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HOW FAMILY OWNERSHIP IMPACT ON PATENTING AS INNOVATION: EVIDENCE FROM CHINA

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Abstract
This study investigates the impact of family ownership on corporate innovation, using evidence from Chinese manufacturing firms. Against the backdrop of China's strategic shift toward indigenous innovation, we examine whether the concentrated, long-term orientation of family-controlled firms fosters or hinders patenting activity. Employing a panel dataset of approximately 3,800 A-share listed firms from 2015 to 2024, we measure innovation by the number of granted patents and family ownership by the percentage of equity held by the controlling family. To address endogeneity concerns, we utilize a Two-Stage Least Squares (2SLS) approach with a lagged ownership instrument, alongside baseline fixed-effects. The results consistently show a positive and statistically significant relationship: higher family ownership leads to greater patenting output, supporting the stewardship and socioemotional wealth perspective. The findings indicate that family firms' patient capital and transgenerational outlook provide a governance advantage in pursuing innovation within China's evolving institutional context. This research contributes to the literature on corporate governance and innovation in emerging economies, offering practical insights for policymakers aiming to leverage the private sector for technological upgrading and for family firms optimizing their innovation strategies.

INTRODUCTION

The role of family ownership in shaping corporate innovation represents a critical yet deeply paradoxical inquiry within the fields of corporate governance and innovation economics. This is particularly salient in the context of China, an economy that has undergone a seismic transformation from a centrally-planned system to a global powerhouse increasingly driven by indigenous innovation. Chinese family firms, emerging from the reforms of the late 20th century, now constitute a dominant and vibrant segment of the private sector, contributing significantly to employment, growth, and technological upgrading. The central dependent variable in this discourse is firm-level innovation, for which the number of granted patents serves as a robust, albeit imperfect, proxy. Patent counts, especially those that are granted after rigorous examination, offer a tangible, quantifiable measure of a firm's innovative output, reflecting its investment in research and development (R&D) and its success in producing novel, legally protected inventions. The independent variable, family ownership, is operationalized through the percentage of equity controlled by a founding family or clan, a metric that signifies not merely financial investment but the infusion of familial values, long-term orientation, and often,

concentrated control into the corporate fabric. The intersection of these two variables family stewardship and innovative ambition presents a complex puzzle with profound implications for China's quest for technological self-reliance and sustainable economic development.

The theoretical and empirical landscape surrounding this relationship is fraught with contradictory predictions and findings. On one hand, the socioemotional wealth (SEW) perspective suggests that family owners, seeking to preserve their legacy and ensure transgenerational sustainability, may adopt a long-term investment horizon that is conducive to patient, breakthrough innovation. They might be more willing to absorb the high risks and extended gestation periods associated with substantive R&D, viewing innovation as an endowment for future generations. Furthermore, the centralized decision-making and reduced agency costs between owners and managers in family firms could facilitate quicker, more decisive allocations of resources to promising innovative projects. On the other hand, a competing strand of literature highlights the potential dark side of family ownership. The imperative to maintain family control and avoid dilution of SEW may lead to risk aversion, particularly towards investments whose outcomes are highly uncertain and could jeopardize family wealth and control. This can manifest as a preference for incremental, exploitative innovation over radical, exploratory endeavors. Additionally, family firms may suffer from nepotism in top management positions, potentially limiting the influx of external talent and diverse ideas crucial for cutting-edge innovation. The entrenchment of family interests might also lead to the expropriation of minority shareholders, diverting resources away from value-creating activities like R&D towards private benefits of control. These divergent theoretical pathways underscore a significant problem: the absence of a consensus on the net effect of family ownership on innovation, especially in institutional contexts markedly different from the West.

This research gap is particularly acute and consequential in China. Most extant literature draws evidence from developed economies in North America and Europe, where legal institutions, financial markets, and governance norms are relatively mature and stable. China presents a starkly contrasting environment characterized by institutional voids, weaker intellectual property rights (IPR) protection despite recent improvements, and pervasive political connections. The behavior of Chinese family firms cannot be divorced from this context. For instance, the perceived weakness of IPR protection could either discourage all firms from patenting or, conversely, make the formal patenting strategy of family firms who may rely more on informal secrecy less appealing compared to non-family firms. Moreover, family ownership in China is often intertwined with complex political strategies, as families may cultivate relationships with government officials to secure resources, licenses, and protection, a phenomenon less emphasized in Western studies. Does this political engagement substitute for or complement innovation efforts? Furthermore, the life-cycle stage of the firm and the generational transition within the controlling family add layers of complexity. First-generation founder-led firms may exhibit different innovative behaviors compared to those managed by second or third generations, a dynamic that is critical in China where many first-generation entrepreneurs are now nearing retirement. The existing literature has yet to fully dissect these nuanced, context-specific mechanisms that connect family ownership to patenting outcomes in China, leaving a substantial void in our understanding.

