The New Lyrics of the Old Folks:
The Role of Family Ownership in Corporate Innovation

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Abstract

According to conventional wisdom, family ownership, which signals a lack of social capital and trust in an economy, may impede innovation. This argument, however, fails to recognize that modern family firms can benefit from capitalist institutions that promote innovation. Using a comprehensive sample of U.S. family-owned public firms and patents for the period from 2000 to 2010, we show that family ownership promotes innovation and that this positive effect can be attributed to reduced financial constraints, a greater commitment to long-term value, and improved corporate governance. Causality is confirmed by an instrumental variable analysis using the state-level divorce rate and a difference-in-difference analysis based on changes in estate taxes (the Economic Growth and Tax Relief Reconciliation Act of 2001).

Keywords: Family firms, innovation, intangible investment

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> “*The competitive position of important U.S. industries has declined relative to those of other nation … Examples of [firms that can overcome the disadvantages of the American system]are companies that have permanent and active family ownership … which seem to enjoy competitive advantages in investing*.”
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> – Michael Porter (1992)

Introduction

Innovation and long-term investment are at the core of firm sustainability (Dierickx and Cool, 1989; Ettlie, 1998) and national competitive advantage (Porter, 1992). One widespread concern has been the deteriorating global competitiveness of U.S. firms owing to the inefficient utilization of innovation capital. Interestingly, family ownership, one of the oldest types of business structures, is argued to potentially help “overcome the disadvantages of the American system” because such an ownership structure seems to “enjoy competitive advantages in investing” (Porter, 1992). However, this intuition contradicts the folk theorem that reliance on family ties and the prosperity of family firms signal a lack of social capital in general and a lack of trust in particular in an economy (e.g., Banfield, 1958; Putnam et al., 1993; Fukuyama, 1995; Mueller and Philippon, 2011) and that a lack of social capital or trust hinders innovation (Coleman, 1988; Hall and Jones, 1999).

The latter inference based on the lack of trust, however, has been traditionally inferred from a context in which family firms operate in the absence of modern capitalist institutions. This relationship thus may not apply to the modern family firms considered by Porter (1992) in which innovation is less sensitive to the impact of distrust because the family firms are located in countries with good capitalist institutions. In this paper, we directly confront this issue and investigate whether family ownership and modern capitalist institutions foster innovation in a synergistic manner or whether the folk theorem still holds that even modernized family firms stifle innovation.[1] Indeed, innovation usually involves experimentation that requires long-term effort despite a highly uncertain outcome and high failure rates (Holmstrom, 1989; Aghion and Tirole, 1994; Manso, 2011). Investing in innovation may therefore induce high information

[1] Family ownership is common in the U.S. (e.g., Shleifer and Vishny, 1986; Anderson and Reeb, 2003a) and is more pervasive internationally (La Porta, Lopez-de-Silanes, and Shleifer, 1999; Claessens et al., 2002). Numerous previous studies focus on whether family ownership imposes agency costs especially on small investors (see, e.g., La Porta, Lopez-de-Silanes, and Shleifer, 1999; Claessens et al., 2002; Faccio and Lang, 2002; Volpin, 2002; Burkart et al., 2003; Durnev and Kim, 2005; Pérez-González, 2006; Bennedsen et al., 2007; Bertrand et al., 2008; Almeida et al., 2011; Ellul, Pagano, and Panunzi, 2010; Masulis, Pham, and Zein, 2011; Franks et al., 2012. Morck, Wolfenzon, and Yeung, 2005 and Khanna and Yafeh, 2007 provide two recent surveys) and whether family ownership alleviates financial constraints or leverages firm reputation (e.g., Gomes, 2000; Khanna, and Palepu, 2000; Almeida and Wolfenzon, 2006; Masulis, Pham, and Zein, 2011). Although some studies examine the investment behavior of firms (Villalonga and Amit, 2006; Ellul, Pagano, and Panunzi, 2010; Anderson, Duru, and Reeb, 2012), the efficiency and quality of the outcome of such investment appears to be underexplored.

and agency costs (Hall and Lerner, 2010) and may be subject to various myopic incentives (e.g., Stein, 1988, 1989; Shleifer and Vishny, 1990; Bushee, 1998). Given such complexity, the unique characteristics of modern family firms, such as long horizons, alignment between ownership and management, and high credit ratings, could stimulate innovation (*innovation enhancing hypothesis*). In contrast, if family firms are still associated with features known to hinder innovation, such as more conservative thinking (Coleman, 1988; Hall and Jones, 1999), if family firms' business model is more prone to agency problems concerning minority shareholders, or if family firms experience financial constraints induced by the need to retain control, family ownership may stifle innovation (*innovation stifling hypothesis*).

We test these alternative hypotheses by using data on the family ownership and patents of a comprehensive sample of public U.S. firms for the period from 2000 to 2010. We focus on patents rather than R&D spending as a proxy for innovation output because patents are tradable intellectual property with a liquid market (Lev 2001). The weekly reports issued by the U.S. Patent and Trademark Office (USPTO) provide a clean, detailed source of innovation performance that allows the market to directly measure innovation and its economic value along *multiple* dimensions, such as quality versus quantity.[2]

We start by providing evidence that family ownership is generally positively related to the quantity, quality, creativity, and versatility of patents. When we directly compare family firms to similar non-family firms via propensity score matching, family firms are associated with 26% more patents filed, 29% more citations received, 29% higher originality scores, and 69% higher generality scores. The first figure indicates that family firms produce more patents. Additionally, the greater number of citations, higher originality, and higher generality indicate that innovation is also of higher quality in family firms than in non-family firms.

This positive relationship between family ownership and innovation is confirmed by multivariate analyses in which we observe that family ownership is associated with approximately 11.5% more patents filed, 12.1% more citations of filed patents, 14.1% higher originality, and 30.0% higher generality for the whole sample. The estimates in the propensity score matched sample are 24.0%, 27.7%, 29.5%, and 61.7% for the number of patents filed, the number of citations, originality, and generality, respectively. This positive relationship is robust to alternative definitions of the main variables and econometric specifications. We also investigate the economic channels through which family ownership can promote innovation, including the possible benefits of long-term commitment, reduced financial constraints, and

[2] Indeed, prior studies have shown that patents provide necessary information about firm intangible asset levels and market values (Lerner, 1994; Lanjouw and Schankerman, 2004; Hall, Jaffe, and Trajtenberg, 2005a). Conversely, R&D may be subject to several problems, such as agency costs (Jensen, 1993; Hall, 1993), managerial manipulation and outsourcing (Dechow and Sloan, 1991; Bushee, 1998), and misrepresentation of intangible assets (Lev and Sougiannis, 1996; Kothari, Laguerre, and Leone, 2002; Lev, Sarath, and Sougiannis, 2005).

improved governance. We provide strong evidence that family firm ownership is particularly effective in enhancing innovation through all these economic channels.

We address potential endogeneity by using both an instrumental variable approach and an event-based difference-in-difference test. We first utilize the state-level divorce rate as an instrument to explain cross-state variation in family ownership. The state-level divorce rate is an ideal instrument because disruptions, such as divorce, negatively affect the sustainability of family ownership (e.g., Stafford et al., 1999; Danes and Amarapurkar, 2001; Galbraith, 2003; Olson et al., 2003; Rutherford et al., 2006). Moreover, the average divorce rate at the state level is not affected by a particular family firm, and the rate does not directly influence firm-level innovation. Rather, the state-level divorce rate is affected by state-level social capital factors, such as religion and culture (e.g., Sweezy and Tiefenthaler, 1996) and, therefore, meets the exclusion restriction in providing exogenous variation in the predominance of family business. Consistent with previous research, we find that the state divorce rate significantly reduces family ownership. We then instrument family ownership with the state divorce rate, and the results confirm our previous findings: family ownership enhances both the quality and quantity of patent output.

We then consider an alternative identification strategy based on an event, the Economic Growth and Tax Relief Reconciliation Act (EGTRRA) of 2001, and the ensuing substantial drop in the federal estate tax rate. This law phased out the federal estate tax and entirely repealed it in 2010. Because estate and inheritance taxes have been demonstrated to negatively affect family firm growth (e.g., Brunetti, 2006; Ellul, Pagano, and Panunzi, 2010), the drastic cut in the federal estate tax provides an exogenous event that affects the incentive to further develop family firms. The results of a difference-in-difference test suggest that a decline in federal estate tax significantly increases both the quantity and quality of family firms' patent output. These results, which are robust to the use of alternative testing windows and the joint use of the instrumental variable, confirm a general causal relation between family ownership and innovation in U.S. firms.[3]

It is important to point out that our results are not driven by greater R&D spending among family firms. In fact, consistent with previous research, we observe a negative relationship between family ownership and R&D input.[4] However, when we scale our main patent variables by lagged R&D—i.e.,

[3] The state-level estate tax does not provide a good instrument because there is little cross-state variation in estate taxes during the early 2000s. Before EGTRRA, all state estate taxes were directly linked to the federal credit on a dollar-for-dollar basis (Francis, 2012). This credit effectively allowed states to share estate tax revenue with the federal government but did not impose an additional burden on family firms. EGTRRA gradually replaced the federal credit with a deduction between 2002 and 2005, which may pose additional state estate and inheritance taxes. However, the majority of states effectively relieve this state-level burden.

[4] Morck, Strangeland, and Yeung (2000), Villalonga and Amit (2006), and Anderson, Duru, and Reeb (2012) demonstrate that family firms spend less on R&D. In addition, family ownership can be associated with poor

when we measure the realized efficiency of R&D inputs in terms of patent outputs—we find that family firms achieve a significant advantage in these efficiency variables. In other words, although family firms invest less in R&D, they perform efficiently, i.e., they produce more and better patents. This new observation contributes to the strand of literature on family ownership and R&D (Miller and Le Breton-Miller, 2005; Villalonga and Amit, 2006; Anderson, Duru, and Reeb, 2012).

It is also important to note that the role of family ownership in corporate innovation and the innovation efficiency of family ownership changes over time. We find that the innovation efficiency of family firms (the R&D-scaled patent variables) improves with the reduction of the estate tax. These improvements suggest that family firms adapt to their institutional environment in affecting innovation. We also observe that cross-county trust within the U.S. still negatively affects the existence of family ownership but that the impact of trust on firm-level innovation becomes less prominent, if not marginal. In other words, the presence of modern capitalist institutions may partially suppress the negative impact of distrust on innovation and may allow family firms to overcome distrust when they engage in innovation. This conjecture is supported by the data: family firms, even when they are associated with low trust, can nonetheless promote innovation. These findings extend the existing literature taking the value of family ties as given and persistent (Banfield, 1958; Coleman, 1988; Putnam et al., 1993; Fukuyama, 1995; Hall and Jones, 1999) by illuminating the role of family ownership in innovation during the modern era.

Our results also contribute to the body of literature on the effects of family ownership on operational performance and real activities by using a large dataset that includes all public U.S. firms. The empirical evidence regarding how family ownership affects firm valuation and performance is mixed in the U.S. (e.g., Anderson and Reeb, 2003a; Villalonga and Amit, 2006). We present new evidence by demonstrating that family firms can increase their performance by focusing on valuing-enhancing innovation activities. Our empirical results suggest that the advantages of financial stability and long-term commitment outweigh the disadvantages of under-diversification and nepotism. The net effect is increased innovation.

Because previous studies have established a positive relation between patent activities and firm value (Lerner, 1994; Hall, Jaffe, and Trajtenberg, 2005a; Matolcsy and Wyatt, 2008; Hirshleifer, Hsu, and Li, 2013; Cohen, Diether, and Malloy, 2013), our results suggest that family ownership may be beneficial to both controlling families and outside shareholders by providing a longer investment horizon. More

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management practices (Bloom and Van Reenen, 2007, 2010). However, Miller and Le Breton-Miller (2005) suggest that family firms tend to invest more in R&D over the long run.

important, our results provide evidence of the beneficial influence of family firms on economic growth through innovation, which creates positive externalities for the entire economy.

Our study also adds to a growing stream of research on the effects of ownership composition and structure on innovation and intangible investment. Baysinger, Kosnik, and Turk (1991) and Lee and O'Neill (2003) observe that the concentration of institutional shareholders is positively associated with corporate R&D investments. Francis and Smith (1995) observe that firms with more concentrated ownership produce more patents. Aghion, Van Reenen, and Zingales (2013) demonstrate that institutional ownership increases patent citations because it is associated with more effective monitoring. We contribute to this literature by demonstrating that family ownership leads to more and better innovation after institutional ownership and concentration are controlled for, suggesting that the influence of family affiliation on innovation activities is distinct from that of institutional investors. This effect is intuitive given that family ownership differs from regular institutional ownership in longer investment horizons, tighter shareholder-manager relationships, and greater reputation concerns.

The remainder of this paper is organized as follows. Section 2 develops testable hypotheses about the effects of family ownership on innovation. Section 3 presents our variables and summary statistics. Section 4 reports the baseline results and robustness checks. Section 5 provides our identification strategies, and Section 6 discusses the channels through which family ownership affects innovation. Section 7 reconciles our findings with the existing research, and Section 8 concludes.

2. Hypotheses Development

In this section, we present our hypotheses regarding the effect of family ownership on innovation. Although family firms are known to thrive in economies with lower levels of social capital (e.g., Banfield, 1958; Putnam et al., 1993; Fukuyama, 1995; Mueller and Philippon, 2011), which may hinder innovation (Coleman, 1988; Hall and Jones, 1999); however, the same may not be true for U.S. family firms if they can fully adapt to institutions that are known to advance innovation. We therefore examine both the positive and the negative effects of family firms on innovation.

We first consider the characteristics of family firms that are positively associated with innovation. For example, family firms are characterized by a long-term view that avoids the myopic and opportunistic behaviors that are typical of short-term investors (Stein, 1988; Bushee, 1998; He and Tian, 2013).[5] This longer horizon also allows for the development and maintenance of a long-term relationship with employees (Weber et al., 2003; Miller and Le Breton-Miller, 2005; Mueller and Philippon, 2011). This

[5] In addition, Fang, Tian, and Tice (2013) observe that increased stock liquidity invites hostile takeovers and myopic shareholders, which hinders innovation.

more stable environment further improves long-term planning, while managers innovate more and behave less myopically with greater job security (e.g., Acharya, Baghai, and Subramanian, 2012, 2013; Chemmanur and Tian, 2011).[6] In addition, family firms tend to groom managers who share similar values and visions, likely making them more tolerant of failures from risky investments and ultimately fostering better innovation (e.g., Manso, 2011; Ederer and Manso, 2013; Tian and Wang, 2014). Overall, these considerations imply that the longer investment horizon makes family firms more likely to excel in innovation.

Family firms also tend to possess different financing structures from other firms. Creditors are often reluctant to lend funds to risky, intangible investment and innovation (Aghion et al., 2004; Atanassov, Nanda, and Seru, 2007; Hsu, Tian, and Xu, 2014). However, family firms are more appreciated by lenders, and they command lower borrowing costs (Anderson and Reeb, 2003b), which implies that being a family firm alleviates the adverse effect of financing constraints for innovation and allows family firms to better plan and implement long-term projects.

Finally, family ownership is associated with closer shareholder-manager alignment. This alignment is particularly important when the timeline of or uncertainty associated with an investment increases the adverse effects of information asymmetry.[7] Innovation requires time, high-quality labor, and intensive capital inputs and delivers an output that is unpredictable and idiosyncratic (Hall and Lerner, 2010). If controlling families more effectively monitor managers (e.g., Anderson and Reeb, 2003a), they are better positioned to undertake long-term investments. All these discussions inform the following hypothesis:

H1a (innovation enhancing hypothesis): Family ownership promotes more effective technological innovation.

We now consider the potential negative effects of family ownership. First, although family ownership is associated with long-term commitment, this very long-term view may produce extreme conservatism. Indeed, the traditional view that family ties are associated with low trust and more conservative thinking (Coleman, 1988; Hall and Jones, 1999) may still apply to U.S. family firms. For instance, families may prefer the status quo and may remain preoccupied with their existing operations and business models (Schulze et al., 2001; Gomez-Mejia et al., 2011). This preoccupation increases family firms' reluctance to embrace and efficiently implement new ideas (e.g., Levitt and March, 1988; Levinthal and March, 1993; Fernandez and Nieto, 2006).

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[6] Both Sapra, Subramanian, and Subramanian (2013) and Atanassov (2013) demonstrate that state-level anti-takeover laws boost local firms' patent output.

[7] For example, Seru (2011) demonstrates that research and development activities are associated with particularly high information asymmetries in conglomerates because of their organization size and geographic distance.

Second, family firms are likely to be more financially constrained. Indeed, retaining control over a firm may induce a family firm to bypass profitable investment opportunities or to implement them less efficiently, especially for long-term and highly uncertain projects. Additionally, controlling families tend to hold considerably under-diversified portfolios. Under-diversification often leads to higher risk-aversion and underinvestment in risky projects (Shleifer and Vishny, 1986; Faccio, Marchica, and Mura, 2011), and the incentive to engage in risky and ambitious R&D projects is ultimately reduced in family firms (Anderson, Duru, and Reeb, 2012).

Third, family ownership may be subject to agency problems because of the combination of ownership and managerial control (Morck, Shleifer, and Vishny, 1988; DeAngelo and DeAngelo, 2000; Anderson and Reeb, 2003a). Such problems may degenerate into nepotism if family firms prefer to appoint family members or friends to top positions rather than hiring professional outsiders, which often destroys firm value (Pérez-González, 2006; Villalonga and Amit, 2006; Bennedsen et al., 2007; Belenzon and Berkovitz, 2010; Bloom and Van Reenen, 2007, 2010). Moreover, family firms may be less transparent than non-family firms (Fan and Wong, 2002). The joint effect of increased potential agency problems and information asymmetry is a reduction in the willingness and ability to innovate. This discussion informs the following alternative hypothesis:

H1b (innovation stifling hypothesis): Family ownership stifles technological innovation.

Before testing these hypotheses, we describe the data and main variables that we use.

3. Data and Summary Statistics

3.1. Family ownership

We construct a database of family-owned U.S. firms following the approach of Masulis, Pham, and Zein (2011). The goal of this approach is to determine whether each public firm is ultimately owned by a family (including biologically linked families, individual entrepreneurs, and known alliances of families/entrepreneurs) or a non-family entity (including governments, widely held firms, collective investment funds, and widely held financial institutions).[8]

[8] We first examine whether an ownership classification of "Employees/Managers", "Employees/Managers/Directors", "Individual(s) or family(ies)", or "One or more named individuals or families" involves families. Next, we determine whether other ownership categories, including "State, Public authority", "Public authority, State, Government", "Bank", "Financial company", "Industrial company", "Insurance company", "Mutual & Pension fund/Trust/Nominee", "Mutual & Pension Fund/Nominee/Trust/Trustee", "Private Equity firm", "Foundation", "Foundation/Research Institute", "Venture capital firm", "Hedge funds", and "Other unnamed shareholders, aggregated", include hidden family ownership. In an unreported analysis, we exclude individual entrepreneurs from our family definition and obtain consistent results.

We proceed in several steps. First, we merge the Osiris and Amadeus (from 2000 to 2007) and Orbis (from 2007 onward) databases from Bureau Van Dijk with the CRSP/Compustat database.[9] These data sources provide the initial family ownership information for the period from 2000 to 2011. However, some ownership information is missing, and some requires further verification. Therefore, to maximize the coverage and accuracy of our sample, we manually verify and augment family ownership information by using company annual reports and various information sources, such as LexisNexis and Factiva.

The controlling shareholder of a firm is the largest shareholder who effectively controls (directly or through the holdings of affiliates) at least 20% of the firm's voting rights. The same threshold is utilized in La Porta, Lopez-de-Silanes, and Shleifer (1999) on controlling rights in general and Masulis, Pham, and Zein (2011) on family ownership in particular. Later sections will show that our results are robust to other thresholds. For indirect ownership, we add the voting rights of a firm across a possible pyramid structure until we determine its ultimate owner.

We then define a dummy variable for family ownership (hereinafter, *Family Dummy*) that takes the value one if the ultimate owner is a family and if the family ownership is at least 20% and zero otherwise. Alternatively, we compute the ultimate family ownership for each firm as a fraction of the total voting rights (hereinafter, *Family Ownership*), with the variable ranging between 0 and 1. These variables provide two measures of family ownership. Because family ownership is quite sticky, we conduct this analysis for four years in the sample period: 2002, 2005, 2008, and 2011.[10] That is, we manually verify and augment the level of family ownership for each firm within the merged sample for these four years and rely on this correction for the closest year for the other years. For instance, in 2006, we utilize the family identities obtained in 2005 to determine the level of firm ownership.

To avoid the potential bias introduced by young firms with short histories of operation or small firms with majority shares controlled by entrepreneurs, we focus on firms with annual sales greater than 100 million dollars and a firm age (since being included in the Compustat database) greater than 5 years.

3.2. Innovation measures

We follow previous research and use firm-level patent data to capture the output of firms' creative and inventive activities (e.g., Kamien and Schwartz, 1975; Griliches, 1990). We retrieve the patent records of all public firms from the updated NBER patent database. For each patent granted by the US Patent and Trademark Office (USPTO) from 1976 to 2006, the database provides the following information: the

[9] We use NCUSIP and Ticker to match the identities of firms between the Bureau Van Dijk and CRSP datasets.

[10] Our sample includes 788 unique firms that have been family owned. Of these firms, sixteen experienced a transition in family ownership (i.e., they were non-family-owned at the beginning of our sample period or became non-family-owned by the end of the sample period).

patent assignees (i.e., the firm that filed the patent application), the Compustat-matched firm identifiers (GVKEY), the technology class, the filing date (i.e., the date on which the firm filed the patent application), a list of prior patents that are cited by the designated patent, and a list of subsequent patents that cite the designated patent through 2006.[11] These details are crucial for the public to understand the technical content and business value of patents and to allow us to measure the innovative activities of each public firm along multiple dimensions. As suggested by Griliches (1990), "[n]othing else even comes close in the quantity of available data, accessibility, and the potential industrial, organizational, and technological detail."

