Citations$_{TN}$***	***Citations$_{TN}$***
Family Firm	-0.445*	-0.402*	-0.397*
	(1.91)	(1.85)	(1.84)
Dual-Class Shares	-	-0.508**	-0.517**
	-	(-2.36)	(-2.37)
Family Firm x Dual-Class Shares	-	-	-0.618*
	-	-	(-1.82)
All other control variables included, but not tabulated for brevity			
Observations	5,836	5,836	5,836
R-squared	0.299	0.307	0.312
Firm, industry & year FE	Yes	Yes	Yes

*Note: This table presents regression results of innovation on various measures of family firm ownership and structure. Panel A uses Research Quotient (RQ) as the measure of innovation; Panel B uses Patents$_{TN}$ (adjusted for industry trend and truncation bias) as the measure of innovation; Panel C uses Citations$_{TN}$ (adjusted for industry trend and truncation bias) as the measure of innovation. Family Firm and Dual-Class Shares are the explanatory variables of interest. Control variables are included in Panel A and are defined in Appendix; control variables are omitted for brevity in Panels B and C. All regressions contain firm and year fixed effects. All variables except binary variables are winsorized at the upper and lower 1% levels. Full variable definitions are provided in Appendix, Table 1. T-statistics are reported in parentheses. Standard errors are adjusted based on the Huber-White sandwich estimate of variances and are clustered by firm. *** indicates significance at the 1% level, ** 5% and * 10%.*

Table 4. Regressions of innovation on family firm ownership and corporate governance structures (Part 1)

Panel A: Board Independence as the measure of corporate governance			
	RQ	***RQ***	***RQ***
Family Firm	1.837***	1.722***	1.708***
	(2.86)	(3.01)	(3.04)
Dual-Class Shares	-	-0.529*	-0.598*
	-	(-1.68)	(-1.67)
Family Firm x Dual-Class Shares	-	-	-0.389**
	-	-	(-2.08)
Board Independence	-	0.068*	0.059
	-	(1.81)	(1.07)
Family Firm x Board Independence	-	-	0.528***
	-	-	(2.66)
Observations	5,836	5,769	5,769
R-squared	0.257	0.299	0.307
Firm, industry & year FE	Yes	Yes	Yes
Panel B: Director Ownership as the measure of corporate governance			
Family Firm	1.837***	1.608**	1.601**
	(2.86)	(2.51)	(2.47)
Dual-Class Shares	-	-0.614	-0.608
	-	(-1.40)	(-1.37)
Family Firm x Dual-Class Shares	-	-	-0.328**
	-	-	(-2.15)
Director Ownership	-	0.007**	0.006**
	-	(2.19)	(1.98)
Family Firm x Director Ownership	-	-	0.318*
	-	-	(1.70)
Observations	5,836	5,769	5,769
R-squared	0.257	0.311	0.315
Firm, industry & year FE	Yes	Yes	Yes
Panel C: CEO Ownership as the measure of corporate governance			
Family Firm	1.837***	1.707***	1.621***
	(2.86)	(2.92)	(2.80)
Dual-Class Shares	-	-0.607*	-0.573*
	-	(-1.69)	(-1.72)
Family Firm x Dual-Class Shares	-	-	-0.423**
	-	-	(-2.11)
CEO Ownership	-	0.005	0.004
	-	(1.37)	(1.29)
Family Firm x CEO Ownership	-	-	0.528
	-	-	(1.43)
Observations	5,836	5,769	5,769
R-squared	0.257	0.268	0.271
Firm, industry & year FE	Yes	Yes	Yes
Panel D: CEO-Chair Duality as the measure of corporate governance			
Family Firm	1.837***	1.821***	1.708***
	(2.86)	(2.95)	(2.92)
Dual-Class Shares	-	-0.507*	-0.566*
	-	(-1.70)	(-1.74)
Family Firm x Dual-Class Shares	-	-	-0.386**
	-	-	(-2.21)
CEO-Chair Duality	-	-0.173**	0.834
	-	(1.98)	(1.21)
Family Firm x CEO-Chair Duality	-	-	-0.663**
	-	-	(2.32)
Observations	5,836	5,769	5,769
R-squared	0.257	0.267	0.307
Firm, industry & year FE	Yes	Yes	Yes

Table 4. Regressions of innovation on family firm ownership and corporate governance structures (Part 2)

Panel E: Gompers et al. (2003) G-Index as the measure of corporate governance			
Family Firm	1.837***	1.896***	1.843***
	(2.86)	(2.71)	(2.74)
Dual-Class Shares	-	-0.644*	-0.637*
	-	(-1.72)	(-1.74)
Family Firm x Dual-Class Shares	-	-	-0.431*
	-	-	(-1.92)
GIM G-Index	-	0.012**	0.010*
	-	(2.28)	(1.71)
Family Firm x GIM G-Index	-	-	-0.037***
	-	-	(2.75)
Observations	5,836	5,351	5,351
R-squared	0.257	0.272	0.279
Firm, industry & year FE	Yes	Yes	Yes
Panel F: Number of Other Boards directors serve on as the measure of corporate governance			
Family Firm	1.837***	1.844***	1.762***
	(2.86)	(2.90)	(2.81)
Dual-Class Shares	-	-0.505*	-0.534*
	-	(-1.71)	(-1.72)
Family Firm x Dual-Class Shares	-	-	-0.359**
	-	-	(-2.04)
Number of Other Boards	-	-0.105*	-0.113
	-	(1.84)	(1.20)
Family Firm x Number of Other Boards	-	-	-0.836
	-	-	(1.25)
Observations	5,836	5,769	5,769
R-squared	0.257	0.284	0.290
Firm, industry & year FE	Yes	Yes	Yes

*Note: This table presents regression results of innovation on various measures of family firm ownership and structure and various measures of corporate governance. Research Quotient (RQ) is the measure of innovation in all analyses. Panel A uses Board Independences as the measure of corporate governance; Panel B uses Director Ownership as the measure of corporate governance; Panel C uses CEO Ownership as the measure of corporate governance; Panel D uses CEO-Chair Duality as the measure of corporate governance; Panel E uses the Gompers et al. (2003) G-Index as the measure of corporate governance; and Panel F uses Number of Other Boards as the measure of corporate governance. Control variables are omitted for brevity. All regressions contain firm and year fixed effects. All variables except binary variables are winsorized at the upper and lower 1% levels. Full variable definitions are provided in Appendix, Table 1. T-statistics are reported in parentheses. Standard errors are adjusted based on the Huber-White sandwich estimate of variances and are clustered by firm. *** indicates significance at the 1% level, ** 5% and * 10%.*