Addressing this gap carries significant theoretical and practical importance. Theoretically, this study contributes by testing and potentially extending mainstream corporate governance and innovation theories in a pivotal emerging economy. It examines whether frameworks like SEW theory, developed primarily in Western contexts, hold explanatory power in China, or whether they require modification to account for institutional specificities such as guanxi (relationship networks) and state-capitalism. It

also engages with the literature on the varieties of capitalism, probing how a relationship-based, network-driven economic system shapes the innovation strategies of its most prevalent form of enterprise. By integrating insights from institutional theory with family firm and innovation literatures, this research can offer a more holistic and contextually grounded model of the determinants of innovation. Practically, the findings hold immense value for multiple stakeholders. For policymakers in China grappling with the "middle-income trap" and the strategic imperative to foster indigenous innovation, understanding whether and under what conditions family firms are effective innovators is crucial. It can inform the design of targeted subsidies, tax incentives, and IPR protection regimes tailored to the needs and behavioral patterns of this vast segment of the economy. For family firm owners and managers, the insights can guide governance choices, succession planning, and R&D portfolio management to better harness their unique advantages for innovation. For investors, both domestic and international, the research can shed light on how family ownership structures impact firm value and long-term competitiveness through the innovation channel, aiding in more informed investment decisions.

Recent empirical studies have begun to scratch the surface of this complex relationship in China, yielding mixed results that further motivate a comprehensive investigation. For example, research by Jiang and colleagues (2020) found that family ownership in China is associated with higher R&D intensity but a lower propensity for breakthrough innovation, suggesting a nuanced trade-off. Conversely, a study by Chen, Hsu, and Chang (2021) demonstrated that family firms with a higher degree of family control exhibit more patent applications, but this effect is moderated by the presence of institutional investors. Importantly, Lu, Zhu, and Zhang (2022) highlighted the critical role of the founder's technological background, showing that founder-led family firms outperform in innovation when the founder possesses relevant technical expertise. Meanwhile, work by Li and colleagues (2023) emphasizes the regional institutional moderators, finding that the innovation output of family firms is more positively affected by ownership in provinces with stronger market intermediary development and legal systems. These studies, while valuable, often focus on specific moderators or channels in isolation. A comprehensive analysis that concurrently examines the direct effect, while accounting for moderating factors like political connections, generational involvement, and regional institutional quality, remains underexplored. Furthermore, many studies rely on patent application data rather than granted patents, the latter being a more stringent indicator of innovative quality and novelty, as it has passed substantive examination. This study, by focusing on granted patents as the key metric of innovation output, seeks to provide a clearer picture of the qualitative impact of family ownership. Ultimately, by systematically unraveling the "how" and "when" behind the family ownership-innovation link in China, this research aims to move beyond simplistic positive or negative assertions, offering a contingent and institutionally-embedded framework that explains the paradoxical role of one of the world's oldest organizational forms in driving or hindering innovation in the world's newest economic superpower.

2. Literature review

The relationship between family ownership and firm innovation constitutes a vibrant and contested domain within academic research, drawing from theoretical foundations in corporate governance, behavioral economics, and strategic management. This literature review synthesizes and critiques the extant body of work, tracing the evolution of thought from broad theoretical dichotomies to increasingly nuanced, contingent models, with a particular focus on the emergent and critical context of China. The central tension in the literature is rooted in two competing theoretical perspectives that predict divergent innovative outcomes for family-owned firms. The stewardship and socioemotional wealth (SEW) perspective posits that family

owners are not merely financial investors but stewards of a transgenerational legacy. Grounded in the work of Miller and Le Breton-Miller (2005), this view suggests that the preservation of SEW encompassing family control, identity, emotional attachment, and the perpetuation of the dynasty fosters a long-term orientation. This patient capital approach is argued to be conducive to innovation, as family firms are more willing to absorb the high risks and extended gestation periods of research and development (R&D) that non-family, professionally-managed firms might avoid due to short-term market pressures. Empirical support for this view is found in studies such as Anderson and Reeb (2003), who documented superior performance in family firms, and Duran et al. (2016), who argued family firms achieve "more with less," exhibiting higher innovation efficiency by leveraging unique familial resources like tacit knowledge and strong social capital.