We then extend our patent data by manually matching the NBER patent database to the HBS patent inventor database of all patents granted by the USPTO through the end of 2010 (Lai et al., 2011; Gao, Hsu, and Li, 2014). Using information regarding the names and locations of patenting entities (including firms, governments, organizations, and institutions) from the NBER patent database, we identify the entities of 82.4% of patents granted during the 2007-2010 period. Therefore, for all patenting public firms contained in the NBER patent database, we obtain their patent records for the 1976-2010 period.

We consider four major innovation measures: patent counts, patent citations, patent originality, and patent generality. The details are provided in the Appendix. The first measure of firm-level innovation output, $Patent_{i,t}$, is the logarithmic value of one plus the patent counts of firm *i* in year *t*. The patent count is the number of successful patent applications filed by firm *i* during year *t* that are eventually granted by the USPTO.[12] This simple, straightforward proxy captures firm innovation output from a *quantitative* perspective, and it has been widely used in economics research (e.g., Griliches, 1981; Hall, 1993). Kamien and Schwartz (1975) survey the literature and note that "[n]evertheless, systematic study of patenting behavior has led Schmookler, Scherer, and others to conclude that the number of patents granted a firm is a usable proxy for inventive outputs." Following Lerner (1994) and Aghion, Van Reenen, and Zingales (2013), we use a logarithmic transformation to mitigate the skewness of the distribution of patent counts.

The second measure of firm-level innovation output is *qualitative*. This proxy ($Citation_{i,t}$) is the logarithmic value of one plus the number of patent citations received by all successful patent applications filed by firm *i* in year *t*. This measure is sometimes referred to as the citation-weighted patent count and reflects a firm's innovation output based on its patent quality. Prior studies often use the number of

[11] The NBER patent database was originally developed by Hall, Jaffe, and Trajtenberg (2005a), and an updated version of this dataset is available at https://sites.google.com/site/patentdataproject/Home.
[12] We also recognize the application-approval lag in patent counts, as it usually takes two to three years for a patent application to be approved by the USPTO (Hall, Jaffe, and Trajtenberg, 2005b). When we restrict our sample to patents granted up to 2007, we obtain consistent results, which are reported in the Internet Appendix.

citations received by a patent to measure the patent's technological contribution and economic value (Trajtenberg, 1990; Harhoff et al., 1999; Hall, Jaffe, and Trajtenberg, 2005a; Aghion, Van Reenen, and Zingales, 2013). The intuition is that the total number of citations across all patents filed by a firm in a sample year delivers a balanced estimate for its innovation output. We adjust the number of citations received by each patent by the technology category and application year, as suggested by Hall, Jaffe, and Trajtenberg (2005b), to correct for truncation bias because it takes time for patents to accumulate citations.

In addition to the *quantity* and *quality* of patents, we are also interested in other dimensions of innovation intensity, such as *creativity* and *versatility*. Therefore, we consider patent originality and generality as developed by Trajtenberg, Henderson, and Jaffe (1997). Originality and generality are based on the distribution of technology classes of citing and cited patents, respectively. Our third measure of firm-level innovation output, $Originality_{i,t}$, is the logarithmic value of one plus the sum of originality scores of patents filed by firm *i* in year *t*. The originality score of each patent is defined as one minus the Herfindahl index of the technology class distribution of all patents that have been cited by the designated patent. The USPTO assigns each patent to the best match among three-digit technology classes consisting of all inventions with similar technology compositions and properties.[13] When a patent cites prior patents from many different technology classes, the patent is considered to be more creative and original because it draws knowledge from a wider range of technologies and because it deviates from existing technology trajectories. The originality scores of all patents filed by a firm in a sample year provide an estimate that weights each patent by its originality. Thus, *Originality* measures firm-level innovation output by considering the creativity of a firm's patents.

The final measure of firm-level innovation output, $Generality_{i,t}$, is the logarithmic value of one plus the sum of the generality scores of patents filed by firm *i* in year *t*. The generality score of each patent is defined as one minus the Herfindahl index of the technology class distribution of all patents that cite the designated patent (Trajtenberg, Henderson, and Jaffe, 1997). When a patent is cited by subsequent patents in many technology classes, the patent is considered to be more general because it can be applied to various technology areas and industries. The generality scores of all patents filed by a firm in a sample year provide an estimate that weights each patent by its generality; *Generality* measures firm-level innovation output by considering the versatility of a firm's patents.

The use of a *one-year* horizon to construct these innovation measures is consistent with previous research. Patent flow is more informative of market value than patent stock (e.g., Hall, 1993; Hall, Jaffe, and Trajtenberg, 2005a) and is less subject to long-term trends within firms. Nevertheless, we also

[13] The detailed list is available at http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cbcby.htm.

consider cumulative innovation proxies with two- and three-year horizons (i.e., year *t+2* and year *t+3*, respectively) in our robustness checks and obtain consistent results.

3.3. Other control variables

We also consider a set of firm-level control variables that likely affect the scale of firm innovation and firm innovation strategies. Firm age (*Firm age*) reflects the life-cycle stage that determines innovation strategies. The market-to-book ratio (*M/B*) is commonly considered to be a proxy of growth options that reflect the value of a firm's intangible assets and future profits. The logarithm of total assets (*Asset*) reflects a firm's size that may affect the scale of its innovation output. The logarithm of annual R&D expenditures plus one (*R&D*) and the logarithm of annual capital expenditures plus one (*CAPEX*) measure the amount of investment in intangible and tangible assets, respectively. *Capital intensity* is defined as the logarithm of total assets divided by the number of employees and reflects innovation choices (e.g., Hall and Ziedonis, 2001; Aghion, Van Reenen, and Zingales, 2013). *Leverage* is defined as long-term debt and current debt divided by total assets and is expected to constrain a firm's innovation investment (e.g., Aghion et al., 2004; Hsu, Tian, and Xu, 2014). *Profit margin* is defined as operating income divided by total sales and reflects a firm's market positioning and competitive strategy. All these variables are constructed with the financial and accounting data obtained from the Compustat database; their detailed definitions are provided in the Appendix.

We also control for institutional ownership following Aghion, Van Reenen, and Zingales (2013), who demonstrate that institutional ownership is positively associated with innovation. Institutional ownership (*% Inst Own*) is defined as the percentage of shares owned by all institutional investors reported in the Thomson Reuters Institutional (13f) Holdings dataset. In addition, we control for the concentration of institutional ownership owing to the reduced monitoring power, higher agency costs, and free-rider problems associated with diffused ownership that may affect innovation investment and performance (Baysinger, Kosnik, and Turk, 1991; Francis and Smith, 1995; Lee and O'Neill, 2003). The degree of institutional ownership concentration (*Own Concentration*) is measured by the Herfindahl index defined as the sum of the squared ownership percentages owned by individual institutional shareholders. Although the nature of family ownership is very different from that of institutional ownership, to address the concern that our results may be driven by institutional ownership, we include institutional ownership and its concentration in our analysis.

3.4. Summary statistics

The main sample consists of 17,025 firm-year observations (3,260 unique firms) for the period from 2000 to 2010. The sample size is determined by family ownership data beginning in 2000 and innovation variables ending in 2010. Panel A of Table 1 reports the summary statistics (including the mean, standard deviation, 25th percentile, median, and 75th percentile) for the innovation variables, family ownership dummies and percentages, and other control variables that are used in our regression analyses. *Patent* has a mean value of 0.61 (corresponding to an average of 0.84 patents per year) and a standard deviation of 1.30, and *Citation* has a mean value of 0.73 (corresponding to an average of 1.08 citations per year) and a standard deviation of 1.76. The medians of these variables are zero, consistent with numerous studies in innovation research.

Originality has a mean value of 0.46 (corresponding to an average originality score of 0.58 per year) and a standard deviation of 1.06, and *Generality* has a mean value of 0.19 (corresponding to an average generality score of 0.21 per year) and a standard deviation of 0.66. *Generality* is, on average, lower than *Originality* because it takes time for a patent to accumulate citations. Nevertheless, this issue does not systematically bias our statistical inferences because it affects *all* firms.

In our sample, 11% of sample firms are family-owned. This fraction is consistent with that reported in La Porta, Lopez-de-Silanes, and Shleifer (1999), although these authors focus mainly on mid-size firms. In addition, 5% of the outstanding shares of all public firms are controlled by families. The standard deviations for the family dummy and percentage are 0.31 and 0.15, respectively. We also note that the average age of public firms is approximately 25 years, with a standard deviation of 18 years. In terms of size, an average firm owns 1,064 million dollars in total assets and spends 4.8 and 38.5 million dollars in R&D and capital expenditures, respectively. In addition, an average firm has a market-to-book ratio of 2.56, a capital intensity ratio of 5.56, a leverage ratio of 0.22, and a profit margin ratio of 0.09.

Panel B compares the major characteristics of family firms to those of non-family firms and presents the p-values for these differences. Family firms are younger, smaller, and characterized by lower levels of institutional ownership and less R&D spending than non-family firms. Such a direct comparison of the innovation output between family firms and non-family firms, however, is less informative, because innovation might be contaminated by differences in these characteristics. In other words, to highlight the impact of family ownership on innovation, one needs to control for firm characteristics. Panel C achieves this goal by creating propensity score matched samples for family and non-family firms. Specifically, propensity scores are created every year based on probit regressions that include all the characteristics tabulated in Panel B and industry fixed effects, which allow us to select, for each family firm, a non-family firm that has similar characteristics to function as its control group. We verify that family firms and firms in the control group have indistinguishable characteristics; the results of the test are reported in Table A1 of the Internet Appendix. Panel C then reports the results for the innovation variables for both family firms and firms in the control group.

In general, family firms are associated with more patents filed relative to non-family firms with similar characteristics. The mean value of *Patent* is 0.258 for family firms, which is approximately 25.9% higher than the value for non-family firms.[14] This difference is statistically significant. Furthermore, family firms seem to produce better patents, in terms of *Citation*, *Originality*, and *Generality*, than firms in the control group. Specifically, being a family firm is associated with 29% more citations received, 29% higher originality scores, and 69% higher generality scores. These summary statistics provide initial support for the innovation-enhancing hypothesis, which we will examine in a multivariate framework in the next section.

4. Main Relationship

We now consider the link between family ownership and innovation. We first report the main results and then assess their robustness.

4.1. Baseline results

To empirically examine whether family ownership affects innovation, we estimate the following pooled regression:

$$Innov_{i,t+1} = \alpha_0 + \beta_1 Family_{i,t} + \gamma Controls_{i,t} + Industry_j + Year_t + \varepsilon_{i,t}, \quad (1)$$

where $Innov_{i,t+1}$ denotes the different innovation output measures of firm *i* in industry *j* in year *t+1* for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$. $Family_{i,t}$ is a family dummy variable, and $Controls_{i,t}$ denotes a list of control variables: $Firm\ age_{i,t}$, the age of firm *i* in year *t*; $M/B_{i,t}$, the market-to-book ratio of firm *i* in year *t*; $\%\ Inst\ Own_{i,t}$, the percentage of institutional shareholders of firm *i* in year *t*; $Own\ Concentration_{i,t}$, the concentration of institutional shareholders of firm *i* in year *t*; $Asset_{i,t}$, the logarithmic total assets of firm *i* in year *t*; $R\&D_{i,t}$, the logarithmic R&D expenditures reported by firm *i* in year *t*; $Capital\ intensity_{i,t}$, the asset-to-employee ratio of firm *i* in year *t*; $CAPEX_{i,t}$, the logarithmic capital expenditures reported by firm *i* in year *t*; $Leverage_{i,t}$, the total debt ratio of firm *i* in year *t*; and $Profit\ margin_{i,t}$, the profit margin of firm *i* in year *t*. $Industry_j$ denotes the industry fixed effects for firm *i* that in industry *j* as defined by the two-digit SIC codes, and $Year_t$ denotes the year fixed effects in year *t*.

The inclusion of industry and year fixed effects helps address the inherent heterogeneity in innovation across industries (such as high-tech industries relative to other industries) or years (such as general

[14] The value of *Patent* is 0.205 for non-family firms, suggesting that being a family firm increases, on average, the magnitude of the variable *Patent* by (0.258-0.205)/0.205=25.9%. Note that the whole sample mean for *Patent* is 0.61, as discussed above, suggesting that the distribution of patents is highly skewed among firms. However, the skewness is much smaller among family firms and firms in the control group. Because of this observation, later sections present robustness checks for our main regression analyses based on the propensity score matched samples.

technology revolutions and waves relative to other periods).[15] We cluster the standard errors in two dimensions by industry and year. We obtain consistent results if we use standard errors that are two-way clustered by firm and year (we will discuss these results shortly).

Table 2 reports the results for Equation (1), which provides strong support for the positive effect of family ownership on innovation. In Panel A, we find that the coefficient estimates of the family dummies are 7.0%, 8.8%, 6.5%, and 5.7% for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$, respectively; they are all statistically significant. We can estimate the economic impact of family ownership on innovation as $\beta_1/\overline{Innov_{i,t+1}}$, where β_1 is the regression coefficient on the family dummy and $\overline{Innov_{i,t+1}}$ refers to the average value of the dependent variable in the sample. This magnitude measures the degree to which innovation differs between a family firm (when the dummy variable takes the value of one) and a non-family firm (when the dummy variable takes the value of zero) relative to its average. Family firms are associated with 11.5% more patents filed, 12.1% more citations of filed patents, 14.1% greater originality, and 30% greater generality than non-family firms. Although the economic magnitudes are highly significant, they may underestimate the impact of family ownership when family ownership has a skewed distribution. We will revisit the economic magnitude shortly based on the propensity score matched samples reported in Table 1.

In Panel B, we use the family ownership percentage rather than the family dummy as a robustness check and obtain consistent results for the positive relation between family ownership and innovation. The coefficient estimates of the family ownership percentage are all positive and statistically significant at the 1% or 5% level for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$. These results not only confirm the positive relation between family ownership and innovation output but also suggest that our findings in Panel A are not driven by the selected threshold for family-owned firms. In other words, the positive relationship between family ownership and innovation is a general pattern, not a specific outcome of the 20% threshold for family ownership that we used to define family dummy.

Among the control variables, we find that innovation increases with firm age, market-to-book ratio, and total assets, which suggests that mature firms, growth firms, and large firms produce more patents. When we control for total assets in the regressions, the coefficients for firm age and market-to-book ratio remain significant and positive. The positive effect of firm age may be attributed to learning that favors experienced firms, whereas the positive effect of market-to-book ratio confirms that the value of growth options increases with the prospect of a firm's patent portfolio strength. The relationship between

[15] We recognize the potential time-varying industry effect. For example, some industries may experience rapid, revolutionary technology changes in some years or may be subject to greater competition pressure that also affects innovation output (Bloom and Van Reenen, 2007). In the robustness check section, we estimate Equation (1) with industry-year joint fixed effects (i.e., $Industry - Year_{j,t}$) and obtain consistent results.

institutional ownership and innovation output is insignificant, whereas ownership concentration is positively and significantly associated with innovation output. The latter finding is consistent with previous studies reporting that concentrated ownership is associated with higher R&D (Baysinger, Kosnik, and Turk, 1991; Lee, and O'Neill, 2003) and higher patent output (Francis and Smith, 1995). Later section will also illustrate that the impact of institutional ownership becomes significant once ownership concentration is removed. The positive relation between R&D and innovation output is intuitive because intangible investments are expected to generate intellectual property. The positive relation between CAPEX and innovation output suggests that complementarity exists between tangible and intangible investments. Capital intensity is not significantly correlated with innovation output, although the coefficient is positive. Unsurprisingly, higher leverage leads to lower innovation output, which is consistent with previous research. Finally, profit margin is negatively associated with innovation output, but its coefficient is insignificant.

4.2. Robustness checks and discussions

Although Table 2 shows that a strong, positive association exists between innovation output and family ownership, we consider additional robustness checks. We provide detailed tables in the Internet Appendix and discuss only the main findings.

We first conduct two robustness checks to demonstrate that our results are not affected by the skewed distribution of family firms in the economy or the definition of family ownership. To address potential econometrics issues that could arise because family firms are outnumbered by non-family firms in the U.S., Table A1 of the Internet Appendix provides propensity score matched samples between family and non-family firms. Propensity score matching allows us to compare family firms with non-family firms of similar characteristics in a more balanced sample. We find that the main impact of family ownership on innovation remains in this balanced sample.[16] The economic magnitude is consistent with Panel C of Table 1 and higher than our estimations based on the whole-sample regressions reported in Table 2. In Panel A, for instance, we find that the coefficient estimates of family dummies are 4.9%, 7.4%, 4.2%, and 3.3% for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$, respectively; they are all statistically significant. The average values for patents, citations, originality, and generality are 0.200, 0.267, 0.142, and 0.053, respectively, in the matched sample. Hence, family firms are associated with 24.0% more patents filed, 27.7% more citations of filed patents, 29.5% greater originality, and 61.7% greater generality than non-family firms with similar characteristics. The economic magnitudes suggest that

[16] This comparison also addresses the potential selection bias that only superior family firms are listed. Because family and non-family firms in this test have similar characteristics, one group is unlikely to be more susceptible to this selection bias than the other group.

family ownership may play a crucial role in promoting innovation in an economy with advanced institutions.

In Table A2 of the Internet Appendix, we check the robustness of our results by redefining the family dummy based on 30% and 40% ownership thresholds. These alternative definitions do not change the positive relationship between family ownership and innovation. In addition, (unreported) tests excluding individual owners from our definition of family ownership also yield consistent results. In short, our main results are robust to the definition of family ownership.

The second set of robustness checks explores the impact of the distribution of our dependent variable—innovation. One potential concern regarding the innovation variables is that they are right-skewed with many zeroes. In all our regressions, we use logarithmic transformations of raw innovation measures to alleviate this impact. Alternatively, we can focus on firm-year observations with non-zero innovation measures. Table A3 of the Internet Appendix presents the results of this test, which are consistent with the main results.

We also recognize that a two- to three-year lag between the patent application date and the final approval date may exist. To alleviate concerns that our results may be driven by patents applied but not granted by the end of 2010, we restrict our sample to the 2000-2007 period and, again, we obtain consistent results (reported in Table A4 of the Internet Appendix). Related to this time issue, in our main specification (Table 2), we relate family ownership in year t to innovation output in year $t+1$. This time convention is commonly used in the literature, because prior empirical studies have posited that it takes less than one year for increases in R&D input to generate increases in patent applications (Hausman, Hall, and Griliches, 1984; Hall, Griliches, and Hausman, 1986; Lerner and Wulf, 2007). Nevertheless, Table A5 of the Internet Appendix considers innovation output over two- and three-year horizons. This specification also better controls for reverse causality because future innovation output is unlikely to affect current family ownership once the current R&D level has been controlled for. We obtain consistent results from this test.

We then conduct a third set of robustness checks related to our control variables. Recall that Table 2 reports a positive yet insignificant impact of institutional ownership on innovation. The lack of significance, however, may simply arise because high institutional ownership implies high ownership concentration. Once we remove the latter variable from the regression, as reported in Table A6 of the Internet Appendix, institutional ownership has a positive and significant impact on innovation. In later analyses (Section 6.3), we will further confirm the positive effect of institutional ownership on innovation by demonstrating that innovation significantly increases as the number of institutional investors with a long investment horizon increases and that the governing role of institutional investors is replaced by family ownership to a certain extent.

Another potential issue related to the control variables is that, following prior corporate finance studies, we do not include current innovation output ($Innov_{i,t}$). This omission is unlikely to affect our inferences because R&D is included in Equation (1). Nonetheless, we include current innovation output in the regressions in a robustness check and we obtain consistent results (reported in Table A7 of the Internet Appendix).

Among the control variables, size might play an important role that may not be fully captured by a linear control. To address its potential nonlinear impact, we also consider size-adjusted innovation performance by scaling the innovation measures with total assets. Table A8 of the Internet Appendix presents the results of this test, which are consistent with the main results. Thus, our main finding is not affected by the size of the sample firms. Finally, to verify that our results are not driven by different asset sales and acquisition behaviors between family and non-family firms, we exclude firm-year observations during which firms engage in asset sales or M&A activities (as acquirers) during a period ranging from t-1 to t+1. Tables A9 and A10 show that our main results remain robust to these specifications.

The last set of robustness checks concern our econometric specifications. Before we discuss them, we should note that we follow the literature on the real effects of family ownership (e.g., Anderson, Duru, and Reeb, 2009, 2012) and do not include firm fixed effects in our main specifications for the following reasons. First, given our wide and short panel of 3,260 firms over 11 years (2000-2010), we are interested in the cross-sectional relation between innovation and family ownership across firms. Second, as suggested by Zhou (2001), estimates of the real effects of firm-level ownership structure should not include firm fixed effects because ownership structure varies substantially across firms but changes slowly over time, and firm innovation may be highly correlated with this individual effect, leading any effect of family ownership to be absorbed by firm fixed effects (Hall, Jaffe, and Trajtenberg, 2005a; Hall, Thoma, and Torrisi, 2007; Noel and Schankerman, 2013). Third, given the large cross-section in our sample (over 1,000), each firm can reasonably be assumed to be a random draw from the same population (e.g., Petersen, 2009).[17]

To alleviate the concern that unobservable industry-year factors may drive our results, we include industry-year joint fixed effects in the regression. These joint fixed effects incorporate factors that vary across time and industry, and our results remain robust to such specifications (reported in Table A11 of the Internet Appendix). Finally, we follow Petersen (2009) and double-cluster standard errors by firm and

[17] More detailed reasons are provided in Zhou (2001), Hall, Jaffe, and Trajtenberg (2005a), Hall, Thoma, and Torrisi (2007), and Noel and Schankerman (2013).

year. Our results remain robust to this specification (shown in Table A12). Overall, the results of the tests reported in this section suggest that the main relationship between family ownership and innovation is highly robust to alternative specifications.

5. Endogeneity Issues

One major concern is endogeneity—e.g., reverse causality, omitted variables, or unobservable factors. For example, the positive relation between family ownership and subsequent innovation may be due to technology waves that correlate with the time trend of family ownership. This explanation is, however, unconvincing because we include year fixed effects in the regression.

A second potential alternative explanation is that some industries experience strong technological growth in our sample period, and the majority of the firms in these industries are family owned. Nevertheless, this explanation does not hold, as we have controlled for industry fixed effects in Equation (1) and industry-year joint fixed effects (shown in Table A11 of the Internet Appendix). In fact because industry-year joint fixed effects absorb any time-varying industry-specific factor, these test results are not vulnerable to omitted variables at the industry level.

A third concern is reverse causality: expected strong innovation growth may strengthen family ownership. Specifically, family shareholders may be reluctant to liquidate stocks if they expect strong subsequent innovation growth in the family-owned firm. This argument implies that family ownership is an increasing function of current innovation output and/or R&D input because both of these factors affect future innovation. To mitigate this reverse causality concern, we include R&D input and current innovation in Equation (1) and obtain consistent results (reported in Table A7 of the Internet Appendix).

Of course, there could be firm-specific characteristics that are spuriously related to family ownership and that cannot be captured by industry and time fixed effects. In the following subsections, we directly address this issue by using two approaches: an instrumental variable specification and an exogenous shock based on a regulatory change (a reduction in the federal-level estate tax rate).

5.1. Instrumental variable regressions with the state-level divorce rate

We use the state-level divorce rate from the 2000 U.S. Census as an instrumental variable because divorce rates are likely to affect family ownership (relevance condition) and to be unrelated to future innovation output (exclusive condition). Previous research provides strong evidence of the impact of divorce on the output of family businesses. For instance, family disruptions, such as divorce, negatively affect the sustainability of a family business (e.g., Stafford et al. 1999; Danes and Amarapurkar, 2001; Galbraith, 2003; Olson et al., 2003; Rutherford et al., 2006). Furthermore, the average divorce rate at the state level cannot be affected by firm actions. Rather, divorce rate is more likely affected by state-level factors, such as religion and culture (e.g., Sweezy and Tiefenthaler, 1996). Finally, we do not expect the state-level divorce rate to influence firm-level innovation directly through channels that are unrelated to family ownership (exclusion restriction). Indeed, when we regress the four innovation variables on the state-level divorce rate (reported in Table A13 of the Internet Appendix in the interest of space), we find that the instrument has insignificant explanatory power on the dependent variables. This lack of significance confirms that the instrument meets the exclusion restrictions. Hence, the state-level divorce rate serves as an ideal identifying instrument.

We use the state-level divorce rate in 2000 (the first year of our sample year) as our instrument because it is less affected by the economic or social changes that occurred during the sample period (2000-2010).[18] In the first stage of the instrumental variable approach, we estimate the following regression for family ownership:

$$Family_{i,t} = \alpha_0 + \gamma_1 Divorce_k + \gamma Controls_{i,t} + Industry_j \; + \; Year_t \; + \varepsilon_{i,t}, \qquad (2)$$

where $Divorce_k$ denotes the state-level divorce rate for firm i located in state k in year t. $Family_{i,t}$ denotes the family ownership dummy (percentage) in Panel A (B). We then use Equation (2) to instrument $Family_{i,t}$ and derive the predicted value of $Family^*_{i,t}$.[19] As reported in Column (1) of Panels A and B of Table 3, the state-level divorce rate negatively affects family ownership and thus meets the relevance condition. In terms of economic significance, a one-standard deviation increase in the average state-level divorce rate is related to a 3.5% reduction in the presence of family firms.

We then replace the family ownership dummies or percentage in Equation (1) with their predicted values from Equation (2) and re-estimate the innovation-family ownership regression. As indicated in Table 3, family ownership retains its significant, positive coefficients in forecasting all the innovation measures. In Panel A, we find that the coefficient estimates of the predicted family ownership dummies are 1.25, 1.82, 1.06, and 0.72 for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$, respectively; they are all statistically significant at the 1% level. Panel B shows that the coefficient estimates of the predicted family ownership percentages are 32.5%, 51.1%, 36.6%, and 46.8% for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$, respectively; they are all statistically significant at the 5% level. With a one-standard deviation increase in the predicted family ownership percentage (10%), a firm's innovation

[18] We obtain these data from the Center for Disease Control and Prevention (CDC). The average state-level divorce rate is 0.44% per couple with considerable cross-state variation, ranging as high as 0.96% and 0.86% in Nevada and Vermont, respectively, and as low as 0.20% and 0.24% in Connecticut and Montana, respectively.

[19] We include all the control variables that are used in Equation (1) for appropriate statistical inferences except R&D. We intentionally exclude R&D from the first-stage regression to ensure that $Family^*_{i,t}$ does not contain any information related to R&D that is directly correlated with future innovation output.

output increases (approximately) by 3.25% in quantity, by 5.11% in quality, 3.66% in creativity, and 4.68% in versatility. Overall, Table 3 indicates that the positive relation between family ownership and subsequent innovation output is not affected by unobservable factors, supporting a *causal* interpretation of the relation.

5.2. Drop in the federal estate tax rate

We then consider a second identification strategy based on an event: a law-induced substantial drop in the federal estate tax rate in 2002. Inheritance taxes are commonly accepted to negatively affect the growth of family firms.[20] The federal estate tax was first enacted in 1916, and the heirs of any property are subject to this tax. In 2001, the Bush administration enacted EGTRRA (or the Bush Tax Cut), which made sweeping changes to the federal estate tax.[21] The maximum estate tax rate was 55% in 2001, and EGTRRA was set to reduce the tax rate to 50% in 2002 with an additional reduction of 1% each year until 2007 to produce a maximum estate tax rate of 45%. In addition, the tax exemption amount increased from $675,000 in 2001 to $1,000,000 in 2002, $1,500,000 in 2004, and $2,000,000 in 2006. Such a policy change not only favors the maintenance and development of family firms but also encourages their shareholders to invest in promising innovation projects because they will capture more of their value and will be less subject to liquidity constraints. We can therefore use a difference-in-difference approach to examine the effect of family ownership on innovation output as follows:

$$Innov_{i,t+1} = \alpha_0 + \beta_0 Family_{i,t} \times After2001_t + \gamma Controls_{i,t} + Industry_j + Year_t + \varepsilon_{i,t}, \quad (3)$$

where $After2001_t$ denotes a dummy that equals one if year *t* is 2002 or 2003 and zero if year *t* is 2000 or 2001. $Family_{i,t}$ denotes the family ownership dummy (percentage) in Panel A (Panel B). We restrict the sample for these regressions to a four-year window that consists of two years pre- and post-event: 2000, 2001, 2002, and 2003 (i.e., *t* = 2000 to 2003). All other variables are the same as those in Equation (1).

[20] Brunetti (2006) finds that the sales of family business are significantly associated with the estate tax owed by using a micro-level dataset of San Francisco County probate court records from 1979 to 1982. Ellul, Pagano, and Panunzi (2010) demonstrate that inheritance taxes significantly reduce family firm investment in a large panel of firms in 38 countries during the 1990-2006 period.

[21] There is little cross-state variation in estate taxes because the federal estate tax rate is higher than and provides full credit toward state estate taxes (Francis, 2012). The state estate tax credit, which effectively shared part of the estate tax payable to the federal government, was phased out between 2002 and 2005 by EGTRRA. The 2001 tax act introduced by EGTRRA itself would have repealed the estate tax for one year (2010) and then readjusted it in 2011 to the 2002 exemption level with a 2001 maximum rate. That is, had no further legislation been passed, the estate of a person who died in 2010 would have been entirely exempt from tax, while that of a person who died in 2011 or later would have been taxed as heavily as it would have been in 2001. However, on December 17, 2010, Congress passed the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010. Section 301 of the 2010 Act reinstated the federal estate tax, and the new law set the exemption for U.S. citizens and residents at $5 million per person and the maximum tax rate at 35 percent for 2011 and 2012. On January 1, 2013, the American Taxpayer Relief Act of 2012 permanently established an exemption of $5 million (with 2011 as the basis for inflation adjustment) per person for U.S. citizens and residents and a maximum tax rate of 40% after 2013.

In Equation (3), our variable of interest is β_0, associated with $Family_{i,t} \times After2001_t$. If $\beta_0 > 0$, the relation between family ownership and subsequent innovation exists, with causality implications. Because we expect stronger family ownership since 2002, its effect on innovation, if any, is expected to be more pronounced because the strengthened family-relatedness due to the estate tax cut is expected to encourage innovation for the reasons suggested in Section 2. However, if the family-innovation relation is spurious, we should not observe statistical significance for β_0. Moreover, if an unobservable factor is driving both family ownership and innovation, then we should not observe a significantly positive β_0 unless this factor also strengthens in 2002.

As displayed in Table 4, the coefficients on $Family_{i,t} \times After2001_t$ are positive and highly statistically significant. Panel A shows that the coefficient estimates of $Family_{i,t} \times After2001_t$ are 10.5%, 22.6%, 7.4%, and 12.7% for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$, respectively. These estimates suggest that family firm innovation output has substantially increased (commensurate to the corresponding coefficients) since 2002. Panel B shows that the coefficient estimates of $Family_{i,t} \times After2001_t$ are 22.0%, 52.7%, 14.0%, and 27.3% for $Patent_{i,t+1}$, $Citation_{i,t+1}$, $Originality_{i,t+1}$, and $Generality_{i,t+1}$, respectively. Although the coefficients of $Family_{i,t}$ are not statistically significant, they are positive with the magnitude consistent with their counterparts in Table 2.

These results suggest that given the same level of family ownership, firm innovation output has increased since 2002. This finding also supports a causal interpretation of the relation. Indeed, if the family-innovation relation is driven by unobservable factors and is not a causal relation, then we should not observe a pronounced relation since 2002.

6. Economic Channels

We now investigate the three channels (long-term commitment, financing, and corporate governance) through which family ownership positively stimulates innovation.

6.1. Long-term commitment

As argued in Section 2, family firms may be more innovative if their family-related shareholders are less myopic and more focused on long-term value. This hypothesis contradicts the alternative that family firms are overly conservative, which makes them more myopic. This effect should be particularly pronounced when other investors in the firm are more short-term oriented. We start by defining a proxy for the long-term investment horizon of the institutional investors. Following Gaspar, Massa, and Matos

(2005), we base this proxy on the turnover of institutional investors' portfolio.[22] The higher the turnover is, the shorter the horizon will be. We estimate the following specification:

$$Innov_{i,t+1} = \alpha_0 + \beta_l Family_{i,t} \times InstOwner_{i,t} \times LowTurnover_{i,t} + \beta_m Family_{i,t} \times InstOwner_{i,t} \times MidTurnover_{i,t} + \beta_h Family_{i,t} \times InstOwner_{i,t} \times HighTurnover_{i,t} + \rho_l InstOwner_{i,t} \times LowTurnover_{i,t} + \rho_m InstOwner_{i,t} \times MidTurnover_{i,t} + \rho_h InstOwner_{i,t} \times HighTurnover_{i,t} + \gamma Controls_{i,t} + Industry_j + Year_t + \varepsilon_{i,t}, \quad (4)$$

where $InstOwner_{i,t}$ denotes the percentage of outstanding equity owned by institutional investors of firm *i* in year *t*, $LowTurnover_{i,t}$ denotes a dummy that equals one if firm *i*'s turnover of institutional ownership in year *t* is in the bottom quartile (i.e., lowest turnover or longest horizon) and zero otherwise, $MidTurnover_{i,t}$ denotes a dummy that equals one if firm *i*'s turnover of institutional ownership in year *t* is in the middle two quartiles and zero otherwise, and $HighTurnover_{i,t}$ denotes a dummy that equals one if firm *i*'s turnover of institutional ownership in year *t* is in the top quartile (i.e., highest turnover or shortest horizon) and zero otherwise. $Family_{i,t}$ denotes the family ownership dummy (percentage) in Panel A (B). $Controls_{i,t}$ denotes all other control variables that are used in Equation (1).

We interact the institutional ownership percentage with low, middle, and high turnover dummies: $InstOwner_{i,t} \times Turnover_{i,t}$, $InstOwner_{i,t} \times MidTurnover_{i,t}$, and $InstOwner_{i,t} \times HighTurnover_{i,t}$. We are interested in the coefficient estimates for β_l, β_m, β_h, ρ_l, ρ_m, and ρ_h. We first expect that $\rho_l > \rho_m > \rho_h$, $\rho_l > 0$, and $\rho_h < 0$ because investor turnover decreases with the investor horizon, long-term investors promote innovation, and short-term investors discourages innovation by pursuing myopic goals and sacrificing long-term advantage. In addition, we expect that $\beta_l > 0$, $\beta_m > 0$, and $\beta_h > 0$ if family ownership helps stabilize the ownership structure and stimulates innovation.[23] We expect the opposite results in the case of excessive conservatism.

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[22] Investor-level portfolio information is obtained from the Factset database. We calculate a measure of how frequently each institutional investor rotates positions on all stocks included in the portfolio (churn rate). If we denote the set of companies held by investor *i* by *Q*, the churn rate of investor *i* at quarter *t* is

$$CR_{i,t} = \frac{\sum_{j \in Q} |N_{j,i,t}P_{j,t} - N_{j,i,t-1}P_{j,t-1} - N_{j,i,t-1}\Delta P_{j,t}|}{\sum_{j \in Q} \frac{N_{j,i,t}P_{j,t} - N_{j,i,t-1}P_{j,t-1}}{2}},$$

where $P_{j,t}$ and $N_{j,i,t}$ represent the price and the number of shares, respectively, of company *j* held by institutional investor *i* at quarter *t*. *S* is the set of shareholders in company *k*, and $w_{k,i,t}$ is the weight of investor *i* of the total percentage held by institutional investors during quarter *t*. The investor turnover of firm *k* is the weighted average of the total portfolio churn rates of its investors over four quarters:

$$Investor\ turnover = \sum_{i \in S} w_{k,i,t} \left(\frac{1}{4} \sum_{r=1}^{4} CR_{i,t-r+1} \right).$$

[23] We do not hypothesize monotonic relations among β_l, β_m, and β_h because we do not have any basis for determining the optimal combination of family and institutional ownership.

In Panel A of Table 5, we first note that the coefficients of $InstOwner_{i,t} \times LowTurnover_{i,t}$ are all significantly positive and that the coefficients of $InstOwner_{i,t} \times HighTurnover_{i,t}$ are all significantly negative. This finding is consistent with our proposition that the investor horizon matters in spurring innovation and provides support for the results obtained by Aghion, Van Reenen, and Zingales (2013). That is, the positive impact of institutional investors on innovation arises from institutional investors with long investment horizons.

The coefficients of all interacted terms between the family firm dummy and institutional investors (i.e., $Family_{i,t} \times InstOwner_{i,t} \times LowTurnover_{i,t}$, $Family_{i,t} \times InstOwner_{i,t} \times MidTurnover_{i,t}$, and $Family_{i,t} \times InstOwner_{i,t} \times HighTurnover_{i,t}$) are positive, supporting the general positive effect of family ownership on innovation. Of the three, the impact of $Family_{i,t} \times InstOwner_{i,t} \times LowTurnover_{i,t}$ is most highly significantly across all the specifications, suggesting that family ownership and long-term institutional ownership are particularly complementary in promoting innovation. In contrast, short-term institutional ownership ($InstOwner_{i,t} \times HighTurnover_{i,t}$) reduces innovation, but family ownership seems to offset this effect. Although this offsetting effect is not statistically significant, the coefficients of $Family_{i,t} \times InstOwner_{i,t} \times HighTurnover_{i,t}$ are positive, ranging from 0.327 to 0.611. Panel B provides consistent results when we replace the family ownership dummy with the family ownership percentage. Overall, Table 5 supports the view that family ownership plays a role similar to that of long-term institutional ownership—as opposed to short-term institutional ownership—in promoting innovation. This result is consistent with the view that family ownership is associated with a long-term vision.

To further illustrate this point, we consider another proxy for short-termism based on relative overvaluation measures developed by Rhodes-Kropf, Robinson, and Viswanathan (2005). This proxy is based on the premise that when a stock is overvalued, a higher percentage of shareholders are momentum-based investors who tend to impose short-term pressure on firm managers and encourage myopic action (Bushee, 1998). We therefore interact family ownership with the degree of overvaluation of the stock. We estimate the following specification:

$$Innov_{i,t+1} = \alpha_0 + \beta_h Family_{i,t} \times High\ Rel\ Val_{i,t} + \beta_m Family_{i,t} \times Mid\ Rel\ Val_{i,t} + \beta_l Family_{i,t} \times Low\ Rel\ Val_{i,t} + \rho_h High\ Rel\ Val_{i,t} + \rho_m Mid\ Rel\ Val_{i,t} + \gamma Controls_{i,t} + Industry_j + Year_t + \varepsilon_{i,t}, \tag{5}$$

where $High\ Rel\ Val_{i,t}$ denotes a dummy that equals one if firm *i*'s relative overvaluation gap is in the highest quartile in year *t* (i.e., most overvalued) and zero otherwise, $Mid\ Rel\ Val_{i,t}$ denotes a dummy that equals one if firm *i*'s relative overvaluation gap is in the middle two quartiles and zero otherwise, and

$Low\ Rel\ Val_{i,t}$ denotes a dummy that equals one if firm i's relative overvaluation gap is in the lowest quartile in year t (i.e., least overvalued) and zero otherwise. A detailed definition of the relative overvaluation gap is provided in the Appendix. $Family_{i,t}$ denotes the family ownership dummy (percentage) in Panel A (B). $Controls_{i,t}$ denotes all other control variables that are used in Equation (1).

We first expect that $\rho_m > \rho_h$ and $\rho_h < 0$ because the short-term pressure from momentum-based investors discourages innovation to promote long-term value. In addition, we expect that $\beta_h > \beta_m > \beta_l > 0$ if family ownership encourages innovation by protecting managers against the myopic preferences of shareholders with short investment horizons. In contrast, we expect the opposite results in the case of excessive conservatism.

We report the results for Equation (5) in Table 6. Panel A indicates that although overvaluation negatively affects innovation (as the coefficients of $High\ Rel\ Val_{i,t}$ range from -0.184 to -0.088 and are significantly negative), family ownership entirely offsets this adverse effect (as the coefficients of $Family_{i,t} \times High\ Rel\ Val_{i,t}$ range from 0.105 to 0.231 and are significantly positive). Therefore, family ownership promotes innovation by guarding against short-term pressure from irrational investors. In particular, overvaluation among non-family firms could reduce the number of patents filed by an average of 21.1%, the number of patent citations by 25.2%, the originality of patents by 25.3%, and the generality of patents by 46.3%. By completely offsetting the negative impacts of momentum-based and myopic investors, family ownership significantly promotes innovation. Similar results are confirmed in Panel B when the family dummy is replaced by the family ownership percentage.

Overall, Tables 5 and 6 support the argument that family ownership protects firms from myopic behavior and encourages them to pursue technological advantages. Moreover, these findings strengthen the causal interpretation of the family-innovation relation. If the positive relation between family ownership and innovation output were driven by an unobservable factor, then such a factor should also correlate with both investment horizons and overvaluation. Identifying a potential factor that satisfies all these criteria would be difficult. The only reasonable interpretation of the results presented in Tables 5 and 6 is that family ownership promotes innovation and that this relation is more pronounced when firms are under short-term pressure from other shareholders.

6.2. Relaxing financial constraints

As we have argued in Section 2, family firms may be more innovative because lenders trust family firms. In contrast, to retain control, family firms may be less innovative because they are less willing to resort to capital markets and are therefore more financially constrained. This effect should be particularly pronounced for more financially constrained firms. Therefore, to test these conflicting hypotheses empirically, we estimate the following specification:

$$Innov_{i,t+1} = \alpha_0 + \beta_h Family_{i,t} \times HighFC_{i,t} + \beta_m Family_{i,t} \times MidFC_{i,t} + \beta_l Family_{i,t} \times LowFC_{i,t} + \rho_h HighFC_{i,t} + \rho_m MidFC_{i,t} + \gamma Controls_{i,t} + Industry_j + Year_t + \varepsilon_{i,t}, \quad (6)$$

where $HighFC_{i,t}$ denotes a dummy that equals one if firm *i*'s financial constraint proxies in year *t* are in the top quartile (i.e., most financially constrained) and zero otherwise, $MidFC_{i,t}$ denotes a dummy that equals one if firm *i*'s financial constraint proxies in year *t* are in the middle two quartiles and zero otherwise, and $LowFC_{i,t}$ denotes a dummy that equals one if firm *i*'s financial constraint proxies in year *t* are in the bottom quartile (i.e., least financially constrained) and zero otherwise. $Family_{i,t}$ denotes the family ownership dummy (percentage) on the left (right) side of the table. $Controls_{i,t}$ is a vector stacking all the other control variables as defined in Equation (1).

We consider three proxies of financial constraints: the WW index developed by Whited and Wu (2005), the KZ index developed by Kaplan and Zingales (1997), and the SA index developed by Hadlock and Pierce (2010). The details of these indexes are provided in Appendix 1. More financially constrained firms have higher WW, KZ, and SA index values.

Equation (6) allows us to investigate how family ownership affects innovation output under different financial constraints. We are interested in the coefficient estimates for β_h, β_m, β_l, ρ_h, and ρ_m. We expect that $\rho_h < 0$ because financial constraints harm overall output by reducing resource support and increasing uncertainty (e.g., Cohen, Levin, and Mowery, 1987; Aghion et al., 2010; Ciftci and Cready, 2011; Brown, Martinsson, and Petersen, 2012). In addition, we expect that $\beta_h > 0$ if more financially constrained firms benefit from family affiliation to a greater extent than other firms and the opposite otherwise.

We report the results in Table 7, with the WW index in Panel A, the KZ index in Panel B, and the SA index in Panel C. The coefficients of $HighFC_{i,t}$ are significantly negative in most columns, and the coefficients of $MidFC_{i,t}$ are negative in all panels. The negative relation between the financial constraint proxies is consistent with previous research.