Conversely, the agency and behavioral risk-aversion perspective highlight the potential constraints family ownership imposes on innovation. Drawing from Jensen and Meckling (1976) and extended by Chrisman et al. (2004) to the family context, this strand emphasizes that the undiversified wealth portfolios of controlling families can make them exceptionally risk-averse. The desire to protect the family's socioemotional and financial wealth may lead to an avoidance of risky, long-term investments like radical R&D in favor of safer, incremental projects or diversification into unrelated, low-innovation businesses. Furthermore, Type II agency problems conflicts between controlling shareholders (the family) and minority investors can lead to resource tunneling and expropriation, diverting funds away from value-creating innovative activities. The literature also points to potential weaknesses in the human capital of family firms, where nepotism may limit the recruitment of top external R&D talent and stifle the diversity of ideas necessary for breakthrough innovation, as discussed by Schulze et al. (2001). This perspective finds empirical backing in studies showing family firms invest less in R&D or focus on less novel types of innovation.

The empirical evidence from global markets reflects this theoretical ambiguity, with meta-analyses revealing highly heterogeneous effects. This inconsistency has spurred a second wave of research that seeks to resolve the paradox by identifying critical contingency factors. Scholars have moved beyond asking if family ownership affects innovation to probing when and how this effect manifests. Key moderators identified in the international literature include firm lifecycle and leadership. Founders, often embodying entrepreneurial vision and deep firm-specific knowledge, tend to foster more innovation than subsequent generations, as later successors may lack technical expertise or be more risk-averse, a dynamic explored by Zellweger et al. (2012). The type of innovation is another crucial differentiator; family firms often excel in incremental innovation, process improvements, and exploiting existing knowledge domains, while underperforming in radical, exploratory innovation that threatens the status quo, as noted by Classen et al. (2014). Furthermore, the external institutional environment, such as the strength of intellectual property rights (IPR) protection and the development of capital markets, has been shown to significantly shape the family-innovation nexus, with stronger institutions mitigating some of the constraining effects of family ownership.

The application of these global frameworks to the Chinese context is not a straightforward translation but requires a deep contextualization within China's unique institutional and cultural landscape. China's economic transition, characterized by formal institutional voids alongside robust informal networks (guanxi), creates a distinct playing field for family firms. A growing body of China-specific literature has begun to map this complex terrain, yielding insights that both corroborate and challenge Western-derived theories. Recent studies confirm the importance of generational stage and founder status. Research by Chu et al. (2019) and Lu et al. (2022) robustly demonstrates that founder-led family firms in China are significantly more innovative than those managed by descendants or professional CEOs. Founders' technological

expertise, in particular, acts as a powerful amplifier, enabling them to better evaluate and champion risky R&D projects. This aligns with the stewardship view but highlights that the "family" effect is often, in practice, a "founder" effect in China's still-maturing private sector.

Perhaps the most distinctive and heavily researched contingency in the Chinese context is the role of political connections. For family firms, navigating a state-dominated economy often necessitates cultivating relationships with government officials and Communist Party organizations. The literature presents a nuanced picture of how this political strategy interacts with innovation. Some studies, such as Su and Lee (2023), posit a substitution effect, where political capital provides alternative pathways to rents (e.g., preferential loans, lucrative contracts, regulatory protection), reducing the imperative for costly and uncertain internal innovation. This can lead to a crowding-out of R&D investments. Conversely, other research suggests a facilitation effect. Political ties can help secure critical state R&D subsidies, mitigate policy uncertainty, and provide access to state-owned enterprise (SOE) innovation networks, thereby actually enabling family firm innovation. The net effect appears contingent on the nature of the connection and the firm's strategy, indicating that political capital is a double-edged sword whose impact on innovation is highly contextual.

Another critical strand of China-focused literature examines the heterogeneity of innovation outputs. Following the lead of He et al. (2021) and Liu et al. (2022), scholars consistently find that Chinese family firms exhibit a marked preference for certain types of patents. They tend to generate more utility model and design patents which protect incremental modifications and ornamental designs and fewer invention patents, which represent substantive technological breakthroughs and undergo the most rigorous examination. This pattern strongly supports the risk-aversion hypothesis, suggesting family firms pursue a strategy of "safe" innovation that protects their core business without venturing into uncharted technological territory. This has profound implications for China's ambition to achieve technological leadership, as it suggests the dominant form of private enterprise may be structurally biased against the radical innovations needed to escape the middle-income trap.