In Panel A (based on the WW index), the coefficients on $Family_{i,t} \times HighFC_{i,t}$ are positive and statistically significant. In addition, the coefficients on $Family_{i,t} \times MidFC_{i,t}$ are all positive, and the coefficients on $Family_{i,t} \times LowFC_{i,t}$ are all insignificant. Similar results are obtained in Panels B and C based on the KZ and SA indexes, respectively. These results strongly support the argument that family ownership reduces the negative effect of financial constraints on innovation.

These findings also strengthen the causal interpretation of the family-innovation relation. If family ownership and innovation output were driven by unobservable factors, then the reported pattern could only be explained by unobservable factors that also correlate with financial constraints. However, we cannot identify any potential factor that satisfies all these criteria. Thus, a reasonable interpretation of the results presented in Table 7 is that family ownership promotes innovation and that this relation is more pronounced when firms are financially constrained.

6.3. Improving governance

Finally, as we argued in Section 2, family firms may be more innovative because of better alignment between ownership and management. The alternative hypothesis is that family firms, being plagued by more agency costs and conflicts of interests among different classes of shareholders, are less innovative. This effect should be particularly pronounced for firms with lower quality governance. To test these hypotheses, we estimate the following specification:

$$Innov_{i,t+1} = \alpha_0 + \beta_h Family_{i,t} \times HighGovernance_{i,t} + \beta_l Family_{i,t} \times LowGovernance_{i,t} + \beta_1 HighGovernance_{i,t} + \gamma Controls_{i,t} + Industry_j + Year_t + \varepsilon_{i,t}, \quad (7)$$

where $HighGovernance_{i,t}$ ($LowGovernance_{i,t}$) equals one if the governance proxies of firm *i* in year *t* are above (below) the median. We consider two governance proxies: the percentage of institutional investors, based on the premise that institutional investors are more active and professional in governing firms, and the entrenchment index (E index) developed by Bebchuk, Cohen, and Ferrell (2009), as this index best captures the negative impact of managerial entrenchment on shareholder value. In Panel A of Table 8, $HighGovernance_{i,t}$ and $LowGovernance_{i,t}$ are defined as $High\ Inst\ Own_{i,t}$ and $Low\ Inst\ Own_{i,t}$, respectively, based on the percentage of institutional ownership. In Panel B of Table 8, $HighGovernance_{i,t}$ and $LowGovernance_{i,t}$ are defined as $Low\ E\ index_{i,t}$ and $High\ E\ index_{i,t}$, respectively, based on the E index. $Family_{i,t}$ denotes the family ownership dummy (percentage) on the left (right) side of the table. $Controls_{i,t}$ denotes all other control variables that are used in Equation (1).

Panel A of Table 8 examines how family ownership influences innovation output through the governance channel based on the assumption that the appearance of institutional investors indicates better governance and encourages innovation, as indicate by Aghion, Van Reenen, and Zingales (2013). We argue that family ownership and institutional ownership are internal and external mechanisms, respectively, and that they are substitutes for each other. We include two interaction terms, $Family_{i,t} \times HighGovernance_{i,t}$ and $Family_{i,t} \times LowGovernance_{i,t}$, in the regression to examine how family ownership affects innovation to different degrees conditional on the existence of external governance mechanisms. We are mainly interested in the coefficient estimates for β_h and β_l, and we expect that $\beta_l > 0$ based on the substitutability argument that family ownership promotes innovation more given the absence of external governance mechanism.

Panel A shows that the coefficients of $Family_{i,t} \times Low\ Inst\ Own_{i,t}$ are significantly positive in all the specifications. By contrast, the coefficients of $Family_{i,t} \times High\ Inst\ Own_{i,t}$ are insignificant in all the specifications. These estimates suggest that in the absence or weak presence of institutional investors, family-owned firms produce stronger patent portfolios than non-family-owned firms. Panel B presents similar results, as the coefficients of $Family_{i,t} \times High\ E\ index_{i,t}$ are positive and statistically significant in all the specifications except the regressions of patents and citations on the family dummies.

Overall, the results presented in Table 8 suggest that family ownership replaces other governance mechanisms in spurring innovation by lowering agency costs and strengthening monitoring, which supports a causal interpretation of the family-innovation relation.

7. A Link to the Existing Body of Literature

One influential conclusion of existing research is that the importance of family ties—such as the popularity of family firms in an economy—may arise due to a lack of social capital and institutions (e.g., Banfield, 1958; Putnam et al., 1993; Fukuyama, 1995; Mueller and Philippon, 2011), which hinders innovation (Coleman, 1988; Hall and Jones, 1999). Morck, Strangeland, and Yeung (2000), Villalonga and Amit (2006), and Anderson, Duru, and Reeb (2012) find that family firms spend less on R&D, although Miller and Le Breton-Miller (2005) suggest that family firms tend to invest more in long-run R&D.

To reconcile our results with those of previous research, we first verify that family firms are indeed associated with less R&D. In Table 9, the first model regresses R&D on the family ownership dummy and illustrates that family ownership is significantly associated with lower R&D. Model (1) in Panel B shows that the fraction of family ownership is also generally associated with lower R&D; however, this relationship is not statistically significant. Overall, we confirm the findings of previous studies that family firms have lower R&D spending.

Concluding that modern family firms face lower innovation incentives from this negative relationship would be, however, premature. To illustrate the impact of family firms on innovation, we scale our main patent variables by lagged R&D—i.e., we measure the realized efficiency of R&D outputs (e.g., Lanjouw and Schankerman, 2004; Cohen, Diether, and Malloy, 2013; Hirshleifer, Hsu, and Li, 2013)—and report the role of family firms in these scaled variables in the next four columns in each panel. The results are reversed. The family firm dummy, for instance, is associated with 24% more patents filed per dollar invested in R&D, 25% more citations of filed patents per dollar invested in R&D, 25% greater originality and 28% greater generality, respectively, when scaled by R&D investment. Family firms, at least in the U.S. and during our sample period, achieve significant advantages in these efficiency variables.

Because the EGTRRA test also implies that family firms in the U.S. generate more patents when estate taxes create incentives to innovate, we also explore whether family firms also became more efficient innovators during the same period. The results in Table 10 confirm an increase in innovation among family firms based on the same difference-in-difference test presented in Table 4 with R&D and R&D scaled patent outputs as the dependent variables. Specifically, we observe that R&D spending does not change drastically over time but that the outputs—in terms of the number of patents filed, number of citations, degree of originality, and degree of generality—are all improved. These observations suggest that family ownership more efficiently spurs innovation when the institutions allow family firms to retain more of the benefits of innovation.

Table A14 in the Internet Appendix highlights the role of institutions. Panel A reveals that the impact of cross-county trust on firm-level innovation remains positive—although its statistical power decreases, typically no longer significant at the 10% level. The capitalist institutions of the modern U.S. economy appear to partially suppress the negative impact of distrust on innovation. In this case, although low levels of trust induce the formation of more family firms, as indicated by Model (1) in Panels B and C of the table, family ownership induced by low trust nonetheless promotes innovation.[24] The results suggest that the family firm business structure may not present an obstacle to innovation. Rather, the characteristics of family firms may intertwine with the prevailing institutions of an economy—enhancing the beneficial impact of good institutions and magnifying the negative influence of detrimental institutions—to affect innovation.

8. Conclusion

Family firms account for a significant portion of business activities and constitute the backbone of economic development worldwide. Nevertheless, their link to innovation is less obvious. In theory, family ownership can promote innovation through several channels (e.g., by focusing on long-term value, alleviating financial constraints, or improving governance) but can hamper it as well (e.g., by following suboptimal investment policies due to conservatism and nepotism, having higher capital costs due to

[24] Because the t-statistics for the impact of trust on firm-level innovation is still approximately 1.5, trust is less exogenous as an instrument than the divorce rate. Hence, we rely on the divorce rate as our main instrument and report the trust-based results here to encourage future research.

under-diversification, or exacerbating agency issues). The lack of clear evidence on this topic is quite surprising given the popularity of family firms worldwide.

In this paper, we utilize complete patent data for U.S. public firms for the period from 2000 to 2010 to examine the impact of family ownership on innovation. We find strong empirical evidence that family-owned firms produce more and higher quality patents. Specifically, family ownership is positively related to the number of firm-level patents as well as the influence, originality, and generality of these patents.

This positive impact is confirmed by instrumental variable regressions and difference-in-difference tests. We find that the state-level divorce rate significantly reduces family ownership. Using this rate as an instrument, we verify that instrumented family ownership enhances both the quality and quantity of firm-level patents. Difference-in-difference tests exploiting the federal estate tax cut ensuing from EGTRRA confirm the direction of the causal link from family ownership to innovation. The impact of family ownership on innovation results from a greater commitment to long-term value, reduced financial constraints, and improved corporate governance. Overall, our investigation illuminates the role of family firms in knowledge-based economies, and our findings may have significant normative implications for innovation policies.

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Appendix: Variable Definitions

Variables	Definition
$Patent_{t+1}$	$Patent_{t+1}$ is defined as the logarithm of 1 plus the total number of successful patent applications ("patents" hereinafter) that are filed by firm i in year t+1 and that are approved by the USPTO from year t+1 to 2010. We use the logarithm of the patent count plus 1 to mitigate skewness in the firm-level patent counts. This measure reflects firm innovation performance from a quantitative perspective.
$Citation_{t+1}$	$Citation_{t+1}$ is defined as the logarithm of 1 plus the total number of citations received by all patents that are filed by firm i in year t+1 and that are approved by the USPTO from year t+1 to 2010. For each patent filed by firm i in year t+1, we track the number of citations received by this patent from year t+1 to the end of 2010. We then sum up the citation numbers across all patents filed by firm i in year t+1 and obtain the number of citations. This measure is sometimes referred to as the citation-weighted patent count. We use the logarithmic citation count plus 1 to mitigate skewness in firm-level patents and citations. This measure reflects firm innovation performance from a qualitative perspective.
$Originality_{t+1}$	$Originality_{t+1}$ is defined as the sum of originality scores of all patents filed by firm i in year t+1. Following Trajtenberg, Henderson, and Jaffe (1997), we define the originality score of an individual patent as one minus the Herfindahl index of the technology class distribution of all patents that have been cited by this particular patent. The USPTO assigns each patent to a three-digit technology class (http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cbcby.htm). For example, if Patent E cites Patent A (assigned to Class X), Patent B (assigned to Class Y), and Patent C (assigned to Class Y), then Patent E's originality score = $1 – [(1/3)^2 + (2/3)^2] = 0.444$. After calculating each patent's originality score, we sum up the originality scores of all patents that are filed by firm i in year t+1 to obtain firm i's originality score in year t+1 (Hsu, Tian, and Xu, 2014). This measure reflects a firm's innovation performance in terms of its combined technologies and its deviation from existing technology trajectories.
$Generality_{t+1}$	$Generality_{t+1}$ is defined as the sum of the generality scores of all patents filed by firm i in year t+1. Following Trajtenberg, Henderson, and Jaffe (1997), we define the generality score of an individual patent as one minus the Herfindahl index of the technology class distribution of all subsequent patents that cite this patent. For example, if Patent A is cited by Patent B (assigned to Class Y), Patent C (assigned to Class Y), Patent D (assigned to Class Z), and Patent F (assigned to Class X), then Patent A's generality score = $1 – [(1/4)^2 + (2/4)^2 + (1/4)^2] = 0.625$. After calculating each patent's generality score, we sum up the generality scores of all patents that are filed by firm i in year t+1 to obtain firm i's generality score in year t+1 (Hsu, Tian, and Xu, 2014). This measure reflects firm-level innovation performance in terms of the application of its innovations to a wide range of technology classes.
Family Dummy	A dummy variable that takes the value of one if a firm's ultimate owner is a family and if the family ownership is at least 20% of the total voting rights (and zero otherwise). This variable is computed for each firm in each given year.
Family Ownership	The fraction of voting rights of a firm that is attributable to its ultimate family ownership. This variable is computed for each firm in each given year.
Firm age	Firm age is defined as the number of years being listed in three main stock exchanges (NYSE, AMEX, and NASDAQ).
M/B	M/B is defined as stock market capitalization divided by the book equity of firm i in year t. Stock market capitalization is defined as firm i's stock price multiplied by the number of shares outstanding at the year end of year t. Book equity is defined as firm i's common equity (CEQ) plus its deferred tax (TXDB).

% Own	The percentage of institutional ownership is the total institutional ownership from 13f filings divided by the total number of shares outstanding. Ownership data are from the Thomson Reuters Institutional (13f) Holdings dataset.
Own Concentration	Institutional ownership concentration is calculated based on the Herfindahl Index of the share distribution of individual investors. It is defined as the sum of squared shares across all institutional investors; for institutional investor i, its share is defined as shares owned by institutional owner i divided by total institutional ownership in year t.
Assets	Assets is defined as the logarithm of firm i's total assets (AT) in millions at the year end of year t.
R&D	R&D is defined as the logarithm of firm i's R&D expenditures (XRD) in millions plus one at the year end of year t.
Capital Intensity	Capital intensity is defined as the logarithm of firm i's total assets (AT) in millions divided by its number of employees (EMP) in thousands at the year end of year t.
CAPEX	CAPEX is defined as the logarithm of firm i's capital expenditures (CAPX) in millions plus one at the year end of year t.
Leverage	Leverage is defined as firm i's long-term debt (DLTT) plus current debt (DLC), divided by its total assets (AT) at the year end of year t.
Profit Margin	Profit margin is defined as firm i's operating income (OIADP) divided by its total sales (SALE) at the year end of year t.
WW index	Whited and Wu (2006) exploit an Euler equation approach from a structural model of investment to create the WW index as a measure of financial constraints. Following Whited and Wu (2006), we compute the WW index according to the following formula: WW = –0.091*CF – 0.062*DIVPOS + 0.021*TLTD – 0.044*LNTA + 0.102*ISG – 0.035*SG, where CF is the ratio of cash flow to total assets; DIVPOS is an indicator that takes the value of one if the firm pays cash dividends; TLTD is the ratio of the long-term debt to total assets; LNTA is the natural log of total assets; ISG is the firm's three-digit SIC industry sales growth; and SG is the firm's sales growth. All variables are deflated by the replacement cost of total assets as the sum of the replacement value of the capital stock plus the rest of the total assets. Whited (1992) details the computation of the replacement value of the capital stock.
KZ index	Lamont, Polk, and Saa-Requejo (2001) use the regression coefficients from Kaplan and Zingales (1997) to compute the KZ index as follows: KZ = −1.001909*CashFlow/PPE + 0.2826389*Tobin's Q + 3.139193*Debt/TotalCapital − 39.3678*Dividends/PPE − 1.314759*Cash/PPE, where CashFlow/PPE is computed as (Item 18 + Item 14)/Item 8, Tobin's Q is computed as (Item 6 + CRSP December Market Equity − Item 60 − Item 74)/Item 6, Debt/TotalCapital is computed as (Item 9 + Item 34)/(Item 9 + Item 34 + Item 216), Dividends/PPE is computed as (Item 21 + Item 19)/Item 8, and Cash/PPE is computed as (Item 1/Item 8). Item numbers refer to Compustat annual data items as in the following: 1 (cash and short-term investments), 6 (liabilities and stockholders' equity–total), 8 (property, plant, and equipment), 9 (long-term debt–total), 14 (depreciation and amortization), 18 (income before extraordinary items), 19 (dividends–preferred), 21 (dividends–common), 34 (debt in current liabilities), 60 (common equity–total), 74 (deferred taxes), and 216 (stockholders' equity–total). Data item 8 is lagged. A firm needs to have valid information on all of the above annual items to be able to have a KZ index.
SA index	Hadlock and Pierce (2010) show that both the WW index and the KZ index rely on endogenous financial choices that may not have a straightforward relation to financial constraints. They create the SA index, which is a combination of firm age and asset size, to measure financial constraints. We use the SA index as a third proxy for financial constraints. Following Hadlock and Pierce (2010), the SA index is calculated as (−0.737*Assets + 0.043*Assets − 0.040*Age), where Assets is the natural log of inflation-adjusted book assets and is capped at (the natural log of) $4.5 billion and Age is the number of years that a firm is listed with a non-missing stock price on Compustat

	and is capped at 37 years.
Industry relative Valuation	Relative valuation gap is estimated following Rhodes-Kropf, Robinson, and Viswanathan (2005). For each industry j and year t, we estimate a valuation model from the following industry-level regressions by using ten years of lagged data: $\log M_{ij\tau} = a_{0jt} + a_{1jt} \log B_{ij\tau} + a_{2jt} \log (NI)^{+}_{ij\tau} + a_{3jt} I(< 0) \log (NI)^{+}_{ij\tau} + a_{4jt} LEV_{ij\tau} + \varepsilon_{ij\tau}$, where $\tau = t-10, \ldots, t-1$; i indexes firms, j indexes industries, and t indexes time. M_{ijt} is the market value of equity, computed by multiplying the common stock price at fiscal year end (item 199) by common shares outstanding (item 25). B_{ijt} is the book value of equity, constructed as stockholders' equity (item 216) and balance sheet deferred taxes and investment tax credit (item 35) minus the book value of preferred stock (item 56). NI is net income (item 172). Because we estimate the regression in logs, we set negative values of net income to zero and include an indicator function for negative values of net income. LEV_{ijt} is the leverage ratio computed as the ratio of total long-term debt (item 9) to total assets (item 6). A firm's total relative valuation is the difference between actual valuation and predicted valuation from the above empirical model and the industry relative valuation of firm i in year t is three-digit SIC industry average of the firm's total relative valuation (excluding firm i).
$Patent_{t+1}/R\&D_t$	This variable is the logarithm of one plus the total number of successful patent applications that are filed by firm i in year t+1 (see variable "$Patent_{t+1}$" for more details) minus the logarithm of R&D in year t. This measure indicates the number of patent filings in year t+1 scaled by R&D expenditure in year t.
$Citation_{t+1}/R\&D_t$	This variable is the logarithm of one plus the total number of citations received by all patents that are filed by firm i in year t+1 (see variable "$Citation_{t+1}$" for more details) minus the logarithm of R&D at year t. This measure indicates the number of patent citations in year t+1 scaled by R&D expenditure in year t.
$Originality_{t+1}/R\&D_t$	This variable is the logarithm of originality measure (see variable "$Originality_{t+1}$" for more details) of firm i in year t+1 minus the logarithm of R&D at year t. This measure indicates the patent originality in year t+1 scaled by R&D expenditure in year t.
$Generality_{t+1}/R\&D_t$	This variable is the logarithm of generality measure (see variable "$Generality_{t+1}$" for more details) of firm i in year t+1 minus the logarithm of R&D at year t. This measure indicates the patent generality in year t+1 scaled by R&D expenditure in year t.

Table 1 Summary Statistics

The sample period ranges from 2000 to 2010. We exclude firms with sales < 100 m and a firm age less than or equal to 5 years. All continuous variables are winsorized at 1%. All other variables are defined in the Appendix. Panel A provides summary statistics. Panel B shows the univariate comparison of the control variables for family and non-family firms. Panel C shows the univariate comparison of the innovation measures for family firms and non-family firms based on propensity score matching. The construction of the propensity score matched sample is detailed in Table A1 of the Internet Appendix.

Panel A Summary Statistics						
	N	Mean	Median	Std	P25	P75
Patent,t+1	17025	0.61	0.00	1.30	0.00	0.69
Citation,t+1	17025	0.73	0.00	1.76	0.00	0.00
Originality,t+1	17025	0.46	0.00	1.06	0.00	0.00
Generality,t+1	17025	0.19	0.00	0.66	0.00	0.00
Family Dummy	17025	0.11	0.00	0.31	0.00	0.00
Family Ownership	17025	0.05	0.00	0.15	0.00	0.00
Firm age	17025	24.74	18.00	18.29	11.00	34.00
M/B	17025	2.56	1.82	2.56	1.14	3.02
% Inst Own	17025	0.59	0.73	0.39	0.14	0.95
Own Concentration	17025	0.05	0.03	0.07	0.02	0.06
Asset	17025	6.97	6.77	1.60	5.77	7.97
R&D	17025	1.57	0.00	2.11	0.00	3.25
Capital Intensity	17025	5.56	5.52	1.15	4.82	6.27
CAPEX	17025	3.65	3.53	1.88	2.30	4.93
Leverage	17025	0.22	0.21	0.18	0.06	0.34
Profit Margin	17025	0.09	0.08	0.11	0.04	0.14
Panel B Univariate						
	Non-family	Family	p-value			
Firm age	25.36	19.59	0.00			
M/B	2.61	2.13	0.00			
% Inst Own	0.60	0.47	0.00			
Own Concentration	0.04	0.09	0.00			
Asset	7.06	6.23	0.00			
R&D	1.67	0.68	0.00			
Capital Intensity	5.60	5.23	0.00			
CAPEX	3.75	2.85	0.00			
Leverage	0.22	0.21	0.00			
Profit Margin	0.09	0.08	0.00			
Panel C Propensity Score Matched Sample						
	Non-family	Family	p-value			
Propensity Score	0.181	0.181	0.921			
Patent,t+1	0.205	0.258	0.034			
Citations,t+1	0.253	0.327	0.036			
Originality,t+1	0.144	0.186	0.029			
Generality,t+1	0.045	0.076	0.005			

Table 2 Main Results

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{t+1} = \alpha_j + \alpha_t + \beta_1 Family + \gamma' X_t + \varepsilon_t$, where α_j is the industry fixed effect at 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at *t*; and the innovation measures are patent count, patent citation count, patent originality, and patent generality measured at *t+1*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.070*	0.088*	0.065**	0.057***
	(0.036)	(0.046)	(0.029)	(0.021)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.008)	(0.013)	(0.005)	(0.006)
% Inst Own	-0.002	0.014	-0.014	-0.022
	(0.041)	(0.047)	(0.031)	(0.017)
Own Concentration	0.507**	0.287	0.522***	0.239***
	(0.198)	(0.245)	(0.172)	(0.090)
Asset	0.069**	0.057	0.065**	0.026
	(0.032)	(0.043)	(0.028)	(0.020)
R&D	0.313***	0.344***	0.253***	0.114***
	(0.060)	(0.087)	(0.052)	(0.041)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.030)	(0.044)	(0.027)	(0.020)
CAPEX	0.087***	0.122***	0.070**	0.049**
	(0.032)	(0.047)	(0.028)	(0.023)
Leverage	-0.261**	-0.413***	-0.223**	-0.180**
	(0.117)	(0.159)	(0.101)	(0.079)
Profit Margin	-0.199	-0.426	-0.096	-0.116
	(0.260)	(0.370)	(0.210)	(0.122)
Constant	-1.798***	-1.987***	-1.483***	-0.651***
	(0.386)	(0.437)	(0.343)	(0.216)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5171	0.4360	0.4932	0.3467
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.148**	0.209**	0.132**	0.116***
	(0.071)	(0.092)	(0.061)	(0.044)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.008)	(0.013)	(0.005)	(0.006)
% Inst Own	-0.003	0.013	-0.015	-0.024
	(0.041)	(0.047)	(0.031)	(0.017)
Own Concentration	0.516**	0.292	0.533***	0.248***
	(0.204)	(0.252)	(0.175)	(0.092)
Asset	0.070**	0.057	0.066**	0.026
	(0.032)	(0.043)	(0.028)	(0.020)
R&D	0.313***	0.344***	0.253***	0.114***
	(0.060)	(0.087)	(0.052)	(0.041)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.030)	(0.044)	(0.027)	(0.021)
CAPEX	0.087***	0.122***	0.070**	0.049**
	(0.032)	(0.047)	(0.028)	(0.023)
Leverage	-0.264**	-0.416***	-0.226**	-0.183**
	(0.117)	(0.160)	(0.101)	(0.079)
Profit Margin	-0.198	-0.426	-0.095	-0.115
	(0.260)	(0.371)	(0.211)	(0.123)
Constant	-1.799***	-1.988***	-1.483***	-0.651***
	(0.387)	(0.438)	(0.343)	(0.216)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5171	0.4361	0.4932	0.3466
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 3 Instrument Variable Regression − State Divorce Rate

The sample period ranges from 2000 to 2010. We estimate the following instrumental variable regression model: $Innov_{t+1} = \alpha_j + \alpha_t + \beta_1 Family + \gamma' X_t + \varepsilon_t$, where the family firm dummy (family ownership percentage) is instrumented by the state-level divorce rate in 2000 in the first stage. Panel A reports results from using the family ownership dummy, and Panel B uses the family ownership percentage. Column 1 reports the first-stage regressions, and Columns 2-5 report the second-stage regressions. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Family	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family		1.252***	1.820***	1.055***	0.718***
		(0.204)	(0.334)	(0.194)	(0.178)
State Divorce	-0.029*				
	(0.016)				
Firm age	-0.007***	0.006***	0.007***	0.005***	0.003***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
M/B	-0.050***	0.034***	0.048***	0.026***	0.018***
	(0.008)	(0.006)	(0.009)	(0.005)	(0.004)
% Inst Own	-0.258**	0.082*	0.137	0.056*	0.025
	(0.103)	(0.047)	(0.088)	(0.032)	(0.018)
Own Concentration	1.766***	-0.440**	-1.099***	-0.270**	-0.290***
	(0.343)	(0.175)	(0.424)	(0.135)	(0.102)
Asset	-0.106**	0.097***	0.093**	0.090***	0.040**
	(0.043)	(0.035)	(0.043)	(0.032)	(0.016)
R&D		0.268***	0.288***	0.212***	0.093***
		(0.051)	(0.060)	(0.043)	(0.025)
Capital Intensity	-0.086	0.037	0.060	0.029	0.026
	(0.053)	(0.049)	(0.073)	(0.044)	(0.035)
CAPEX	-0.063**	0.089**	0.126*	0.072*	0.050*
	(0.030)	(0.045)	(0.068)	(0.037)	(0.028)
Leverage	0.043	-0.262	-0.401*	-0.229	-0.176*
	(0.148)	(0.183)	(0.211)	(0.158)	(0.094)
Profit Margin	0.819***	-0.397	-0.702*	-0.266	-0.222
	(0.184)	(0.314)	(0.374)	(0.243)	(0.144)
Constant	-2.744***	-2.284***	-2.374***	-1.896**	-0.828**
	(0.345)	(0.833)	(0.868)	(0.746)	(0.396)
Observations	17,025	17,025	17,025	17,025	17,025
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	% Family Own	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own		0.325***	0.511***	0.366**	0.468***
		(0.118)	(0.191)	(0.158)	(0.127)
State Divorce	-0.008***				
	(0.003)				
Firm age	-0.000***	0.005***	0.005***	0.004***	0.002***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
M/B	-0.003***	0.023***	0.035***	0.017***	0.014***
	(0.001)	(0.006)	(0.009)	(0.004)	(0.002)
% Inst Own	-0.012*	0.018	0.027	0.008	-0.009
	(0.006)	(0.037)	(0.048)	(0.027)	(0.012)
Own Concentration	0.110***	0.133	-0.173	0.156	-0.015
	(0.043)	(0.099)	(0.145)	(0.099)	(0.090)
Asset	-0.009**	0.063**	0.054	0.060**	0.024***
	(0.004)	(0.029)	(0.039)	(0.027)	(0.007)
R&D		0.313***	0.345***	0.253***	0.115***
		(0.045)	(0.056)	(0.041)	(0.003)
Capital Intensity	-0.003	0.012	0.027	0.008	0.014**
	(0.005)	(0.045)	(0.066)	(0.040)	(0.006)
CAPEX	-0.000	0.086*	0.121*	0.069*	0.048***
	(0.004)	(0.046)	(0.069)	(0.038)	(0.006)
Leverage	-0.008	-0.245	-0.401	-0.207	-0.172***
	(0.019)	(0.209)	(0.250)	(0.174)	(0.027)
Profit Margin	0.006	-0.221	-0.445	-0.120	-0.135***
	(0.013)	(0.329)	(0.386)	(0.254)	(0.045)
Constant	0.136***	-1.889***	-1.931**	-1.540**	-0.652***
	(0.016)	(0.723)	(0.761)	(0.631)	(0.242)
Observations	17,025	17,025	17,025	17,025	17,025
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 4 Difference-in-Difference Regression

The sample period ranges from 2000 to 2003. After2001 is a dummy that is equal to one if the year > 2001. Panel A reports results from using the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family*after2001	0.105*	0.226**	0.074**	0.127***
	(0.056)	(0.104)	(0.033)	(0.034)
Family	0.039	-0.002	0.057	0.018
	(0.062)	(0.119)	(0.051)	(0.048)
Firm age	0.005***	0.005*	0.004**	0.002
	(0.002)	(0.003)	(0.002)	(0.001)
M/B	0.021**	0.034**	0.013**	0.009
	(0.009)	(0.016)	(0.006)	(0.007)
% Inst Own	-0.029	-0.018	-0.036	-0.082*
	(0.070)	(0.093)	(0.057)	(0.045)
Own Concentration	0.294**	0.027	0.395***	0.410***
	(0.146)	(0.274)	(0.120)	(0.097)
Asset	0.125***	0.145**	0.122***	0.091**
	(0.043)	(0.066)	(0.037)	(0.038)
R&D	0.445***	0.619***	0.376***	0.272***
	(0.042)	(0.063)	(0.038)	(0.045)
Capital Intensity	0.003	0.014	-0.003	-0.007
	(0.040)	(0.060)	(0.036)	(0.033)
CAPEX	0.062*	0.094	0.048	0.051
	(0.035)	(0.060)	(0.029)	(0.032)
Leverage	-0.279**	-0.496**	-0.241**	-0.213*
	(0.137)	(0.207)	(0.118)	(0.113)
Profit Margin	0.124	-0.002	0.199	0.183
	(0.309)	(0.592)	(0.294)	(0.269)
Constant	-1.111***	-1.479***	-0.927***	-0.772***
	(0.227)	(0.376)	(0.208)	(0.225)
Observations	6,316	6,316	6,316	6,316
R-squared	0.6252	0.5900	0.6087	0.5523
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own*after2001	0.220*	0.527***	0.140*	0.273***
	(0.130)	(0.193)	(0.076)	(0.062)
% Family Own	0.093	-0.003	0.134	0.031
	(0.138)	(0.241)	(0.111)	(0.107)
Firm age	0.005***	0.005*	0.004**	0.002
	(0.002)	(0.003)	(0.001)	(0.001)
M/B	0.021**	0.034**	0.013*	0.009
	(0.009)	(0.016)	(0.007)	(0.007)
% Inst Own	-0.031	-0.019	-0.039	-0.084*
	(0.071)	(0.093)	(0.056)	(0.045)
Own Concentration	0.304*	0.037	0.412***	0.423***
	(0.157)	(0.293)	(0.126)	(0.099)
Asset	0.125***	0.145**	0.122***	0.091**
	(0.043)	(0.067)	(0.038)	(0.038)
R&D	0.444***	0.619***	0.376***	0.272***
	(0.042)	(0.063)	(0.038)	(0.045)
Capital Intensity	0.003	0.014	-0.003	-0.007
	(0.040)	(0.060)	(0.036)	(0.033)
CAPEX	0.062*	0.093	0.048	0.050
	(0.035)	(0.060)	(0.031)	(0.032)
Leverage	-0.282**	-0.499**	-0.243*	-0.215*
	(0.139)	(0.210)	(0.128)	(0.114)
Profit Margin	0.125	-0.001	0.206	0.184
	(0.309)	(0.593)	(0.284)	(0.270)
Constant	-1.109***	-1.481***	-0.973***	-0.766***
	(0.230)	(0.377)	(0.208)	(0.227)
Observations	6,316	6,316	6,316	6,316
R-squared	0.6252	0.5901	0.6086	0.5522
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 5 Family Ownership and Investor Horizon

The sample period ranges from 2000 to 2010. Inst Owner is the percentage of outstanding equity owned by institutional investors. Turnover is constructed following Gaspar, Massa, and Matos (2005). Low (High) Turnover is a dummy equal to one if turnover is in the lowest (highest) quartile in year t. Mid Turnover is a dummy equal to one if turnover is in the middle two quartiles in year t. Panel A reports results from using the family ownership dummy, and Panel B uses the family ownership percentage. The regressions contain all the control variables and fixed effects included in Table 2 as well as Mid Turnover and High Turnover dummies. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation, t+1	Originality, t+1	Generality, t+1
Family*Inst Owner*Low Turnover	2.003***	2.728***	1.666***	0.892***
	(0.549)	(0.818)	(0.460)	(0.337)
Family*Inst Owner*Mid Turnover	0.564	0.954**	0.566**	0.619**
	(0.357)	(0.430)	(0.283)	(0.250)
Family*Inst Owner*High Turnover	0.327	0.611	0.351	0.544*
	(0.960)	(1.207)	(0.755)	(0.315)
Inst Owner*Low Turnover	0.915***	1.155***	0.783***	0.425***
	(0.255)	(0.371)	(0.222)	(0.147)
Inst Owner*Mid Turnover	-0.209	-0.327	-0.195	-0.186
	(0.204)	(0.280)	(0.171)	(0.121)
Inst Owner*High Turnover	-2.527***	-4.189***	-2.427***	-2.078***
	(0.954)	(1.232)	(0.817)	(0.637)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5223	0.4428	0.4998	0.3572
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation, t+1	Originality, t+1	Generality, t+1
% Family Own*Inst Owner*Low Turnover	3.191***	4.513***	2.638***	1.432**
	(0.978)	(1.483)	(0.841)	(0.592)
% Family Own*Inst Owner*Mid Turnover	1.409**	2.215**	1.340**	1.259**
	(0.710)	(0.922)	(0.555)	(0.491)
% Family Own*Inst Owner*High Turnover	-0.075	0.510	0.129	0.948
	(1.957)	(2.532)	(1.564)	(0.662)
Inst Owner*Low Turnover	0.954***	1.204***	0.817***	0.442***
	(0.254)	(0.377)	(0.228)	(0.152)
Inst Owner*Mid Turnover	-0.224	-0.346	-0.208	-0.191
	(0.197)	(0.274)	(0.166)	(0.121)
Inst Owner*High Turnover	-2.511***	-4.172***	-2.414***	-2.071***
	(0.959)	(1.234)	(0.821)	(0.638)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5223	0.4429	0.4999	0.3572
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 6 Family Ownership and Over-valuation Gap

The sample period ranges from 2000 to 2010. The relative valuation gap is estimated following Rhodes-Kropf, Robinson, and Viswanathan (2005). For each industry j and year t, we estimate a valuation model from the following industry-level regressions by using ten years of lagged data: $\log M_{ij\tau} = a_{0jt} + a_{1jt} \log B_{ij\tau} + a_{2jt} \log (NI)^{+}_{ij\tau} + a_{3jt} I(< 0) \log (NI)^{+}_{ij\tau} + a_{4jt} LEV_{ij\tau} + \varepsilon_{ij\tau}$, where $\tau = t-10, \ldots, t-1$; i indexes firms, j indexes industries, and t indexes time. M_{ijt} is the market value of equity, computed by multiplying the common stock price at fiscal year end (item 199) by common shares outstanding (item 25). B_{ijt} is the book value of equity, constructed as stockholders' equity (item 216) and balance sheet deferred taxes and investment tax credit (item 35) minus the book value of preferred stock (item 56). NI is net income (item 172). Because we estimate the regression in logs, we set negative values of net income to zero and include an indicator function for negative values of net income. LEV_{ijt} is the leverage ratio computed as the ratio of total long-term debt (item 9) to total assets (item 6). A firm's total relative valuation is the difference between the actual valuation and the predicted valuation from the above empirical model, and the industry relative valuation of firm i in year t is the three-digit SIC industry average of firm's total relative valuation (excluding firm i). Low (High) RelVal is a dummy equal to one if the industry relative valuation of firm i is in the lowest (highest) quartile in year t. Mid RelVal is a dummy equal to one if industry relative valuation of firm i is in the middle two quartiles. Panel A reports results from using the family ownership dummy, and Panel B uses the family ownership percentage. The regressions contain all the control variables and fixed effects included in Table 2 as well as Mid RelVal and High RelVal dummies. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family*High RelVal	0.148**	0.231***	0.142***	0.105***
	(0.060)	(0.080)	(0.047)	(0.036)
Family*Mid RelVal	0.007	0.027	0.002	0.026
	(0.053)	(0.072)	(0.046)	(0.025)
Family*Low RelVal	0.047	0.023	0.050	0.030
	(0.093)	(0.127)	(0.070)	(0.034)
High RelVal	-0.129*	-0.184*	-0.116*	-0.088**
	(0.067)	(0.102)	(0.061)	(0.045)
Mid RelVal	0.034	0.013	0.033	0.010
	(0.048)	(0.072)	(0.037)	(0.025)
Controls	Yes	Yes	Yes	Yes
Observations	16,660	16,661	16,663	16,663
R-squared	0.4854	0.4030	0.4619	0.3067
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own*High RelVal	0.315**	0.480***	0.302***	0.216***
	(0.134)	(0.173)	(0.101)	(0.083)
% Family Own*Mid RelVal	0.023	0.067	0.011	0.046
	(0.104)	(0.137)	(0.092)	(0.047)
% Family Own*Low RelVal	0.138	0.137	0.126	0.077
	(0.158)	(0.212)	(0.119)	(0.063)
High RelVal	-0.126*	-0.176*	-0.114*	-0.086**
	(0.065)	(0.098)	(0.059)	(0.044)
Mid RelVal	0.035	0.017	0.033	0.010
	(0.047)	(0.070)	(0.036)	(0.025)
Controls	Yes	Yes	Yes	Yes
Observations	16,660	16,661	16,663	16,663
R-squared	0.4854	0.4030	0.4620	0.3066
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 7 Family Ownership and Financial Constraints

The sample period ranges from 2000 to 2010. The WW Index is constructed following Whited and Wu (2005). The KZ Index is constructed following Kaplan and Zingales (1997). The SA Index is constructed following Hadlock and Pierce (2010). For each year, firms are assigned into quartiles based on their respective financial constraint index. High WW (KZ/SA) is a dummy equal to one if a firm is assigned to top quartile in year t. Low WW (KZ/SA) is a dummy equal to one if a firm is assigned to bottom quartile in year t. Mid WW (KZ/SA) is a dummy equal to one if a firm is assigned to middle two quartiles in year t. Panels A and B contain all the control variables and fixed effects included in Table 2. Panel C contains the control variables and fixed effects included in Table 2 except for firm age and firm size. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A WW Index

Panel I Family Firm Dummy					Panel II Family Ownership Percentage				
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1	VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family*High WW	0.037**	0.039*	0.031**	0.018*	% Family Own*High WW	0.061**	0.073*	0.050**	0.034*
	(0.015)	(0.022)	(0.013)	(0.011)		(0.030)	(0.043)	(0.025)	(0.021)
Family*Mid WW	0.005	0.009	0.009	0.012**	% Family Own*Mid WW	0.018	0.026	0.022	0.026**
	(0.011)	(0.015)	(0.008)	(0.005)		(0.019)	(0.026)	(0.015)	(0.010)
Family*Low WW	0.026	0.041	0.017	0.016	% Family Own*Low WW	0.074	0.130	0.046	0.035
	(0.044)	(0.054)	(0.036)	(0.023)		(0.087)	(0.101)	(0.070)	(0.038)
High WW	-0.182**	-0.230**	-0.165**	-0.079	High WW	-0.176**	-0.224**	-0.161**	-0.078
	(0.084)	(0.104)	(0.076)	(0.049)		(0.083)	(0.103)	(0.074)	(0.048)
Mid WW	-0.025	-0.029	-0.038	-0.028	Mid WW	-0.026	-0.028	-0.039	-0.029
	(0.069)	(0.076)	(0.061)	(0.039)		(0.068)	(0.074)	(0.060)	(0.039)
Control	Yes	Yes	Yes	Yes	Control	Yes	Yes	Yes	Yes
Observations	16,966	16,966	16,966	16,966	Observations	16,966	16,966	16,966	16,966
R-squared	0.5180	0.4373	0.4942	0.3468	R-squared	0.5179	0.4374	0.4940	0.3468

Panel B KZ Index

Panel I Family Firm Dummy					Panel II Family Ownership Percentage				
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1	VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family*High KZ	0.027***	0.036***	0.025***	0.023***	% Family Own*High KZ	0.054**	0.075***	0.050**	0.042**
	(0.008)	(0.013)	(0.008)	(0.008)		(0.021)	(0.028)	(0.019)	(0.017)
Family*Mid KZ	0.007	0.009	0.009	0.013**	% Family Own*Mid KZ	0.014	0.028	0.018	0.028**
	(0.013)	(0.017)	(0.010)	(0.006)		(0.034)	(0.040)	(0.025)	(0.012)
Family*Low KZ	0.020	0.023	0.016	0.006	% Family Own*Low KZ	0.038	0.050	0.027	0.013
	(0.017)	(0.021)	(0.013)	(0.007)		(0.043)	(0.052)	(0.029)	(0.016)
High KZ	-0.173**	-0.207**	-0.117*	-0.022	High KZ	-0.173***	-0.206***	-0.117**	-0.020
	(0.076)	(0.101)	(0.060)	(0.036)		(0.058)	(0.040)	(0.044)	(0.020)
Mid KZ	-0.150***	-0.195***	-0.114***	-0.058***	Mid KZ	-0.151***	-0.196***	-0.115***	-0.057***
	(0.046)	(0.050)	(0.037)	(0.020)		(0.037)	(0.024)	(0.029)	(0.009)
Control	Yes	Yes	Yes	Yes	Control	Yes	Yes	Yes	Yes
Observations	16,923	16,923	16,923	16,923	Observations	16,923	16,923	16,923	16,923
R-squared	0.5177	0.4372	0.4936	0.3473	R-squared	0.5177	0.4372	0.4935	0.3472

Panel C SA Index									
Panel I Family Firm Dummy					Panel II Family Ownership Percentage				
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1	VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family*High SA	0.039**	0.053**	0.032**	0.023**	% Family Own*High SA	0.067*	0.097**	0.057*	0.042**
	(0.018)	(0.023)	(0.015)	(0.010)		(0.037)	(0.047)	(0.031)	(0.019)
Family*Mid SA	0.014	0.014	0.015*	0.013**	% Family Own*Mid SA	0.031	0.040	0.030	0.026**
	(0.012)	(0.015)	(0.009)	(0.006)		(0.024)	(0.031)	(0.019)	(0.013)
Family*Low SA	-0.038	-0.038	-0.032	-0.008	% Family Own*Low SA	-0.070	-0.073	-0.063	-0.016
	(0.036)	(0.047)	(0.031)	(0.021)		(0.070)	(0.084)	(0.060)	(0.033)
High SA	-0.178***	-0.206***	-0.138***	-0.066***	High SA	-0.172***	-0.199***	-0.133***	-0.064***
	(0.043)	(0.060)	(0.035)	(0.024)		(0.042)	(0.057)	(0.035)	(0.023)
Mid SA	-0.191***	-0.207***	-0.161***	-0.085***	Mid SA	-0.189***	-0.207***	-0.159***	-0.084***
	(0.046)	(0.052)	(0.039)	(0.029)		(0.045)	(0.051)	(0.039)	(0.028)
Control	Yes	Yes	Yes	Yes	Control	Yes	Yes	Yes	Yes
Observations	17,025	17,025	17,025	17,025	Observations	17,025	17,025	17,025	17,025
R-squared	0.5144	0.4351	0.4898	0.3448	R-squared	0.5142	0.4350	0.4896	0.3446

Table 8 Family Ownership and External Governance

The sample period ranges from 2000 to 2010. High (Low) Own is a dummy equal to one if the sample firm's percentage of outstanding equity owned by institutional investors is above (below) the median in year t. High (Low) E index is a dummy equal to one if the E index is above (below) the median in year t, where E index is obtained from Lucian Bebchuk's website. Panel A splits the sample by institutional ownership, and Panel B splits the sample by the E Index. The left panels use the family ownership dummy, and the right panels use the family ownership percentage. The regressions contain all the control variables and fixed effects included in Table 2. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Institutional Ownership