The moderating role of external governance and institutional development within China has also received significant attention. Studies like that of Wu et al. (2022) show that the presence of institutional investors can discipline family owners, mitigate their risk aversion, and provide complementary monitoring and expertise, thereby enhancing innovation efficiency. More importantly, the vast regional disparities in institutional quality across China provide a natural laboratory for testing institutional theory. Li et al. (2023) and others demonstrate that the innovative performance of family firms is significantly stronger in provinces with more developed market intermediaries, stronger legal enforcement, and better protection of property rights. In regions with weaker institutions, the constraining effects of family ownership on innovation are more pronounced, as families resort to more conservative, control-preserving strategies. This highlights that the family-innovation link is not fixed but is dynamically shaped by the sub-national institutional fabric.

Despite these significant advances, several critical gaps remain in the literature on Chinese family firms and innovation. First, there is a tendency to examine moderators political ties, generations, institutions in isolation. An integrated framework that models how these factors interact (e.g., how the effect of political connections differs between founder- and descendant-led firms in regions with strong vs. weak IPR protection) is conspicuously absent. Second, while much research uses patent applications as a proxy, there is a relative paucity of studies focusing specifically on granted patents, a superior measure of innovative quality and novelty that filters out strategic, low-quality filings. This is a non-trivial distinction in China, where patenting subsidies have sometimes led to an explosion of applications of varying substance. Third, the internal heterogeneity of family ownership structures is often underexplored. The effects may differ markedly between firms with a

single dominant family, those with multiple family branches, and those with complex ownership pyramids, each presenting different governance challenges and incentives for innovation. Finally, the dynamic aspect of innovation trajectories over time, particularly around the sensitive period of succession, is less studied through longitudinal designs that could capture causal shifts in R&D strategy.

The literature reveals that the impact of family ownership on patenting in China is not a monolithic positive or negative force but a multifaceted phenomenon mediated by a matrix of firm-level governance characteristics, strategic choices, and external institutional conditions. The Chinese context amplifies certain contingencies, particularly political strategy and regional institutional quality, while confirming others like the founder effect. To move the field forward, future research must embrace more holistic, integrated models, employ finer-grained measures of innovation output like granted patents, and delve deeper into the internal diversity of family firm structures. By doing so, scholars can provide a more complete and actionable understanding of how one of China's most important economic actors contributes to the nation's pivotal transition to an innovation-driven economy.

H1a: The Family ownership has positive impact on firm innovation.

H1b: The Family ownership has negative impact on firm innovation.

3. Data & Methodology

This study employs a comprehensive firm-level panel dataset to empirically investigate the relationship between family ownership and innovation among Chinese manufacturing firms. The secondary data is meticulously compiled from two authoritative and widely utilized databases in China-based financial and economic research: the China Stock Market & Accounting Research (CSMAR) database and the Chinese Research Data Services (CNRDS) platform. CSMAR provides detailed information on corporate governance, ownership structures, and financial statements, while CNRDS offers granular, high-quality data on patent applications and grants, which is critical for accurately measuring innovation output. Our sample is constructed by merging these datasets, focusing specifically on A-share listed manufacturing firms (as per the China Securities Regulatory Commission industry classification) from the years 2015 to 2024. The final unbalanced panel comprises approximately 3,800 unique firms, yielding around 25,000 firm-year observations. The choice of the 2015-2024 timeframe is strategically significant for several reasons. This period captures a crucial phase in China's economic and innovation policy landscape, initiated by the formal announcement of the "Made in China 2025" industrial strategy in 2015, which marked a decisive national shift towards prioritizing high-tech manufacturing and indigenous innovation. Furthermore, the period encompasses significant institutional developments, including continued reforms in intellectual property rights (IPR) protection, the maturation of the STAR Market (launched in 2019) for technology firms, and the overarching push for "dual circulation" and technological self-sufficiency. Studying this decade allows for an analysis of family firm behavior within a sustained policy environment explicitly favoring innovation, while also capturing potential variations in response to external shocks such as the U.S.-China trade tensions and the global pandemic, thereby offering a robust and contemporary assessment of the research question.

The empirical models used for the analysis is specified as follows.

$$DI_{it} = \beta_0 + \beta_1 FO_{it} + \lambda\, Controls_{it} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad \text{..... (Eq 1)}$$

where DI_{it} denotes digital innovation of firm i in year t; FO_{it} represent Family ownership, and $Controls_{it}$ is a vector of control variables. Firm fixed effects (μ_i) account for time-invariant unobserved heterogeneity, while year fixed effects (λ_t) control for macroeconomic shocks and policy changes affecting all firms.

To model the relationship between family ownership and innovation, we specify a baseline empirical model where the dependent variable is the firm's innovation output, measured by the natural logarithm of one plus the total number of patents granted in a given year. The key independent variable is family ownership, operationalized as the percentage of total shares held by the controlling family. In line with established practices in the literature, we control for a vector of firm-specific characteristics that are known to influence innovation, including firm size (log of total assets), leverage (total debt to assets), profitability (return on assets), cash flow, firm age, and R&D intensity (R&D expenditure scaled by sales). We also include industry and year fixed effects to account for unobserved heterogeneity across sectors and common macroeconomic shocks over time. The primary estimation strategy for this panel data is the fixed effects (FE) model. The FE estimator is preferred as our baseline because it controls for all time-invariant, unobserved firm-specific factors that may be correlated with both ownership structure and innovation propensity, such as intrinsic managerial quality, corporate culture, or long-term strategic positioning that does not change over the decade. This approach effectively mitigates omitted variable bias stemming from these time-constant confounders, providing a more reliable estimate of the within-firm effect of changes in family ownership (or the relative differences in levels that persist after accounting for firm means) on changes in patenting activity.

Acknowledging the potential complexities in the error structure of panel data, we supplement our baseline FE estimates with a Generalized Least Squares (GLS) estimator for robustness. Panel data often suffer from issues like heteroskedasticity (unequal error variances across firms) and serial correlation (correlation of a firm's errors over time). While the FE model provides consistent estimates, standard errors may be inefficient if these conditions are present. The GLS approach allows us to model these patterns in the variance-covariance matrix of the errors explicitly, yielding more efficient parameter estimates and more reliable inference. By comparing the results from the FE and GLS models, we can assess the stability and robustness of our core findings to different assumptions about the error process.

A more fundamental econometric challenge is the potential endogeneity of the family ownership variable. The concern is bidirectional causality: while family ownership may influence innovation, a firm's innovation trajectory and associated risk profile may also influence the family's decision to retain or adjust its ownership stake. For instance, a highly innovative but volatile firm might prompt a risk-averse family to dilute its holdings. To address this endogeneity and establish a stronger causal claim, we employ a Two-Stage Least Squares (2SLS) instrumental variable approach. The success of this method hinges on identifying a valid instrument a variable that is correlated with family ownership but uncorrelated with the error term in the innovation equation (i.e., it affects innovation only through its impact on ownership). Drawing on established instruments in corporate finance literature, we employ the regional prevalence of family-owned businesses in the firm's province of headquarters, lagged by one period, as our primary instrument. This measure, calculated as the proportion of listed firms in the province that are family-controlled, is rooted in sociological and institutional theory regarding regional business cultures and norms, as discussed by Li et al. (2023). A higher regional density of family firms creates a supportive ecosystem of norms, networks, and intermediary services that makes maintaining family ownership more feasible and socially normative, thereby influencing a firm's ownership structure. However, it is plausibly exogenous to the specific innovation output of any single firm, conditional on other controls. For robustness, we also consider an alternative instrument: the average family ownership level among firms in the same industry and region, excluding the firm itself. The 2SLS procedure involves a first-stage regression where family ownership is regressed on the instrument alongside all exogenous controls, and a second stage where the fitted values of ownership from the first stage are used to explain innovation. The

strength of the instrument will be tested using standard diagnostic statistics, including the F-statistic from the first-stage regression (where a value above 10 indicates a strong instrument) and tests for over-identifying restrictions where applicable. By triangulating evidence from the baseline FE model, the robust GLS estimator, and the causal 2SLS approach, this methodology is designed to provide a comprehensive and credible analysis of how family ownership shapes patenting outcomes in Chinese manufacturing.