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1	VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family*High Inst Own	-0.056	-0.078	-0.029	0.013	Family %*High Inst Own	-0.085	-0.097	-0.039	0.052
	(0.074)	(0.095)	(0.057)	(0.028)		(0.131)	(0.163)	(0.102)	(0.050)
Family*Low Inst Own	0.147***	0.190***	0.123***	0.084**	Family %*Low Inst Own	0.303***	0.412***	0.246***	0.160**
	(0.050)	(0.065)	(0.042)	(0.033)		(0.100)	(0.128)	(0.085)	(0.063)
High Inst Own	0.026	0.042	0.011	-0.004	High Inst Own	0.021	0.037	0.007	-0.008
	(0.028)	(0.035)	(0.022)	(0.014)		(0.028)	(0.034)	(0.022)	(0.014)
Control	Yes	Yes	Yes	Yes	Control	Yes	Yes	Yes	Yes
Observations	17,025	17,025	17,025	17,025	Observations	17,025	17,025	17,025	17,025
R-squared	0.5176	0.4365	0.4936	0.3468	R-squared	0.5175	0.4365	0.4936	0.3467

Panel B Entrenchment Index

	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1	VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family*High E Index	0.202	0.218	0.190*	0.134*	Family %*High E Index	0.706**	0.853**	0.609**	0.386**
	(0.151)	(0.223)	(0.112)	(0.077)		(0.296)	(0.423)	(0.259)	(0.196)
Family*Low E Index	-0.008	-0.040	0.003	0.028	Family %*Low E Index	-0.045	-0.066	-0.026	0.053
	(0.071)	(0.094)	(0.056)	(0.030)		(0.149)	(0.192)	(0.121)	(0.063)
High E Index	-0.119**	-0.126	-0.092*	-0.034	High E Index	-0.121**	-0.127*	-0.094**	-0.034
	(0.054)	(0.077)	(0.047)	(0.027)		(0.054)	(0.076)	(0.047)	(0.027)
Control	Yes	Yes	Yes	Yes	Control	Yes	Yes	Yes	Yes
Observations	10,683	10,683	10,683	10,683	Observations	10,683	10,683	10,683	10,683
R-squared	0.5479	0.4759	0.5247	0.3885	R-squared	0.5480	0.4760	0.5248	0.3885

Table 9 Family Ownership and Innovation Efficiency

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{t+1} = \alpha_j + \alpha_t + \beta_1 Family + \gamma' X_t + \varepsilon_t$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at *t*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	R&D,t+1	Patent,t+1 /R&D,t	Citation, t+1 /R&D,t	Originality, t+1 /R&D,t	Generality, t+1 /R&D,t
Family	-0.262**	0.242***	0.253***	0.253***	0.279***
	(0.106)	(0.092)	(0.093)	(0.095)	(0.101)
Firm age	0.004	0.002	0.002	0.001	-0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
M/B	0.118***	-0.054***	-0.040**	-0.068***	-0.087***
	(0.010)	(0.009)	(0.017)	(0.009)	(0.011)
% Inst Own	-0.105	0.086	0.098	0.082	0.091
	(0.079)	(0.062)	(0.062)	(0.063)	(0.073)
Own Concentration	0.040	0.420	0.204	0.429	0.128
	(0.355)	(0.278)	(0.268)	(0.297)	(0.320)
Asset	0.433***	-0.228***	-0.228**	-0.258***	-0.358***
	(0.104)	(0.080)	(0.094)	(0.086)	(0.101)
Capital Intensity	0.336***	-0.218***	-0.193**	-0.243***	-0.284***
	(0.116)	(0.083)	(0.085)	(0.090)	(0.103)
CAPEX	-0.005	0.086**	0.121***	0.069*	0.048
	(0.055)	(0.039)	(0.045)	(0.040)	(0.043)
Leverage	-1.505***	0.753**	0.554	0.879***	1.126***
	(0.355)	(0.309)	(0.358)	(0.312)	(0.339)
Profit Margin	-1.240***	0.820*	0.547	1.012**	1.198***
	(0.366)	(0.450)	(0.518)	(0.431)	(0.391)
Constant	-4.565***	1.354**	1.021	1.944***	3.412***
	(0.836)	(0.526)	(0.692)	(0.563)	(0.736)
Observations	17,025	17,025	17,025	17,025	17,025
R-squared	0.6106	0.3879	0.3046	0.4554	0.5476
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	R&D,t+1	Patent,t+1 /R&D,t	Citation, t+1 /R&D,t	Originality, t+1 /R&D,t	Generality, t+1 /R&D,t
% Family Own	-0.365	0.386*	0.436**	0.391*	0.423*
	(0.248)	(0.210)	(0.209)	(0.217)	(0.232)
Firm age	0.004	0.002	0.003	0.001	-0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
M/B	0.118***	-0.054***	-0.040**	-0.068***	-0.087***
	(0.010)	(0.009)	(0.017)	(0.008)	(0.011)
% Inst Own	-0.095	0.079	0.091	0.074	0.082
	(0.078)	(0.061)	(0.061)	(0.062)	(0.072)
Own Concentration	-0.055	0.493*	0.270	0.509*	0.219
	(0.356)	(0.285)	(0.276)	(0.302)	(0.320)
Asset	0.433***	-0.229***	-0.228**	-0.259***	-0.359***
	(0.104)	(0.080)	(0.094)	(0.086)	(0.101)
Capital Intensity	0.337***	-0.219***	-0.194**	-0.244***	-0.285***
	(0.117)	(0.084)	(0.086)	(0.090)	(0.104)
CAPEX	-0.005	0.085**	0.121***	0.068*	0.047
	(0.055)	(0.039)	(0.045)	(0.040)	(0.043)
Leverage	-1.494***	0.743**	0.545	0.869***	1.115***
	(0.353)	(0.307)	(0.356)	(0.310)	(0.337)
Profit Margin	-1.252***	0.830*	0.555	1.023**	1.210***
	(0.368)	(0.452)	(0.520)	(0.434)	(0.394)
Constant	-4.576***	1.362**	1.028	1.952***	3.422***
	(0.838)	(0.529)	(0.695)	(0.566)	(0.739)
Observations	17,025	17,025	17,025	17,025	17,025
R-squared	0.6099	0.3872	0.3041	0.4546	0.5467
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 10 Family Ownership and Innovation Efficiency: Difference-in-Difference

The sample period ranges from 2000 to 2003. After2001 is a dummy equal to one if the year > 2001. Panel A reports results from using the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	R&D,t+1	Patent,t+1 /R&D,t	Citation, t+1 /R&D,t	Originality, t+1 /R&D,t	Generality, t+1 /R&D,t
Family	-0.151	0.125	0.057	0.157	0.131
	(0.107)	(0.111)	(0.136)	(0.106)	(0.113)
Family*after2001	-0.024	0.125*	0.239**	0.089**	0.153***
	(0.054)	(0.064)	(0.101)	(0.041)	(0.043)
Firm age	0.008***	-0.000	0.002	-0.002	-0.004*
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
M/B	0.125***	-0.046***	-0.012	-0.063***	-0.079***
	(0.017)	(0.009)	(0.015)	(0.011)	(0.013)
% Inst Own	-0.040	-0.003	-0.000	-0.008	-0.048
	(0.084)	(0.077)	(0.093)	(0.072)	(0.071)
Own Concentration	-0.039	0.265	0.007	0.368	0.372
	(0.403)	(0.212)	(0.265)	(0.255)	(0.292)
Asset	0.309***	-0.045	0.029	-0.069	-0.131*
	(0.104)	(0.059)	(0.071)	(0.063)	(0.079)
Capital Intensity	0.336***	-0.185**	-0.115	-0.214**	-0.253***
	(0.113)	(0.083)	(0.075)	(0.089)	(0.097)
CAPEX	0.083	0.010	0.058	-0.010	-0.018
	(0.057)	(0.040)	(0.057)	(0.041)	(0.043)
Leverage	-1.334***	0.446*	0.002	0.576**	0.739**
	(0.348)	(0.264)	(0.272)	(0.273)	(0.305)
Profit Margin	-1.551***	1.175**	0.719	1.385***	1.560***
	(0.435)	(0.465)	(0.659)	(0.453)	(0.469)
Constant	-3.203***	0.597**	-0.330	0.900***	1.336***
	(0.629)	(0.284)	(0.298)	(0.297)	(0.508)
Observations	6,316	6,316	6,316	6,316	6,316
R-squared	0.6293	0.2521	0.0987	0.3625	0.4880
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	R&D,t+1	Patent,t+1 /R&D,t	Citation, t+1 /R&D,t	Originality, t+1 /R&D,t	Generality, t+1 /R&D,t
% Family Own	-0.174	0.192	0.064	0.245	0.160
	(0.224)	(0.255)	(0.302)	(0.213)	(0.255)
% Family Own*after2001	-0.106	0.297*	0.580***	0.226***	0.374***
	(0.130)	(0.168)	(0.205)	(0.081)	(0.114)
Firm age	0.008***	-0.000	0.002	-0.002	-0.004*
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
M/B	0.125***	-0.046***	-0.012	-0.063***	-0.079***
	(0.017)	(0.009)	(0.015)	(0.011)	(0.012)
% Inst Own	-0.034	-0.008	-0.004	-0.013	-0.054
	(0.083)	(0.076)	(0.094)	(0.073)	(0.072)
Own Concentration	-0.096	0.308	0.039	0.416*	0.428
	(0.392)	(0.216)	(0.280)	(0.252)	(0.288)
Asset	0.310***	-0.045	0.029	-0.069	-0.132*
	(0.103)	(0.060)	(0.072)	(0.063)	(0.079)
Capital Intensity	0.336***	-0.185**	-0.115	-0.214**	-0.253***
	(0.113)	(0.082)	(0.076)	(0.087)	(0.097)
CAPEX	0.084	0.009	0.057	-0.011	-0.018
	(0.057)	(0.042)	(0.059)	(0.043)	(0.044)
Leverage	-1.327***	0.440*	-0.004	0.569**	0.731**
	(0.343)	(0.265)	(0.282)	(0.275)	(0.300)
Profit Margin	-1.561***	1.182**	0.724	1.394***	1.569***
	(0.419)	(0.479)	(0.662)	(0.480)	(0.471)
Constant	-3.665***	0.902***	-0.102	1.286***	1.869***
	(0.533)	(0.291)	(0.432)	(0.291)	(0.449)
Observations	6,316	6,316	6,316	6,316	6,316
R-squared	0.6290	0.2517	0.0987	0.3620	0.4875
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Internet Appendix

The New Lyrics of the Old Folks: The Role of Family Ownership in Corporate Innovation

This Internet Appendix consists of four sets of robustness checks (Tables A1 to A12) for the main results reported in Table 2. Table A13 provides tests of the exclusion restriction of our instrument. Table A14 analyzes the role of social trust in the family-innovation relation.

We first conduct two robustness checks to demonstrate that our results in Table 2 are unaffected by the skewed distribution of family firms in the economy or their definitions. To address the potential econometric issues related to the lower number of family firms relative to non-family firms in the U.S., Table A1 of the Internet Appendix creates propensity score matched samples for family and non-family firms. Propensity scores are created based on all the characteristics tabulated in Panel B of Table 1. We then select, for each family firm, a non-family firm that most closely resembles it to provide its control. Panel A of Table A1 verifies that the firm characteristics between family firms and firms in the control group are indistinguishable. Panel B then reports an innovation regression based on these two groups. The positive impact of family ownership on innovation remains in a balanced sample.[25] Table A2 examines the robustness of our results by redefining a family dummy based on thresholds of 30% or 40% of ownership. These alternative definitions do not alter the positive relationship between family ownership and innovation.

The second set of robustness checks addresses the distribution and availability of our dependent variable—innovation. One potential concern about our innovation variables is that they are right-skewed with many zeroes. To alleviate this concern, Table A3 presents the result of tests focused on firm-year observations with non-zero innovation measures; the results are consistent with the main results. Another potential concern is that there could be a two- to three-year lag between each patent application date and its final approval (grant) date; hence, our results may be driven by those patents applied for but not granted by the end of 2010. To address this concern,

[25] This comparison also addresses potential selection bias, that is, that only superior family firms are listed. Because both family and non-family firms in this test have similar characteristics, it is difficult to argue that one group is more susceptible to this selection bias.

we restrict our sample to the 2000-2007 period and obtain consistent results, as presented in Table A4. Table A5 further considers innovation output in two- and three-year horizons. This specification also better controls for reverse causality because it is unlikely for future innovation output to affect current family ownership once the current R&D level has been controlled for. We obtain consistent results from this test.

The third set of robustness checks addresses concerns about control variables. We first recall that Table 2 reports a positive yet insignificant impact of institutional ownership on innovation. Table A6 illustrates that this lack of significance arises because high institutional ownership implies a high ownership concentration. Once we remove ownership concentration from the tests, institutional ownership exhibits a positive and significant impact on innovation. The second potential concern is that some omitted long-term variable may drive both innovation and family ownership. To address this issue, Table A7 includes lagged innovation output ($Innov_{i,t}$)—any omitted long-term variables driving both innovation and family ownership should be absorbed by lagged innovation. We find that such an adjustment does not change our findings.

Third, among the control variables, size might play an important role that may not be fully captured by a linear control. To determine whether a potential nonlinear impact may exist, we also consider size-adjusted innovation performance by scaling the innovation measures with total assets. Table A8 reports results that are consistent with our main results. Finally, to ensure that our results are not driven by potential different asset sales and acquisition behaviors between family and non-family firms, we exclude firm-year observations during which firms engaged in asset sales or M&A activities (as acquirer) during t−1 to t+1. Tables A9 and A10 show that our main results remain robust to the exclusion of these observations.

The fourth set of robustness checks concerns our econometric specifications. To alleviate the concern that unobservable industry-year factors may drive our results, we include industry-year joint fixed effects in our regression for Table A11. We also follow Petersen (2009) and double-cluster the standard errors by firm and year in Table A12. Our results remain robust to both specifications. Overall, tests reported in this Internet Appendix suggest that the main relationship between family ownership and innovation is highly robust to alternative specifications.

Table A13 examines the exclusion restriction of our instrument in which we directly regress the four innovation variables on the state-level divorce rate. We find that the instrument has insignificant explanatory power for the dependent variables, which provides favorable evidence that the instrument meets the exclusion restriction.

Table A14 explores the impact of cross-county trust. We obtain the trust measure from the General Social Survey (GSS) questionnaire, which asks respondents about the extent to which they can trust others. We assign value of 1 when respondents state that they can trust others and 0 otherwise. The cross-county trust measure is averaged across all respondents from that county in 2000. In cases where the trust measure is not available in that county in 2000, we use averages from the most recent years. In Panel A, we regress innovation on trust, and find that cross-county trust in the U.S. does not significantly affect firm-level innovation. The t-statistics of the impact is typically approximately 1.5. This marginal lack of significance suggests that the modern capitalism institutions adopted in the country may partially offset the otherwise negative impact of distrust on innovation, which motivates us to further conduct a two-stage test to explore the impact of trust on family ownership in the first stage and the impact of trust-instrumented family ownership on innovation in the second stage. Model 1 of Panel B conducts the first-stage test from which we find that the prosperity of family firms is indeed associated with low trust. The next four models show that low trust-induced family dummies nonetheless promote innovation. Panel C applies the same two-stage test by using the variable of family ownership percentage and presents very similar results: low-trust is typically associated with higher family ownership in a firm, and higher family ownership nonetheless promotes innovation.

Table A1 Propensity Score Matching

The sample period ranges from 2000 to 2010. We create a propensity score matched sample via following steps: 1) For each year, we estimate the propensity to be a family firm given various firm characteristics by using a Probit model: $Prob(Family|X_t) = \alpha_j + \gamma' X_t + \varepsilon_t$, where α_j is the industry fixed effect at the 2-digit SIC level and X is a vector of control variables measured at t. 2) We rank the estimated propensity score obtained in step 1 in ascending order and match each family firm to a non-family firm with the closest propensity score. 3) We repeat steps 1 and 2 for all years in our sample. In Panel A, we provide results for t tests on the control variables for family firms and non-family firms matched based on propensity score matching. In Panel B, we estimate the following regression model by using family firms and matched non-family firms: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at t; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at $t+1$. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A T Tests on Matched Sample

	Non-family	Family	p-value
Propensity Score	0.181	0.181	0.921
Firm age	18.787	19.594	0.170
M/B	2.169	2.125	0.547
% Inst Own	0.456	0.474	0.137
Own Concentration	0.090	0.091	0.464
Asset	6.168	6.230	0.177
R&D	0.619	0.676	0.198
Capital Intensity	5.138	5.229	0.135
CAPEX	2.815	2.851	0.528
Leverage	0.206	0.207	0.847
Profit Margin	0.085	0.082	0.365

Panel B Regressions on Matched Sample

	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.049*	0.074**	0.042*	0.033**
	(0.029)	(0.031)	(0.023)	(0.014)
Firm age	0.002	0.002	0.001	0.001
	(0.003)	(0.003)	(0.002)	(0.001)
M/B	0.014	0.020	0.012	0.005
	(0.012)	(0.016)	(0.010)	(0.005)
% Inst Own	-0.073	-0.102	-0.057	-0.035
	(0.066)	(0.084)	(0.054)	(0.032)
Own Concentration	-0.106	-0.331*	-0.035	-0.067
	(0.112)	(0.187)	(0.091)	(0.051)
Asset	0.053*	0.044	0.049*	0.023
	(0.031)	(0.037)	(0.025)	(0.015)
R&D	0.246***	0.277***	0.191***	0.076**
	(0.053)	(0.075)	(0.043)	(0.031)
Capital Intensity	0.018	0.029	0.015	0.015
	(0.026)	(0.037)	(0.023)	(0.014)
CAPEX	0.042**	0.074***	0.032**	0.021**
	(0.018)	(0.028)	(0.015)	(0.009)
Leverage	-0.125	-0.118	-0.084	-0.004
	(0.118)	(0.156)	(0.097)	(0.067)
Profit Margin	-0.031	-0.155	-0.084	-0.201
	(0.248)	(0.340)	(0.221)	(0.144)
Constant	-0.563**	-0.535**	-0.511***	-0.253*
	(0.224)	(0.258)	(0.196)	(0.145)
Observations	3,612	3,612	3,612	3,612
R-squared	0.3748	0.2999	0.3559	0.2352
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A2 Alternative Definitions of Family Firm Dummy

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at t; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. In Panel A, the family dummy is equal to one if the family ownership percentage is above 30%. In Panel B, the family firm dummy is one if the family ownership percentage is above 40%. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family ownership>30%				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.092**	0.120**	0.078**	0.063**
	(0.041)	(0.057)	(0.036)	(0.027)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.008)	(0.013)	(0.005)	(0.006)
% Inst Own	-0.001	0.014	-0.014	-0.023
	(0.040)	(0.047)	(0.031)	(0.017)
Own Concentration	0.509**	0.287	0.529***	0.248***
	(0.210)	(0.262)	(0.178)	(0.092)
Asset	0.069**	0.057	0.065**	0.026
	(0.032)	(0.043)	(0.028)	(0.020)
R&D	0.313***	0.344***	0.253***	0.114***
	(0.060)	(0.087)	(0.052)	(0.041)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.030)	(0.044)	(0.027)	(0.021)
CAPEX	0.087***	0.122**	0.070**	0.049**
	(0.032)	(0.047)	(0.028)	(0.023)
Leverage	-0.263**	-0.416***	-0.226**	-0.183**
	(0.117)	(0.159)	(0.101)	(0.079)
Profit Margin	-0.199	-0.427	-0.096	-0.116
	(0.260)	(0.371)	(0.211)	(0.123)
Constant	-1.799***	-1.988***	-1.483***	-0.651***
	(0.387)	(0.438)	(0.343)	(0.216)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5172	0.4361	0.4933	0.3466
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family ownership>40%				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.067*	0.118**	0.060**	0.058***
	(0.034)	(0.046)	(0.030)	(0.019)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.008)	(0.013)	(0.005)	(0.006)
% Inst Own	-0.004	0.012	-0.016	-0.024
	(0.040)	(0.047)	(0.031)	(0.017)
Own Concentration	0.533**	0.306	0.549***	0.260***
	(0.207)	(0.250)	(0.177)	(0.093)
Asset	0.070**	0.057	0.065**	0.026
	(0.032)	(0.043)	(0.028)	(0.020)
R&D	0.312***	0.344***	0.252***	0.114***
	(0.060)	(0.087)	(0.052)	(0.041)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.030)	(0.044)	(0.028)	(0.021)
CAPEX	0.087***	0.122***	0.070**	0.049**
	(0.032)	(0.047)	(0.028)	(0.023)
Leverage	-0.265**	-0.418***	-0.227**	-0.184**
	(0.118)	(0.160)	(0.102)	(0.079)
Profit Margin	-0.196	-0.425	-0.093	-0.114
	(0.261)	(0.371)	(0.211)	(0.123)
Constant	-1.798***	-1.988***	-1.482***	-0.651***
	(0.387)	(0.438)	(0.343)	(0.216)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5170	0.4360	0.4931	0.3464
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A3: Non-zero Innovation Measures

The sample period ranges from 2000 to 2010. We drop all observations with zero innovation measures. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at t; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at $t+1$. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Ownership Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.237*	0.257*	0.204*	0.228**
	(0.124)	(0.148)	(0.118)	(0.104)
Firm age	0.000	-0.002	0.000	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
M/B	0.023**	0.036***	0.014*	0.015**
	(0.009)	(0.014)	(0.008)	(0.007)
% Inst Own	0.010	-0.003	0.005	-0.000
	(0.070)	(0.117)	(0.068)	(0.062)
Own Concentration	0.687	-0.747	0.743	0.069
	(0.460)	(0.712)	(0.546)	(0.542)
Asset	0.254***	0.167**	0.239***	0.170***
	(0.048)	(0.070)	(0.044)	(0.055)
R&D	0.309***	0.341***	0.275***	0.216***
	(0.025)	(0.041)	(0.024)	(0.029)
Capital Intensity	0.051	0.097	0.048	0.093*
	(0.049)	(0.068)	(0.045)	(0.053)
CAPEX	0.152***	0.269***	0.135***	0.163***
	(0.041)	(0.054)	(0.037)	(0.039)
Leverage	-0.699***	-0.958***	-0.646***	-0.685***
	(0.164)	(0.219)	(0.157)	(0.160)
Profit Margin	-0.281	-0.280	-0.180	-0.229
	(0.215)	(0.285)	(0.209)	(0.202)
Constant	-4.991***	-2.544***	-3.357***	-3.902***
	(0.369)	(0.601)	(0.361)	(0.430)
Observations	5,185	3,813	4,992	2,820
R-squared	0.5995	0.5062	0.5858	0.5682
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B % Family Ownership				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.579**	0.692*	0.533*	0.698***
	(0.291)	(0.361)	(0.281)	(0.240)
Firm age	0.000	-0.002	0.000	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
M/B	0.023**	0.036***	0.014*	0.015**
	(0.009)	(0.014)	(0.008)	(0.007)
% Inst Own	0.009	-0.001	0.005	0.002
	(0.070)	(0.115)	(0.067)	(0.062)
Own Concentration	0.727	-0.706	0.777	0.103
	(0.461)	(0.683)	(0.544)	(0.537)
Asset	0.253***	0.166**	0.238***	0.169***
	(0.048)	(0.069)	(0.044)	(0.054)
R&D	0.309***	0.342***	0.276***	0.217***
	(0.025)	(0.042)	(0.024)	(0.030)
Capital Intensity	0.052	0.099	0.049	0.096*
	(0.049)	(0.068)	(0.045)	(0.053)
CAPEX	0.152***	0.269***	0.135***	0.164***
	(0.041)	(0.054)	(0.037)	(0.039)
Leverage	-0.698***	-0.958***	-0.645***	-0.684***
	(0.164)	(0.219)	(0.158)	(0.160)
Profit Margin	-0.276	-0.281	-0.178	-0.230
	(0.214)	(0.282)	(0.208)	(0.202)
Constant	-4.991***	-2.557***	-3.365***	-3.910***
	(0.369)	(0.603)	(0.361)	(0.431)
Observations	5,185	3,813	4,992	2,820
R-squared	0.5996	0.5065	0.5860	0.5692
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A4 Restricted to Patents Filed Before 2008

The sample period ranges from 2000 to 2007. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at t; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at $t+1$. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Ownership Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.078*	0.102**	0.075**	0.068***
	(0.042)	(0.051)	(0.034)	(0.023)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.002)	(0.001)	(0.001)
M/B	0.020***	0.031**	0.013***	0.012**
	(0.007)	(0.012)	(0.004)	(0.005)
% Inst Own	-0.011	-0.009	-0.026	-0.038*
	(0.048)	(0.053)	(0.037)	(0.020)
Own Concentration	0.436**	0.162	0.498***	0.239**
	(0.189)	(0.246)	(0.167)	(0.098)
Asset	0.080**	0.069	0.077**	0.030
	(0.039)	(0.052)	(0.034)	(0.026)
R&D	0.390***	0.448***	0.318***	0.150***
	(0.048)	(0.084)	(0.044)	(0.047)
Capital Intensity	0.004	0.013	-0.001	0.010
	(0.033)	(0.047)	(0.030)	(0.024)
CAPEX	0.093***	0.137***	0.076**	0.058**
	(0.036)	(0.051)	(0.032)	(0.026)
Leverage	-0.253**	-0.433***	-0.218**	-0.190**
	(0.114)	(0.149)	(0.099)	(0.079)
Profit Margin	-0.031	-0.223	0.065	-0.050
	(0.293)	(0.420)	(0.230)	(0.147)
Constant	-1.494***	-1.704***	-1.294***	-0.728***
	(0.296)	(0.295)	(0.274)	(0.163)
Observations	13,726	13,726	13,726	13,726
R-squared	0.5810	0.4981	0.5590	0.3996
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B % Family Ownership				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.156*	0.233**	0.144**	0.136***
	(0.085)	(0.104)	(0.073)	(0.049)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.002)	(0.001)	(0.001)
M/B	0.020***	0.032**	0.013***	0.012**
	(0.007)	(0.012)	(0.004)	(0.005)
% Inst Own	-0.013	-0.010	-0.028	-0.039*
	(0.048)	(0.053)	(0.037)	(0.021)
Own Concentration	0.450**	0.172	0.514***	0.251**
	(0.198)	(0.257)	(0.173)	(0.102)
Asset	0.080**	0.070	0.077**	0.031
	(0.039)	(0.052)	(0.034)	(0.027)
R&D	0.389***	0.447***	0.318***	0.150***
	(0.048)	(0.084)	(0.044)	(0.047)
Capital Intensity	0.004	0.013	-0.001	0.010
	(0.033)	(0.047)	(0.030)	(0.024)
CAPEX	0.093**	0.137***	0.076**	0.058**
	(0.036)	(0.051)	(0.032)	(0.026)
Leverage	-0.256**	-0.437***	-0.221**	-0.193**
	(0.115)	(0.149)	(0.100)	(0.079)
Profit Margin	-0.030	-0.223	0.066	-0.049
	(0.294)	(0.421)	(0.230)	(0.147)
Constant	-1.493***	-1.704***	-1.293***	-0.727***
	(0.296)	(0.294)	(0.274)	(0.164)
Observations	13,726	13,726	13,726	13,726
R-squared	0.5810	0.4981	0.5590	0.3996
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A5 Long-term Effect of Family Ownership on Innovation

The sample period ranges from 2000 to 2010. In Panels A1 and A2, we estimate the following regression model: $Innov_{i,t+2} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at *t*; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+2*. Panel A1 uses the family ownership dummy, and Panel A2 uses the family ownership percentage. In Panels B1 and B2, we estimate following regression model: $Innov_{t+3} = \alpha_j + \alpha_t + \beta_1 Family + \gamma' X_t + \varepsilon_t$. The innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+3*. Panel B1 uses the family ownership dummy, and Panel B2 uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A1 Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+2	Citation,t+2	Originality,t+2	Generality,t+2
Family	0.072*	0.082*	0.068**	0.052**
	(0.037)	(0.044)	(0.029)	(0.020)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.025***	0.036***	0.019***	0.013**
	(0.008)	(0.013)	(0.006)	(0.006)
% Inst Own	-0.016	-0.007	-0.025	-0.025
	(0.041)	(0.048)	(0.032)	(0.017)
Own Concentration	0.462***	0.174	0.491***	0.202**
	(0.176)	(0.194)	(0.156)	(0.083)
Asset	0.062*	0.041	0.060*	0.019
	(0.035)	(0.047)	(0.031)	(0.020)
R&D	0.301***	0.316***	0.243***	0.098**
	(0.064)	(0.089)	(0.056)	(0.039)
Capital Intensity	0.020	0.033	0.014	0.013
	(0.034)	(0.048)	(0.030)	(0.020)
CAPEX	0.093***	0.127***	0.075**	0.047**
	(0.033)	(0.049)	(0.029)	(0.022)
Leverage	-0.289**	-0.386**	-0.241**	-0.169**
	(0.117)	(0.158)	(0.100)	(0.076)
Profit Margin	-0.179	-0.364	-0.102	-0.076
	(0.263)	(0.329)	(0.214)	(0.109)
Constant	-0.932***	-0.432*	-0.819***	-0.088
	(0.184)	(0.248)	(0.152)	(0.115)
Observations	14,412	14,412	14,412	14,412
R-squared	0.5107	0.4220	0.4874	0.3243
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel A2 Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+2	Citation,t+2	Originality,t+2	Generality,t+2
% Family Own	0.156**	0.210**	0.140**	0.110***
	(0.076)	(0.095)	(0.064)	(0.042)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.025***	0.036***	0.019***	0.013**
	(0.008)	(0.013)	(0.006)	(0.006)
% Inst Own	-0.017	-0.008	-0.026	-0.026
	(0.041)	(0.049)	(0.032)	(0.018)
Own Concentration	0.471**	0.174	0.502***	0.209**
	(0.183)	(0.204)	(0.161)	(0.085)
Asset	0.062*	0.041	0.060*	0.019
	(0.035)	(0.048)	(0.031)	(0.020)
R&D	0.301***	0.316***	0.243***	0.098**
	(0.064)	(0.089)	(0.056)	(0.039)
Capital Intensity	0.020	0.032	0.014	0.013
	(0.034)	(0.048)	(0.030)	(0.020)
CAPEX	0.093***	0.126***	0.075**	0.047**
	(0.033)	(0.049)	(0.029)	(0.022)
Leverage	-0.292**	-0.389**	-0.244**	-0.171**
	(0.118)	(0.159)	(0.100)	(0.076)
Profit Margin	-0.178	-0.364	-0.101	-0.076
	(0.264)	(0.330)	(0.215)	(0.110)
Constant	-0.932***	-0.432*	-0.819***	-0.088
	(0.183)	(0.248)	(0.152)	(0.115)
Observations	14,412	14,412	14,412	14,412
R-squared	0.5108	0.4221	0.4874	0.3243
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B1 Family Firm Dummy				
	(1)	(2)	(3)	(4)

Panel B2 Family Ownership Percentage				
	(1)	(2)	(3)	(4)

VARIABLES	Patent,t+3	Citation,t+3	Originality,t+3	Generality,t+3
Family	0.076**	0.093**	0.067**	0.047**
	(0.037)	(0.043)	(0.029)	(0.020)
Firm age	0.004***	0.004***	0.004***	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
M/B	0.026***	0.033**	0.020***	0.011*
	(0.008)	(0.014)	(0.006)	(0.006)
% Inst Own	-0.024	-0.016	-0.029	-0.027
	(0.042)	(0.045)	(0.033)	(0.019)
Own Concentration	0.350**	0.065	0.390**	0.164*
	(0.176)	(0.223)	(0.153)	(0.084)
Asset	0.055	0.034	0.054	0.016
	(0.038)	(0.047)	(0.033)	(0.019)
R&D	0.289***	0.288***	0.233***	0.082**
	(0.068)	(0.090)	(0.058)	(0.036)
Capital Intensity	0.024	0.030	0.016	0.011
	(0.037)	(0.049)	(0.032)	(0.019)
CAPEX	0.096***	0.120**	0.077**	0.040*
	(0.035)	(0.049)	(0.030)	(0.021)
Leverage	-0.326***	-0.381**	-0.274***	-0.146**
	(0.118)	(0.149)	(0.102)	(0.071)
Profit Margin	-0.153	-0.184	-0.084	-0.014
	(0.263)	(0.326)	(0.216)	(0.133)
Constant	-0.091	0.360	-0.090	0.075
	(0.184)	(0.258)	(0.157)	(0.125)
Observations	12,035	12,035	12,035	12,035
R-squared	0.5056	0.4054	0.4818	0.2976
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

VARIABLES	Patent,t+3	Citation,t+3	Originality,t+3	Generality,t+3
% Family Own	0.170**	0.233**	0.143**	0.101**
	(0.082)	(0.096)	(0.066)	(0.042)
Firm age	0.004***	0.005***	0.004***	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
M/B	0.026***	0.034**	0.020***	0.011*
	(0.008)	(0.014)	(0.006)	(0.006)
% Inst Own	-0.026	-0.017	-0.030	-0.028
	(0.042)	(0.046)	(0.033)	(0.019)
Own Concentration	0.358*	0.066	0.398**	0.170**
	(0.185)	(0.233)	(0.160)	(0.085)
Asset	0.056	0.034	0.054	0.016
	(0.038)	(0.048)	(0.033)	(0.019)
R&D	0.289***	0.288***	0.232***	0.082**
	(0.068)	(0.090)	(0.058)	(0.036)
Capital Intensity	0.024	0.030	0.016	0.011
	(0.037)	(0.049)	(0.032)	(0.020)
CAPEX	0.096***	0.119**	0.077**	0.040*
	(0.035)	(0.049)	(0.030)	(0.021)
Leverage	-0.329***	-0.384**	-0.277***	-0.148**
	(0.119)	(0.150)	(0.102)	(0.072)
Profit Margin	-0.153	-0.185	-0.084	-0.014
	(0.264)	(0.327)	(0.217)	(0.133)
Constant	-0.093	0.356	-0.092	0.074
	(0.184)	(0.258)	(0.158)	(0.125)
Observations	12,035	12,035	12,035	12,035
R-squared	0.5056	0.4055	0.4818	0.2977
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A6 Reconcile with Aghion et al. (2013)

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at *t*; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.081**	0.092**	0.077***	0.061***
	(0.032)	(0.038)	(0.027)	(0.022)
Firm age	0.004***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.015**	0.021*	0.010*	0.009*
	(0.007)	(0.012)	(0.005)	(0.005)
% Inst Own	0.089*	0.124**	0.061*	0.016
	(0.049)	(0.053)	(0.036)	(0.015)
Asset	0.042**	0.024	0.046**	0.023
	(0.019)	(0.024)	(0.018)	(0.014)
R&D	0.371***	0.428***	0.293***	0.131***
	(0.067)	(0.103)	(0.056)	(0.044)
Capital Intensity	-0.020	-0.011	-0.021	-0.005
	(0.017)	(0.020)	(0.015)	(0.009)
CAPEX	0.062***	0.088***	0.051***	0.036**
	(0.020)	(0.028)	(0.018)	(0.015)
Leverage	-0.261*	-0.410**	-0.222*	-0.187**
	(0.148)	(0.199)	(0.123)	(0.087)
Profit Margin	-0.312	-0.552	-0.207	-0.195
	(0.257)	(0.381)	(0.208)	(0.135)
Constant	-1.176***	-1.330***	-0.996***	-0.522***
	(0.286)	(0.351)	(0.257)	(0.190)
Observations	17,025	17,025	17,025	17,025
R-squared	0.4881	0.4047	0.4659	0.3214
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(5)	(6)	(7)	(8)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.147**	0.182**	0.136**	0.118***
	(0.062)	(0.077)	(0.055)	(0.044)
Firm age	0.004***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.015**	0.022*	0.010**	0.009*
	(0.007)	(0.012)	(0.005)	(0.005)
% Inst Own	0.087*	0.123**	0.059*	0.015
	(0.049)	(0.053)	(0.036)	(0.015)
Asset	0.042**	0.023	0.046**	0.022
	(0.019)	(0.024)	(0.018)	(0.014)
R&D	0.371***	0.428***	0.292***	0.131***
	(0.067)	(0.103)	(0.056)	(0.044)
Capital Intensity	-0.020	-0.011	-0.021	-0.005
	(0.017)	(0.020)	(0.015)	(0.009)
CAPEX	0.062***	0.088***	0.051***	0.036**
	(0.020)	(0.028)	(0.018)	(0.015)
Leverage	-0.263*	-0.413**	-0.224*	-0.189**
	(0.149)	(0.199)	(0.124)	(0.088)
Profit Margin	-0.310	-0.550	-0.205	-0.194
	(0.258)	(0.381)	(0.208)	(0.135)
Constant	-1.169***	-1.324***	-0.989***	-0.518***
	(0.285)	(0.351)	(0.256)	(0.189)
Observations	17,025	17,025	17,025	17,025
R-squared	0.4880	0.4047	0.4657	0.3213
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A7 Lagged Innovation Included

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{i,t+1} = \beta_0 Innov_{i,t} + \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at *t*; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Ownership Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.018***	0.019***	0.015**	0.003
	(0.007)	(0.003)	(0.007)	(0.002)
Patent,t	0.793***			
	(0.047)			
Citations, t		0.670***		
		(0.045)		
Originality, t			0.794***	
			(0.049)	
Generality, t				0.670***
				(0.062)
Firm age	0.001***	0.001***	0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
M/B	0.007**	0.011*	0.006**	0.002
	(0.004)	(0.006)	(0.003)	(0.002)
% Inst Own	0.039**	0.022	0.033**	0.007
	(0.016)	(0.025)	(0.013)	(0.009)
Own Concentration	-0.079*	-0.084	-0.072*	-0.037
	(0.046)	(0.078)	(0.040)	(0.030)
Asset	-0.003	-0.006	-0.004	-0.008***
	(0.009)	(0.017)	(0.006)	(0.002)
R&D	-0.012	0.002	-0.014	-0.014**
	(0.016)	(0.021)	(0.013)	(0.006)
Capital Intensity	0.012	0.008	0.010	0.004
	(0.009)	(0.019)	(0.008)	(0.003)
CAPEX	0.012	0.029*	0.009	0.006*
	(0.009)	(0.015)	(0.006)	(0.003)
Leverage	-0.054	-0.083	-0.042	-0.020
	(0.038)	(0.051)	(0.029)	(0.022)
Profit Margin	0.051	-0.114	0.042	-0.012
	(0.095)	(0.136)	(0.077)	(0.047)
Constant	-0.253**	-0.018	-0.151*	0.070***
	(0.109)	(0.069)	(0.081)	(0.018)
Observations	15,278	15,278	15,278	15,278
R-squared	0.8287	0.7400	0.8291	0.7875
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B % Family Ownership				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.052***	0.066***	0.039***	0.013***
	(0.010)	(0.005)	(0.013)	(0.004)
Patent,t	0.793***			
	(0.047)			
Citations, t		0.670***		
		(0.045)		
Originality, t			0.794***	
			(0.049)	
Generality, t				0.670***
				(0.062)
Firm age	0.001***	0.001***	0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
M/B	0.008**	0.011*	0.006**	0.002
	(0.004)	(0.006)	(0.003)	(0.002)
% Inst Own	0.039**	0.022	0.033**	0.007
	(0.016)	(0.026)	(0.013)	(0.009)
Own Concentration	-0.080*	-0.086	-0.072*	-0.038
	(0.046)	(0.079)	(0.040)	(0.030)
Asset	-0.003	-0.006	-0.004	-0.008***
	(0.009)	(0.017)	(0.006)	(0.003)
R&D	-0.012	0.002	-0.014	-0.014**
	(0.016)	(0.021)	(0.013)	(0.006)
Capital Intensity	0.012	0.008	0.010	0.004
	(0.009)	(0.019)	(0.008)	(0.003)
CAPEX	0.012	0.029*	0.009	0.006*
	(0.009)	(0.015)	(0.006)	(0.003)
Leverage	-0.055	-0.084*	-0.043	-0.020
	(0.038)	(0.051)	(0.029)	(0.021)
Profit Margin	0.051	-0.115	0.042	-0.012
	(0.095)	(0.135)	(0.077)	(0.047)
Constant	-0.253**	-0.020	-0.151*	0.070***
	(0.109)	(0.069)	(0.081)	(0.018)
Observations	15,278	15,278	15,278	15,278
R-squared	0.8288	0.7400	0.8291	0.7875
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A8: Innovation Measures Scaled by Firm Size

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at 2-digit SIC level; α_t is the year fixed effect; *X* is a vector of control variables measured at *t*; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*, scaled by log asset at *t*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1 /Asset,t	Citation,t+1 /Asset,t	Originality,t+1 /Asset,t	Generality,t+1 /Asset,t
Family	0.070*	0.088*	0.065**	0.057***
	(0.036)	(0.046)	(0.029)	(0.021)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.008)	(0.013)	(0.005)	(0.006)
% Inst Own	-0.002	0.014	-0.014	-0.022
	(0.041)	(0.047)	(0.031)	(0.017)
Own Concentration	0.507**	0.287	0.522***	0.239***
	(0.198)	(0.245)	(0.172)	(0.090)
Asset	-0.931***	-0.943***	-0.935***	-0.974***
	(0.032)	(0.043)	(0.028)	(0.020)
R&D	0.313***	0.344***	0.253***	0.114***
	(0.060)	(0.087)	(0.052)	(0.041)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.030)	(0.044)	(0.027)	(0.020)
CAPEX	0.087***	0.122***	0.070**	0.049**
	(0.032)	(0.047)	(0.028)	(0.023)
Leverage	-0.261**	-0.413***	-0.223**	-0.180**
	(0.117)	(0.159)	(0.101)	(0.079)
Profit Margin	-0.199	-0.426	-0.096	-0.116
	(0.260)	(0.370)	(0.210)	(0.122)
Constant	-1.798***	-1.987***	-1.483***	-0.651***
	(0.386)	(0.437)	(0.343)	(0.216)
Observations	17,025	17,025	17,025	17,025
R-squared	0.7346	0.6035	0.7880	0.8872
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1 /Asset,t	Citation,t+1 /Asset,t	Originality,t+1 /Asset,t	Generality,t+1 /Asset,t
% Family Own	0.148**	0.209**	0.132**	0.116***
	(0.071)	(0.092)	(0.061)	(0.044)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.008)	(0.013)	(0.005)	(0.006)
% Inst Own	-0.003	0.013	-0.015	-0.024
	(0.041)	(0.047)	(0.031)	(0.017)
Own Concentration	0.516**	0.292	0.533***	0.248***
	(0.204)	(0.252)	(0.175)	(0.092)
Asset	-0.930***	-0.943***	-0.934***	-0.974***
	(0.032)	(0.043)	(0.028)	(0.020)
R&D	0.313***	0.344***	0.253***	0.114***
	(0.060)	(0.087)	(0.052)	(0.041)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.030)	(0.044)	(0.027)	(0.021)
CAPEX	0.087***	0.122***	0.070**	0.049**
	(0.032)	(0.047)	(0.028)	(0.023)
Leverage	-0.264**	-0.416***	-0.226**	-0.183**
	(0.117)	(0.160)	(0.101)	(0.079)
Profit Margin	-0.198	-0.426	-0.095	-0.115
	(0.260)	(0.371)	(0.211)	(0.123)
Constant	-1.799***	-1.988***	-1.483***	-0.651***
	(0.387)	(0.438)	(0.343)	(0.216)
Observations	17,025	17,025	17,025	17,025
R-squared	0.7346	0.6035	0.7880	0.8872
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A9: Exclude Firm-year with Asset Sales during t−1 to t+1