3.1 Dependent Variable (Innovation)

The dependent variable, Innovation, is measured as the annual count of patents granted to a firm. We use granted patents rather than applications or R&D spending because they represent inventions that have passed official examination, offering a more reliable and quality-adjusted indicator of actual innovative output. To construct the variable, we collect data on all patents (invention, utility model, and design) granted to each firm in a given year from the CNRDS database. For regression analysis, we take the natural logarithm of one plus the total granted patents to address skewness and zero values. Additional analyses distinguish between invention patents (higher novelty) and utility/design patents (more incremental) to examine potential quality differences.

3.2 Independent Variable (Family Ownership)

The independent variable is Family Ownership, measured as the percentage of a firm's total shares held by the controlling family or its related members. This data is sourced from the annual ownership structure files in the CSMAR database. We use the continuous annual percentage (ranging from 0% to 100%) to allow for a detailed analysis of how different levels of family control affect patenting outcomes. In baseline models, we use the current year's ownership value; in robustness checks, we employ a one-year lag to address potential simultaneity. This approach enables testing for both linear and non-linear effects of ownership concentration on innovation.

3.3 Control Variable

In this study, we evaluate the impact of board characteristics on digital innovation, including a range of control variables by studying precious studies. Which are return on assets (ROA), profitability (PR), debt ratio (DR), Tobin's Q (TQ), big four, CEOD and ownership concentration.

Table 5.1 Measurement of Variables

Variables Type	Variables Name	Simbel	Definition
INDEPENDENT VARIABLES	Family Ownership	FO	Percentage of total family ownership shares
DEPENDENT VARIABLES	Digital Innovation	DI	LN of total number of granted patents
CONTROL VARIABLES	Return on Assets	ROA	Natural log of total income divided by total asset
	Debt Ratio	DR	Total liabilities/total assets
	Tobin's Q	TQ	Market Value / Total Assets
	Profitability	PR	Net Profit of the year
	Audit Quality	AQ	The presence of top big four audit companies= 1, otherwise 0.

	Ownership Concentration	IOWN	Percentage of top 10 shareholders
	CEO Duality	CEOD	Number of Independent Audit Committee Members

3.4 Empirical Results and Discussion

The summary statistics describe the dataset's key variables. Family Ownership (FO) has a mean of 40.16%, indicating that, on average, the controlling family holds a significant minority to majority stake in the sample firms, with substantial variation (Std. dev. = 24.70) from 0% to 97%. Innovation (DI), measured as the log of patents granted, averages 3.33, with wide dispersion (Min 0, Max 9.71), confirming substantial differences in innovative output. Firm Size (PR), Profitability (DR), Market Valuation (TQ), Audit Quality (AUDI), and CEO Duality (CEOD) show typical corporate characteristics with meaningful variation. Analyst Coverage (AQ) appears as a binary variable (Mean 0.05), indicating only 5% of observations are covered. Ownership Concentration (OWNC) outside the family averages 32.71%, highlighting the prevalent co-existence of other blockholders. The variable-specific observation counts suggest a slight, non-systematic amount of missing data. Overall, the statistics confirm a panel dataset suitable for multivariate analysis, with sufficient variation in both the dependent and independent variables.

Table 1 Summary Statistics

Variable	Observation	Mean	Std. dev.	Min	Max
DI	18,390	3.33	1.56	0	9.71
FO	18,321	40.16	24.70	0	97
PR	16,206	18.89	1.47	11.98	24.9
DR	18,291	0.38	0.19	0.06	0.93
TQ	18,291	2.43	1.01	1.35	5.18
AQ	18,366	0.05	0.22	0	1
CEOD	18,325	0.34	0.48	0	1
OWNC	18,188	32.71	14.08	1.84	89.99
AUDI	18,357	1.33	1.11	0	6

The correlation matrix shows preliminary bivariate relationships. Family Ownership (FO) has a positive correlation with Innovation (DI) (0.14), suggesting a preliminary association between higher family ownership and greater patenting output. FO is also strongly correlated with Firm Size (PR) (0.69), indicating larger firms in the sample tend to have higher family ownership, which warrants controlling for size to isolate FO's unique effect. Innovation (DI) shows positive correlations with Market Valuation (TQ) (0.19), Ownership Concentration (OWNC) (0.42), and Audit Quality (AUDI) (0.32), hinting at potential complementary factors for innovation. The low to moderate correlations among most independent variables (all below 0.70, except FO-PR) generally suggest no severe multicollinearity that would impede regression analysis. The negative correlation between Profitability (DR) and DI (-0.08) is small, indicating no strong linear trade-off.

Table 2 Correlation Matrix

Variables	DI	FO	PR	DR	TQ	AQ	CEOD	OWNC	AUDI
DI	1.00								
FO	0.14	1.00							
PR	0.17	0.69	1.00						
DR	-0.08	0.14	0.08	1.00					
TQ	0.19	0.04	0.08	-0.01	1.00				
AQ	-0.02	-0.01	-0.02	0.01	-0.01	1.00			
CEOD	0.07	0.03	0.02	0.00	0.08	0.00	1.00		
OWNC	0.42	0.17	0.19	-0.02	0.16	-0.01	0.15	1.00	
AUDI	0.32	0.13	0.15	-0.08	0.29	-0.02	0.10	0.14	1.00

The baseline fixed-effects regression provides the core result: Family Ownership (FO) has a positive and statistically significant impact on Innovation (DI). The coefficient of 0.23* indicates that, holding all other factors constant, a one-percentage-point increase in family ownership is associated with a 0.23 increase in the log of granted patents. Given the logarithmic scale, this represents a meaningful economic effect, supporting the hypothesis that family ownership is conducive to firm innovation in the Chinese manufacturing context.

Among the control variables, Firm Size (PR) and Profitability (DR) show positive and significant effects, aligning with the resource-based view that larger, more profitable firms have greater capacity for innovation. Audit Quality (AUDI) is also positive and significant, suggesting that better governance and external monitoring support innovative output. Market Valuation (TQ) has a small negative effect, possibly reflecting market short-termism or valuation pressures that could marginally discourage long-term R&D. Analyst Coverage (AQ) is positive, indicating external scrutiny may encourage innovation. CEO Duality (CEOD) and Non-Family Ownership Concentration (OWNC) are statistically insignificant in this specification.

The model includes year and industry fixed effects, and the R^2 of 0.14 is reasonable for a firm-level innovation study using panel data. The results robustly establish a positive baseline relationship between family ownership and patenting activity.

Table 3 To Check the Family Ownership Impact on DI (Baseline Regression)

This table shows the results Baseline Regression. T-statistics are reported the impact of family ownership on digital innovation (DI). *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DI
	0.23***
FO	(3.8)
	0.01***
PR	(2.72)
	0.29***
DR	(3.71)
	-0.02*
TQ	(-1.74)
	0.18**
AQ	(2.36)

	0.002
CEOD	(1.54)
	0.00
OWNC	(-1.15)
	0.004***
AUDI	(4.52)
R^2	0.14
YEAR EF	YES
INDUSTRY EF	YES
OBSERVATION	14799

The Two-Stage Least Squares (2SLS) regression addresses potential endogeneity in the relationship. The first stage shows that the one-period lag of family ownership (LFO) is a very strong and statistically significant (t=134) predictor of the current period's family ownership (FO), with a coefficient of 0.86. This confirms the chosen instrument is highly relevant, a conclusion strongly supported by the Kleibergen-Paap LM statistic of 18152, which far exceeds conventional thresholds and robustly rejects the null hypothesis of underidentification.

In the second stage, the key result remains: Family Ownership (FO) continues to have a positive and statistically significant (t=9.87) impact on Innovation (DI), with a coefficient of 0.09. While this estimated effect is smaller in magnitude than the baseline OLS estimate (0.23 in Table 3), it remains economically meaningful. The reduction in coefficient size suggests that the baseline OLS model may have been slightly upward biased, possibly due to reverse causality or omitted variable bias, where more innovative firms might also attract or retain higher family ownership. The 2SLS result, by using a lagged instrument, isolates a more plausibly causal effect and confirms that the positive relationship is not merely an artifact of endogeneity.

The significance and signs of several control variables (PR, TQ, AUDI) change or strengthen compared to the baseline, which is common when moving from OLS to an instrumental variable framework, as the estimation focuses on variation driven by the instrument. The model's R^2 is 0.12. Overall, the 2SLS test validates the core finding: an exogenous increase in family ownership leads to a significant increase in firm innovation.

Table 4 Endogeneity Test: Two Stages Least Square

This table shows the results of Two Stages Least Square. Where instrumental variable is lag of family ownership. T-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

Variable	Stage 1		Stage 2
LFO	0.86***		
	(134)		
FO			0.09***
			(9.87)
	0.01		0.28***
PR	(0.31)		(2.96)
		0.06***	0.05*
DR		(4.74)	(1.75)
	-0.01		1.83***
TQ	(-0.33)		(24.6)

AQ	-0.02*** (-3.42)	-0.17*** (-12.61)
CEOD	0.04 (1.33)	0.70*** (9.76)
OWNC	-0.01*** (-5.77)	-0.01*** (-4.84)
AUDI	0.00 (0)	0.01*** (10.3)
R^2		0.12
K-P LM		18152
Observation		14885

4. Conclusion

This study provides robust empirical evidence on the relationship between family ownership and innovation in Chinese manufacturing firms, contributing to the ongoing debate within corporate governance and innovation economics. Our analysis, utilizing a comprehensive panel dataset from 2015 to 2024 and employing rigorous econometric techniques, establishes a significant and positive causal impact of family ownership on firm-level innovation, measured by the number of granted patents. The baseline fixed-effects model reveals a strong positive association, which is subsequently validated and confirmed as a causal relationship through a Two-Stage Least Squares (2SLS) approach designed to address endogeneity concerns. While the magnitude of the effect is slightly attenuated in the instrumental variable estimation, the core finding remains unequivocal: an exogenous increase in family ownership leads to a measurable increase in innovative output. This result lends substantial support to the stewardship and socioemotional wealth (SEW) perspective, indicating that the long-term orientation, patient capital, and legacy concerns prevalent in Chinese family firms create a governance environment that is, on average, conducive to transforming R&D efforts into legally protected inventions.

The findings carry important implications for theory and practice. Theoretically, they affirm that the core tenets of SEW theory possess significant explanatory power in the Chinese context, a pivotal emerging economy with distinct institutional characteristics. The positive link suggests that familial stewardship can effectively mitigate the classic short-termism problem and provide the stability needed for innovation, even within an environment of evolving intellectual property rights and significant state influence. Practically, for policymakers in China, the results underscore the vital role that the vast family-owned segment of the private sector can play in the national innovation system. Rather than viewing family governance as a potential impediment to radical innovation, policies should be designed to harness its unique strengths. This could involve tailoring R&D subsidy programs and intellectual property protections to the specific needs and risk profiles of family firms, as well as facilitating professionalization and succession planning to preserve their innovative capacity across generations. For family firm owners and managers, the study offers reassurance that maintaining control and pursuing a transgenerational legacy can be aligned with a strategy of technological upgrading and patenting.

However, this conclusion should be interpreted with nuance. The positive average effect does not preclude significant heterogeneity, as highlighted in the literature review. The aggregate finding may mask variations where family ownership constrains certain types of innovation, particularly radical breakthroughs, or where its effect is moderated by factors such as generational stage, the absence of a founder, or weak regional institutions. Future research

should delve deeper into these contingent conditions, exploring how internal family dynamics and external institutional pressures interact to shape the quality not just the quantity of innovation. Nonetheless, this study provides a clear and foundational insight: in the contemporary Chinese manufacturing landscape, family ownership acts as a significant and positive driver of patenting activity, positioning family firms as crucial agents in the nation's journey toward technological self-reliance and innovation-driven growth.

4.1 Recommendation & Limitations

Recommendations: Based on the findings, we offer several recommendations. For policymakers, it is crucial to design innovation incentives, such as R&D tax credits and streamlined patent-granting processes, that are accessible and attractive to family firms, acknowledging their long-term investment horizon. Policies supporting professional governance and smooth intergenerational succession can help preserve innovative capacity. For **family firm owners and boards, the results suggest that actively maintaining a substantial ownership stake can be aligned with an innovation-led growth strategy. They should consider formalizing R&D governance, integrate external technological expertise, and leverage their patient capital to pursue more ambitious, long-horizon projects. For investors, recognizing family ownership as a positive signal for sustained innovation output can inform better long-term valuation models and investment decisions in the Chinese market.

Limitations: This study has several limitations that point to future research directions. First, while the use of granted patents improves quality measurement, it cannot fully capture the commercial impact or radicalness of innovation. Second, the study focuses on listed manufacturing firms; the dynamics in unlisted or service-sector family firms may differ. Third, although we address endogeneity with a lagged instrument, the possibility of other omitted variables influencing both ownership and innovation cannot be entirely ruled out. Finally, the analysis establishes a positive aggregate relationship but does not extensively explore the heterogeneous mechanismssuch as the specific role of founders versus descendants, or the interaction with political tiesthat likely underlie this average effect. Future studies should employ more granular data to unpack these conditional pathways and their implications for different types of innovation.

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