The sample period ranges from 2000 to 2010. We include firm-year observations where there are no asset sales (Compustat item 107) during *t−1* to *t+1*. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at t; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.087*	0.083	0.085**	0.063*
	(0.048)	(0.062)	(0.041)	(0.035)
Firm age	0.004**	0.005**	0.004**	0.002*
	(0.002)	(0.002)	(0.002)	(0.001)
M/B	0.032**	0.043**	0.024**	0.015*
	(0.013)	(0.019)	(0.010)	(0.008)
% Inst Own	-0.051	-0.062	-0.055	-0.045
	(0.049)	(0.075)	(0.039)	(0.030)
Own Concentration	0.786***	0.575**	0.762***	0.377***
	(0.278)	(0.287)	(0.248)	(0.137)
Asset	0.084**	0.069	0.074**	0.031
	(0.041)	(0.049)	(0.036)	(0.021)
R&D	0.292***	0.292***	0.237***	0.095**
	(0.062)	(0.086)	(0.054)	(0.038)
Capital Intensity	-0.004	0.014	-0.006	0.006
	(0.025)	(0.037)	(0.021)	(0.015)
CAPEX	0.068**	0.100**	0.057**	0.038**
	(0.028)	(0.047)	(0.026)	(0.019)
Leverage	-0.299*	-0.418*	-0.253*	-0.155*
	(0.173)	(0.220)	(0.151)	(0.093)
Profit Margin	0.030	-0.198	0.096	-0.033
	(0.340)	(0.389)	(0.286)	(0.145)
Constant	-0.476**	0.053	-0.440***	-0.048
	(0.213)	(0.298)	(0.163)	(0.117)
Observations	7,072	7,072	7,072	7,072
R-squared	0.5119	0.4208	0.4881	0.3285
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.174**	0.187	0.155**	0.116*
	(0.086)	(0.121)	(0.076)	(0.063)
Firm age	0.004**	0.005**	0.004**	0.002**
	(0.002)	(0.002)	(0.002)	(0.001)
M/B	0.032**	0.043**	0.024**	0.015*
	(0.013)	(0.019)	(0.010)	(0.008)
% Inst Own	-0.052	-0.063	-0.057	-0.046
	(0.049)	(0.076)	(0.039)	(0.031)
Own Concentration	0.807***	0.587*	0.789***	0.397***
	(0.290)	(0.301)	(0.260)	(0.148)
Asset	0.084**	0.069	0.075**	0.031
	(0.041)	(0.050)	(0.036)	(0.021)
R&D	0.292***	0.291***	0.236***	0.094**
	(0.062)	(0.086)	(0.054)	(0.038)
Capital Intensity	-0.004	0.014	-0.006	0.006
	(0.025)	(0.037)	(0.021)	(0.016)
CAPEX	0.067**	0.099**	0.057**	0.038**
	(0.028)	(0.047)	(0.026)	(0.019)
Leverage	-0.302*	-0.421*	-0.256*	-0.157*
	(0.172)	(0.219)	(0.150)	(0.093)
Profit Margin	0.032	-0.197	0.100	-0.031
	(0.339)	(0.389)	(0.285)	(0.144)
Constant	-0.477**	0.051	-0.440***	-0.048
	(0.214)	(0.299)	(0.164)	(0.118)
Observations	7,072	7,072	7,072	7,072
R-squared	0.5119	0.4208	0.4880	0.3283
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A10: Exclude Firm-years with M&A during t-1 to t+1

The sample period ranges from 2000 to 2010. We exclude firm-year observations where firms engage in M&A activities (as acquirer) during *t−1* to *t+1*. M&A information is from SDC. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at *t*; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.050	0.079*	0.046*	0.042***
	(0.032)	(0.040)	(0.025)	(0.016)
Firm age	0.003**	0.004**	0.003**	0.002**
	(0.002)	(0.002)	(0.001)	(0.001)
M/B	0.013*	0.018*	0.008*	0.008**
	(0.007)	(0.010)	(0.005)	(0.004)
% Inst Own	0.001	-0.031	-0.002	-0.024
	(0.047)	(0.057)	(0.035)	(0.028)
Own Concentration	0.251	0.148	0.267**	0.115**
	(0.155)	(0.232)	(0.119)	(0.058)
Asset	0.055**	0.049	0.052**	0.026
	(0.027)	(0.037)	(0.023)	(0.017)
R&D	0.317***	0.367***	0.254***	0.117***
	(0.060)	(0.090)	(0.050)	(0.040)
Capital Intensity	0.009	0.031	0.005	0.009
	(0.024)	(0.036)	(0.021)	(0.016)
CAPEX	0.066***	0.097***	0.049***	0.028**
	(0.023)	(0.034)	(0.018)	(0.012)
Leverage	-0.183*	-0.372**	-0.143*	-0.119**
	(0.101)	(0.151)	(0.083)	(0.060)
Profit Margin	-0.059	-0.156	0.006	0.008
	(0.235)	(0.313)	(0.165)	(0.074)
Constant	-0.603***	-0.381*	-0.519***	-0.114
	(0.183)	(0.207)	(0.160)	(0.111)
Observations	11,666	11,666	11,666	11,666
R-squared	0.4910	0.4098	0.4660	0.3247
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.101*	0.161**	0.089*	0.082**
	(0.061)	(0.075)	(0.052)	(0.033)
Firm age	0.003**	0.004**	0.003**	0.002**
	(0.002)	(0.002)	(0.001)	(0.001)
M/B	0.013*	0.018*	0.008*	0.008**
	(0.007)	(0.010)	(0.005)	(0.004)
% Inst Own	-0.000	-0.033	-0.003	-0.025
	(0.048)	(0.058)	(0.035)	(0.028)
Own Concentration	0.260*	0.161	0.277**	0.123**
	(0.157)	(0.235)	(0.121)	(0.060)
Asset	0.055**	0.049	0.052**	0.026
	(0.027)	(0.037)	(0.023)	(0.017)
R&D	0.317***	0.366***	0.253***	0.116***
	(0.060)	(0.090)	(0.050)	(0.040)
Capital Intensity	0.009	0.031	0.005	0.009
	(0.024)	(0.036)	(0.021)	(0.016)
CAPEX	0.065***	0.097***	0.049***	0.027**
	(0.023)	(0.034)	(0.018)	(0.012)
Leverage	-0.185*	-0.376**	-0.146*	-0.121**
	(0.101)	(0.152)	(0.084)	(0.060)
Profit Margin	-0.058	-0.155	0.007	0.009
	(0.235)	(0.313)	(0.166)	(0.074)
Constant	-0.604***	-0.382*	-0.519***	-0.114
	(0.183)	(0.207)	(0.161)	(0.112)
Observations	11,666	11,666	11,666	11,666
R-squared	0.4909	0.4098	0.4659	0.3246
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A11 Industry-year Joint Fixed Effects

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{i,t+1} = \alpha_{jt} + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_{jt} is the industry-year joint fixed effect at the 2-digit SIC level in every year; *X* is a vector of control variables measured at *t*; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Family Firm Dummy				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.061*	0.067*	0.058**	0.045***
	(0.036)	(0.036)	(0.027)	(0.013)
Firm age	0.004***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.019***	0.026***	0.013***	0.010***
	(0.007)	(0.009)	(0.004)	(0.003)
% Inst Own	-0.012	-0.008	-0.023	-0.032*
	(0.047)	(0.053)	(0.037)	(0.019)
Own Concentration	0.503**	0.271	0.525***	0.230**
	(0.190)	(0.218)	(0.173)	(0.087)
Asset	0.070**	0.069*	0.066**	0.032*
	(0.032)	(0.041)	(0.028)	(0.017)
R&D	0.323***	0.362***	0.261***	0.121***
	(0.038)	(0.048)	(0.033)	(0.022)
Capital Intensity	0.003	0.009	-0.000	0.006
	(0.031)	(0.043)	(0.028)	(0.020)
CAPEX	0.081**	0.098**	0.065**	0.038*
	(0.034)	(0.045)	(0.030)	(0.020)
Leverage	-0.254**	-0.374***	-0.217**	-0.161**
	(0.118)	(0.137)	(0.101)	(0.069)
Profit Margin	-0.087	-0.229	0.003	-0.028
	(0.261)	(0.342)	(0.200)	(0.102)
Constant	-1.671***	-1.864***	-1.394***	-0.717***
	(0.244)	(0.258)	(0.236)	(0.157)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5645	0.5150	0.5407	0.4380
SIC2-year joint FE	Yes	Yes	Yes	Yes

Panel B Family Ownership Percentage				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.126*	0.155*	0.113**	0.088***
	(0.070)	(0.087)	(0.057)	(0.029)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.020***	0.026***	0.014***	0.010***
	(0.007)	(0.009)	(0.004)	(0.003)
% Inst Own	-0.013	-0.009	-0.024	-0.033*
	(0.047)	(0.053)	(0.037)	(0.019)
Own Concentration	0.513**	0.276	0.535***	0.239***
	(0.197)	(0.230)	(0.177)	(0.087)
Asset	0.070**	0.070*	0.066**	0.032*
	(0.032)	(0.041)	(0.028)	(0.017)
R&D	0.322***	0.361***	0.261***	0.121***
	(0.038)	(0.048)	(0.033)	(0.022)
Capital Intensity	0.003	0.009	-0.000	0.006
	(0.031)	(0.043)	(0.028)	(0.020)
CAPEX	0.081**	0.098**	0.065**	0.038*
	(0.034)	(0.045)	(0.030)	(0.020)
Leverage	-0.257**	-0.376***	-0.219**	-0.163**
	(0.118)	(0.138)	(0.102)	(0.069)
Profit Margin	-0.086	-0.229	0.004	-0.027
	(0.261)	(0.342)	(0.200)	(0.102)
Constant	-1.672***	-1.865***	-1.394***	-0.717***
	(0.244)	(0.258)	(0.237)	(0.157)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5645	0.5151	0.5407	0.4379
SIC2-year joint FE	Yes	Yes	Yes	Yes

Table A12 Standard Errors Two-way Clustered by Firm and Year

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta \times Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; X is a vector of control variables measured at t; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. Panel A uses the family ownership dummy, and Panel B uses the family ownership percentage. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. Standard errors are two-way clustered at the firm and year level.

	Panel A Family Firm Dummy			
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
Family	0.070*	0.088	0.065*	0.057**
	(0.042)	(0.057)	(0.035)	(0.025)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.002)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.007)	(0.013)	(0.006)	(0.006)
% Inst Own	-0.002	0.014	-0.014	-0.022
	(0.044)	(0.058)	(0.036)	(0.022)
Own Concentration	0.507***	0.287	0.522***	0.239**
	(0.179)	(0.257)	(0.145)	(0.093)
Asset	0.069***	0.057*	0.065***	0.026
	(0.024)	(0.032)	(0.021)	(0.016)
R&D	0.313***	0.344***	0.253***	0.114***
	(0.055)	(0.083)	(0.047)	(0.039)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.020)	(0.030)	(0.017)	(0.010)
CAPEX	0.087***	0.122***	0.070***	0.049***
	(0.018)	(0.027)	(0.016)	(0.014)
Leverage	-0.261***	-0.413***	-0.223***	-0.180***
	(0.089)	(0.135)	(0.077)	(0.063)
Profit Margin	-0.199	-0.426	-0.096	-0.116
	(0.171)	(0.282)	(0.157)	(0.120)
Constant	-1.798***	-1.987***	-1.483***	-0.651***
	(0.190)	(0.270)	(0.174)	(0.157)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5171	0.4360	0.4932	0.3467
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

	Panel B Family Ownership Percentage			
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
% Family Own	0.148*	0.209*	0.132*	0.116**
	(0.084)	(0.114)	(0.070)	(0.049)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.002)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.017***	0.013**
	(0.007)	(0.013)	(0.006)	(0.006)
% Inst Own	-0.003	0.013	-0.015	-0.024
	(0.044)	(0.058)	(0.036)	(0.023)
Own Concentration	0.516***	0.292	0.533***	0.248***
	(0.179)	(0.256)	(0.145)	(0.095)
Asset	0.070***	0.057*	0.066***	0.026
	(0.024)	(0.032)	(0.021)	(0.016)
R&D	0.313***	0.344***	0.253***	0.114***
	(0.055)	(0.083)	(0.047)	(0.039)
Capital Intensity	0.012	0.027	0.007	0.013
	(0.020)	(0.030)	(0.017)	(0.010)
CAPEX	0.087***	0.122***	0.070***	0.049***
	(0.018)	(0.027)	(0.016)	(0.014)
Leverage	-0.264***	-0.416***	-0.226***	-0.183***
	(0.089)	(0.136)	(0.077)	(0.064)
Profit Margin	-0.198	-0.426	-0.095	-0.115
	(0.171)	(0.282)	(0.157)	(0.120)
Constant	-1.799***	-1.988***	-1.483***	-0.651***
	(0.191)	(0.270)	(0.174)	(0.157)
Observations	17,025	17,025	17,025	17,025
R-squared	0.5171	0.4361	0.4932	0.3466
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A13 Exclusion Restrictions of the Instrument

The sample period ranges from 2000 to 2010. We estimate the following regression model: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta_1 Instrument_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; *Instrument* is the state divorce rate at *t*; *X* is a vector of control variables measured at *t*; and the innovation measures are the patent count, patent citation count, patent originality, and patent generality measured at *t+1*. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5% and 1%, respectively. Standard errors are two-way clustered at the industry (2-digit SIC) and year level.

	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation,t+1	Originality,t+1	Generality,t+1
State Divorce	0.029	0.034	0.023	0.009
	(0.020)	(0.025)	(0.016)	(0.008)
Firm age	0.006***	0.007***	0.005***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.024***	0.035***	0.016***	0.011*
	(0.009)	(0.013)	(0.006)	(0.006)
% Inst Own	-0.041	-0.040	-0.043	-0.037*
	(0.035)	(0.051)	(0.029)	(0.022)
Own Concentration	0.328**	0.103	0.354***	0.155**
	(0.158)	(0.242)	(0.126)	(0.077)
Asset	0.088**	0.086*	0.076**	0.031
	(0.034)	(0.048)	(0.030)	(0.022)
R&D	0.297***	0.334***	0.242***	0.113***
	(0.054)	(0.080)	(0.047)	(0.038)
Capital Intensity	-0.017	-0.011	-0.016	0.001
	(0.024)	(0.036)	(0.022)	(0.017)
CAPEX	0.062**	0.087**	0.051*	0.036*
	(0.029)	(0.044)	(0.026)	(0.020)
Leverage	-0.168*	-0.267*	-0.137	-0.105*
	(0.101)	(0.140)	(0.084)	(0.057)
Profit Margin	-0.388	-0.585*	-0.236	-0.148
	(0.244)	(0.354)	(0.195)	(0.125)
Constant	-1.663***	-1.856***	-1.357***	-0.583***
	(0.275)	(0.331)	(0.219)	(0.149)
Observations	17,025	17,025	17,025	17,025
R-squared	0.4992	0.4188	0.4777	0.3341
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table A14: Impact of Cross-county Trust

The sample period ranges from 2000 to 2010. Panel A reports the results of the following regression: $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta_1 Trust_i + \gamma \times X_{i,t} + \varepsilon_{i,t}$, where α_j is the industry fixed effect at the 2-digit SIC level; α_t is the year fixed effect; and $Trust_i$ is the county-level trust constructed from the General Social Survey (GSS) survey conducted in 2000. Panels B and C estimate the following two-stage regression model: $Family_{i,t} = \alpha_j + \alpha_t + \beta \; Trust_i + \gamma Controls_{i,t} + \varepsilon_{i,t}$ in the 1st stage, and $Innov_{i,t+1} = \alpha_j + \alpha_t + \beta_1 Projected\text{-}Family_{i,t} + \gamma \times X_{i,t} + \varepsilon_{i,t}$ in the 2nd stage, where $Family_{i,t}$ refers to the family firm dummy in Panel B and the family ownership percentage in Panel C, respectively, and $Projected\text{-}Family_{i,t}$ is the projected value of family variables computed from the first stage. In both Panels B and C, Column 1 reports the first-stage regressions and Columns 2-5 report the second-stage regressions. All other variables are defined in the Appendix. Standard errors are presented beneath the coefficients within parentheses. *, **, and *** denote significance levels at 10%, 5% and 1%, respectively. Standard errors are corrected for heteroskedasticity and are two-way clustered at the industry (2-digit SIC) and year level.

Panel A Exclusion Restriction				
	(1)	(2)	(3)	(4)
VARIABLES	Patent,t+1	Citation, t+1	Originality, t+1	Generality, t+1
Trust	0.201	0.219	0.160	0.035
	(0.145)	(0.149)	(0.125)	(0.058)
Firm age	0.005***	0.005***	0.004***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
M/B	0.021*	0.030*	0.014*	0.012**
	(0.011)	(0.018)	(0.008)	(0.006)
% Inst Own	-0.024	-0.007	-0.034	-0.033
	(0.057)	(0.057)	(0.049)	(0.028)
Own Concentration	0.625**	0.414	0.643**	0.340
	(0.280)	(0.331)	(0.291)	(0.208)
Asset	0.075**	0.058	0.072**	0.032
	(0.035)	(0.045)	(0.033)	(0.021)
R&D	0.302***	0.327***	0.245***	0.109***
	(0.062)	(0.087)	(0.055)	(0.040)
Capital Intensity	0.000	0.011	-0.005	0.004
	(0.045)	(0.069)	(0.039)	(0.032)
CAPEX	0.084*	0.118	0.067*	0.045
	(0.048)	(0.076)	(0.039)	(0.030)
Leverage	-0.254	-0.430	-0.227	-0.189
	(0.213)	(0.280)	(0.180)	(0.123)
Profit Margin	-0.123	-0.373	-0.004	-0.065
	(0.357)	(0.453)	(0.282)	(0.167)
Constant	-0.570	0.042	-0.504	0.051
	(0.347)	(0.321)	(0.332)	(0.185)
Observations	12,837	12,837	12,837	12,837
R-squared	0.5101	0.4297	0.4868	0.3425
SIC2 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B Family Firm Dummy					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Family	Patent,t+1	Citation, t+1	Originality, t+1	Generality, t+1
Family		1.526***	2.179***	1.272***	0.846***
		(0.026)	(0.232)	(0.145)	(0.013)
Trust	-0.112**				
	(0.047)				
Firm age	-0.006***	0.006***	0.006***	0.005***	0.002***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)
M/B	-0.047***	0.034***	0.047***	0.025***	0.018***
	(0.006)	(0.004)	(0.010)	(0.005)	(0.002)
% Inst Own	-0.253***	0.082***	0.141*	0.054	0.025
	(0.040)	(0.027)	(0.074)	(0.047)	(0.015)
Own Concentration	1.460***	- 0.642***	-1.381***	-0.414*	-0.354***
	(0.199)	(0.154)	(0.396)	(0.231)	(0.089)
Asset	-0.113***	0.106***	0.098**	0.098***	0.048***
	(0.023)	(0.015)	(0.047)	(0.033)	(0.009)
R&D		0.249***	0.263***	0.199***	0.084***
		(0.006)	(0.038)	(0.025)	(0.003)
Capital Intensity	-0.080***	0.044***	0.066	0.032	0.025***
	(0.019)	(0.012)	(0.062)	(0.039)	(0.007)
CAPEX	-0.034*	0.092***	0.129**	0.074**	0.049***
	(0.019)	(0.012)	(0.051)	(0.031)	(0.007)
Leverage	0.214**	- 0.259***	-0.413***	-0.234**	-0.181***
	(0.089)	(0.060)	(0.151)	(0.106)	(0.035)
Profit Margin	0.520***	- 0.359***	-0.684*	-0.204	-0.184***
	(0.147)	(0.093)	(0.389)	(0.233)	(0.054)
Constant	-2.714***	- 2.426***	-2.447***	-2.027***	-0.925**
	(0.659)	(0.729)	(0.696)	(0.569)	(0.422)
Observations	12,837	12,837	12,837	12,837	12,837
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Panel C Family Ownership Percentage					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	% Family Own	Patent,t+1	Citation, t+1	Originality, t+1	Generality, t+1
% Family Own		2.327***	3.556***	2.031***	1.492***
		(0.068)	(0.087)	(0.052)	(0.030)
Trust	-0.138**				
	(0.058)				
Firm age	-0.005***	0.006***	0.006***	0.005***	0.003***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
M/B	-0.054***	0.032***	0.046***	0.024***	0.018***
	(0.007)	(0.004)	(0.005)	(0.003)	(0.002)
% Inst Own	-0.315***	0.035	0.078**	0.017	0.003
	(0.044)	(0.025)	(0.037)	(0.021)	(0.015)
Own Concentration	1.897***	-0.096	-0.677***	0.012	-0.117
	(0.204)	(0.148)	(0.215)	(0.125)	(0.087)
Asset	-0.112***	0.102***	0.100***	0.097***	0.051***
	(0.025)	(0.015)	(0.021)	(0.012)	(0.009)
R&D		0.263***	0.267***	0.207***	0.080***
		(0.006)	(0.009)	(0.005)	(0.003)
Capital Intensity	-0.119***	0.030**	0.054***	0.023**	0.023***
	(0.020)	(0.012)	(0.017)	(0.010)	(0.007)
CAPEX	-0.065***	0.086***	0.121***	0.069***	0.046***
	(0.020)	(0.012)	(0.017)	(0.010)	(0.007)
Leverage	-0.046	- 0.284***	-0.470***	-0.260***	-0.210***
	(0.097)	(0.058)	(0.083)	(0.048)	(0.034)
Profit Margin	0.874***	- 0.258***	-0.570***	-0.129*	-0.151***
	(0.169)	(0.090)	(0.130)	(0.076)	(0.053)
Constant	-1.993	- 2.307***	-2.372**	-1.954***	-0.930**
	(1.755)	(0.700)	(1.016)	(0.590)	(0.414)
Observations	12,837	12,837	12,837	12,837	12,837
SIC2 FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes