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Dispersion of Family Ownership and Innovation Input in Family Firms

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Abstract: Innovation is an investment in future growth and development, and it is critical for family businesses to maintain a competitive advantage. Different types of innovation inputs have different uncertainties, advantages, and risks. Product innovation and process innovation are two distinct types of innovation that necessitate significantly different organizational resource allocation and risk taking. Ownership is the source of decision-making authority, and the dispersion of intra-family ownership influence goal preferences, risk taking, and resource allocation. We investigate the effect of intra-family ownership dispersion on the decision preferences of two unique types of innovation inputs by distinguishing between product and process innovations. The greater the concentration of ownership within the family, the more likely it is that the proportion of product innovation input is higher than the proportion of process innovation input. We further discuss the moderating effects of both the proportion of family directors and collective decision-making mode on the different innovation input decisions by family firms. Using a sample of 882 Chinese small- and medium-sized family firms from the 2015 All-China Federation of Industry and Commerce, we find support for these proposed relationships. The implications of these findings extend to both family business and innovation research.

Keywords: family business; ownership dispersion; innovation input

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1. Introduction

In a business environment of increasing technological change, innovation is a strategic investment with far-reaching implications for companies [1]. It is the core driver of a company's ability to develop competitive advantage to survive and thrive [2]. Making successful innovation decisions remains challenging for numerous organizations, including family businesses [3,4]. Faced with the situation of low value-added products and services, solidified competition in the industry, saturated industry scale, and a gradually obsolete marketing model, Chinese family firms must cultivate a sustainable competitive advantage with technological innovation. For traditional Chinese family firms to achieve high-quality development, innovation-based transformation and upgrading, quality enhancement, and efficiency enhancement are unavoidable options. Identifying innovation risks and allocating innovation resources is a crucial issue for Chinese family-owned firms in the context of inheritance and transformation. This implies that family firms should not only increase their investment in innovation for the long-term development of the family and the business, but also further evaluate how to make deeper investments in innovation in the present and make optimal innovation investment decisions [5].

However, the relationship between family firms and innovation is inconclusive [3]. Scholars have developed a rich debate around this controversial topic: do family firms promote or hinder innovation? Regarding innovation investment, a portion of the research, based on a socio-emotional wealth perspective and combined with behavioral agency theory, argues that family firms usually exhibit higher risk aversion, adopt more conservative

innovation strategies, are reluctant to make uncertain and long-term investments, and tend to invest less in innovation due to the need to maintain family control, and preserve socio-emotional wealth and other non-economic goals [6,7]. Another part of the research, based on stewardship theory, argues that family control is characterized by the integration of managerial and owner identities, information symmetry, decision-making autonomy, and high execution efficiency, and that family goals tend to be aligned with corporate goals, with a greater focus on long-term orientation, resulting in more technological innovation advantages for family firms. In response to the preceding controversy, scholars with a contingency perspective believe that more contextual factors should be considered in the research of the relationship between family firms and innovation inputs, including the institutional context and macroeconomic cycles from an external perspective, and whether the level of firm performance meets the expected standards, from an internal perspective [7,8].

The factors influencing technological innovation and output outcomes are different in family and non-family firms. First, because different types of owners may have varied investment horizons, risk aversion, diversification strategies, and return expectations [9]. In addition, family involvement in ownership, management, and governance may result in the development of unique resources for family firms [10], which can influence various aspects of technological innovation. The incentives, power structures, and legitimacy norms that are unique to family firms create particular advantages and barriers that may have a substantial impact on technical innovation [11–13].

A technological-innovation input decision is a multidimensional decision made by the core decision-making alliance based on the objectives of the family business and after weighing the risks and benefits of innovation activities, which are related to the competitive advantage and future development of the firm. According to innovation research, technological innovation is not a uniform phenomenon [14]. In addition, there are considerable disparities across the various types of technical innovation [15,16]. According to the nature and characteristics of innovation, scholars have classified technological innovation into product innovation and process innovation [17,18]. Significant differences exist between the two types of innovation in terms of innovation activity, uncertainty risk, and cost–benefits [19]. The majority of current research discussing innovation inputs in family firms consider innovation as a homogeneous whole, ignoring the inherent distinctions between different types of innovation and failing to investigate the relationship between family firms and different types of innovation. Identifying various types of innovation promotes a deeper understanding of the innovation inputs of family businesses. The study of family firms' innovation inputs cannot end at comparing family firms with non-family firms in terms of innovation inputs, but needs to, further, compare family firms' differences in different types of innovation inputs [20]. Therefore, the focus of the research on innovation in family businesses must move from "how much" innovation investment is to "what kind" of innovation investment decisions are made.

The innovation input decisions of family firms are made by the decision-making team with ownership, control, and management power. Family members with the power to control corporate assets constitute a core coalition that can influence the formulation and implementation of corporate decisions. Existing studies tend to assess family involvement as an overall factor impacting innovation inputs, without distinguishing the differences in individual goals and interest preferences among the family members who compose the core coalition. The dispersion of ownership within the family has a significant impact on the individual roles, goals, and interactions between family shareholders and family managers, the process of interaction, and the intensity of conflict, and the institutional arrangement of the power structure within family members has a significant impact on the strategic behavior of the firm [21], and the efficiency of family governance.

Most previous studies on the innovation of family firms have focused on comparing the differences in innovation activities and performance between family firms and non-family firms [7,22–24]; however, due to the influence of family system characteristics and family governance, family firms are not a homogeneous whole. Furthermore, for major strategic

decisions such as innovation investment, the type and distribution of decision-making power are important factors that lead to various heterogeneous innovation behaviors [25,26]. From the perspective of corporate governance, ownership is the source of decision-making power, and the distribution of ownership within the family is a crucial perspective for comprehending the innovation input decisions of family firms. When making decisions on innovation inputs, the distribution of ownership influences the objective preferences, risk taking and resource-allocation discretion of the family decision-making team. Intra-family ownership distribution is a significant factor influencing firms' innovation input decisions. Therefore, it is required to take into account the ownership dispersion among family members when explaining the differences in family innovation input decisions.

In addition, an innovation input decision is a significant decision that impacts the firm's survival and development, and the distribution of decision-making power and decision-making patterns is essential for ensuring the firm's key decisions [13]. Consequently, it is essential to address the problem of the moderating effect of the contextual factors of decision-making power distribution and corporate decision-making patterns on the relationship between ownership dispersion and innovation input decisions in family firms.

This study investigates the influence of family ownership distribution on firms' innovation input decisions from the perspective of family firms' ownership dispersion and attempts to address the following questions: First, does family ownership dispersion influence firms' innovation input decision preferences, i.e., the relative weight of product and process innovation inputs? Second, what contextual factors govern the process of the role of family-firm ownership dispersion? We further explore family directorship proportion and collective decision-making patterns as the contextual conditions for the effect of ownership dispersion on innovation input decisions.

This paper may offer the following contributions: First, it aids in the comprehension of the innovation input decision preferences of family firms. In previous research on family-firm innovation that are still controversial, studies based on the subject perspective tend to treat innovation inputs as a homogeneous whole by default, ignore the internal differences of different types of innovation inputs, and fail to explore the relationship between family firms and different types of innovation inputs. This paper distinguishes two different types of innovation inputs, product innovation and process innovation, and examines the choice preferences and input weights of family firms when confronted with two types of innovation inputs by analyzing their risk and benefit characteristics, which helps to understand more deeply the characteristics of different types of innovation input decisions themselves and conducts a new investigation into family firms' innovation input-decision preferences.

Second, this paper helps to enrich the research on the antecedents of innovation inputs in family firms. Most previous studies have taken family factors as a homogeneous whole and examined the influence of family involvement on innovation inputs. This paper examines the influence of ownership dispersion on the proportion of two distinct types of innovation inputs, product innovation and process innovation, from the perspective of intra-family ownership dispersion, which compensates for the regretful situation that most existing studies take the family as a whole and do not distinguish the goals of individual family members, nor their preferences for innovation inputs; this provides a new research perspective for understanding family firms' innovation inputs.

Thirdly, innovation decisions and choices are integrated decisions made by the core coalition with decision-making authority in the firm. In this paper, we investigate the contextual factors of the role of intra-family ownership dispersion on the innovation input decision-making process from two perspectives: the distribution of decision-making power and the decision-making pattern, i.e., the family directorship proportion and collective decision-making pattern.

Finally, this paper contributes to family-firm heterogeneity by revealing different types of innovation input decision preferences among family firms in terms of ownership disper-

sion, decision power distribution, and decision patterns. The findings of this paper indicate that family ownership dispersion will influence family firms' goal preferences, risk taking, and resource-allocation discretion when deciding innovation inputs, resulting in varied family innovation-input behavior. Moreover, even with the same ownership dispersion, differences in decision-making power distribution and decision-making patterns have an impact on the innovative inputs of family firms. The preceding findings support the variability in the heterogeneity of family businesses and the necessity to examine them.

2. Literature Review and Hypothesis Development

2.1. Different Types of Technological Innovation—Product and Process Innovation

Innovation activities are a series of different types of continuous activities with clear objectives, including the development of new products, the update of manufacturing technological processes, the adoption of new raw materials, the development of new markets, and the implementation of new organizational structures. This study will mainly focus on technological innovation. Technological innovation can be defined as the set of activities by which a firm conceives, designs, manufactures and launches a new product, technology, system or technique. Research has shown that firms that are technologically creative companies are more likely to surpass their rivals [27]. This explains why technological innovation has been the focus of substantial theoretical and empirical research and is now widely acknowledged as a crucial factor in retaining excellent performance [28].

Technological innovation has a significant impact on the survival of and growth in companies and industries [29]. Utterback and Abernathy [18] divided technological innovation into product innovation and process innovation according to the content and technological characteristics of the innovation. Although they share certain characteristics, there are significant variances in terms of risk, cost–benefit and difficulty of imitativeness [15]. Therefore, when examining technological innovation activities, it is vital to differentiate between them precisely [30].

Product innovation refers to an improvement in existing products through the introduction of new technologies or technological combinations, as well as innovation for the product itself to suit the needs of customers or the market by solving the "what to produce" challenge [31]. Process innovation is to improve product quality and production processes by modifying the equipment, process standards, material input, workflow, etc., used in the manufacture or delivery of a product or service [18]. To increase productivity and production quality, decrease production costs, and solve the problem of the "how to produce" challenge [32,33].

By enhancing product quality and expanding product offers, product innovation provides firms with a new competitive advantage. Frequently, product innovation is prompted or pushed by new market demands and opportunities. Due to the scattered information on consumer preferences and rapidly shifting market demands, the innovation direction and revenue estimation of product innovation are uncertain, making the risk factor high and the possibility of success difficult to predict [34]. Process innovation originates from the requirements to reduce costs and improve production efficiency in market competition by improving production conditions and processes. Compared with product innovation, process innovation is closer to a technical behavior, and its technical trajectory, purpose, and technique are more transparent. Therefore, the costs and benefits of process innovation can be roughly estimated by technical models, the risk uncertainty is relatively low and the possibility of success is greater. In terms of imitability, product innovation has a lower imitability due to its innovative substance and higher consumption of innovative resources, since it is more likely firms will seek patent protection for its innovation achievements. Process innovation is achieved through the acquisition of new equipment, adoption of new manufacturing methods, etc., and highly replicable.

Both product innovation and process innovation are necessary innovation inputs for firms in the face of rapid and diverse customer needs and market changes, as well as a fierce international competition environment; however, enterprises have limited resources;

therefore, when making technology innovation investment decisions, enterprises need to constantly adjust the proportion of product innovation and process innovation in the total innovation investment of enterprises according to the internal and external situation of enterprises [35] The ratio of product innovation and process innovation to the total innovation investment is adjusted according to the internal and external conditions.

2.2. Family Ownership Dispersion and Innovation Input Decisions

Family members' kinship ties tend to be diverse and complex in the context of the intergenerational handover and industrial transformation and upgrading of family firms, and potential agency problems and family conflicts may, therefore, become increasingly prominent in family firms. Family shareholders are naturally linked together through kinship, which is commonly considered as an overall influencing factor in family-firms research to analyze the impact on the strategic behavior and results of family firms. The family members have individual differences in their goals and interests. In fact, there are individual differences in the goals and interests pursued by family members, which are characterized by external consistency but internal diversity. Scholars have focused on the impact of intra-family kinship effects on value creation and governance efficiency through the composition of family executives, intra-family power distribution, and intra-family kinship effects [25,36–38], which illustrates the importance of a reasonable distribution of intra-family power. Specifically, family ownership arrangement encompasses the family as a whole, individual family members, and the relationship between the two [37]. Different mechanisms of power distribution can lead to differences in the distribution of power among members. From the perspective of power distribution, this paper defines the distribution of ownership within family firms as the distribution of ownership among family members, which refers to the concentration or dispersion of ownership distribution due to different shareholdings of family members.

Previous research has demonstrated that the degree of ownership dispersion among family members is a crucial factor that might impact the performance of small- and medium-sized family firms. Gersick et al. [39] pointed out that family ownership divides with time as family owners pass their shares to their offspring and the firm transitions from "controlling owners" to "sibling partnerships" and, finally, to the "cousin consortium" stage. Schulze, Lubatkin and Dino [21] extended this idea with the development of a theory that analyzes the extent to which family ownership fragmentation among multiple family members changes the agency relationship. The agency problems typically associated with ownership do not apply solely to situations where ownership is dispersed among the same family, as family relationships may facilitate the coordination and distribution of ownership within groups. When ownership is concentrated in the hands of a single owner (most often the founder), parental "disinterest" motivates the controlling owner to develop a strong connection between personal and family wealth and corporate prosperity [38]. At this juncture, corporate decision makers are more likely to make decisions that maximize the interests of both the family and the firm, i.e., preferring investments that are conducive to wealth creation rather than a drain on corporate resources [21]. Studies have shown that founder-owned-and-managed businesses are more likely to perform better [40,41]. As family ownership divides and leadership is distributed among siblings, most owners may lack the power and influence required to exert decisions over other family members, which can result in poor decision making, distorted investment preferences, and poor performance. When family ownership is further dispersed among multiple members of the extended family, each family member may only invest a small portion of his or her wealth in the family business, increasing the likelihood of consumption and poor investment strategies [21,42]. In this case, family firms need to accommodate both the participating and non-participating family owners of the business. Schulze, Lubatkin and Dino [21] argued that family firms with high intra-family ownership dispersion may favor decisions that protect the value of current assets against future ownership dilution.

The choice and preference of family firms to invest in innovation is strongly related to the goals of the family and the firm, the available resources, and risk taking [43]. Product and process innovations differ greatly in risk, cost–benefit, and difficulty in imitation. Family firms with different ownership dispersions have different attitudes toward product and process innovation in terms of resource allocation and risk taking. First, in terms of goal preferences and risk taking, family firms with relatively concentrated ownership tend to combine the future of the firm with their personal and family visions, have a long-term orientation, pay more attention to the long-term development of the firm, and are more willing to increase their investment in innovation in order to achieve "longevity" [44]. At the same time, decision makers with greater ownership have a deeper grasp of the firm, hold specific resources and skills that can help it grow [45], and are more willing and able to undertake some risky but advantageous innovation projects for a company's future development. Second, concentrated ownership means that decision makers have more discretionary power, more centralized decision-making authority, greater control over resource allocation, and may firmly promote innovation projects requiring the pooling of people and material resources. Consequently, family firms with concentrated ownership have a greater preference for risk taking and higher resource requirements for product innovation, both in terms of ability and willingness.

With the divergence of family members' objectives, the possibilities of managerial opportunism arise, increasing the likelihood of family agents who free ride [46]. When the ownership of each family member is relatively fragmented, family members are more likely to pursue their own interests, have fragmented goals, and have widely different investment preferences and risk aversions as well as plans for corporate development, and they may be more concerned about the income they can receive through dividend distributions. Innovations with a high level of risk are long-term investments with uncertain rewards over an extended period of time. When the concentration of family ownership is low, family members are more likely to invest in relatively low-risk process innovation to protect their own interests, whereas higher risk product innovation is somewhat hindered. If ownership is spread too thinly among family members, the existence of small teams with different interests will inevitably make it difficult to implement various decisions smoothly and cause fragmentation in strategic decision making. Due to the dispersion of ownership, the influence of the family on the business is limited, each family member is unable to independently influence the firm's decisions, and the behavior of each member is subject to fewer checks and balances by other family members. The cost of coordination among family members is relatively greater. Thus, when ownership is relatively dispersed within the family, family firms are more willing to invest in process innovation with shorter expected returns and lower risk.

In conclusion, we argue that family ownership dispersion may be a significant factor influencing the innovation input decisions of family firms, and we propose the following hypothesis 1:

Hypothesis 1. *The greater the concentration of ownership within the family, the more likely the proportion of product innovation input is higher than the proportion of process innovation input.*

2.3. The Moderating Role of Proportion of Family Directors and Collective Decision Making

Innovative input decisions are crucial to the survival of and growth in a business, and the distribution of decision-making power and the decision-making model are essential to the efficacy of innovative input decisions [13]. The proportion of family directors implies different decision-making power distribution, and the decision-making mode refers to the manner in which significant choices are made collectively or centrally. Below, we further discuss how the moderating effects of both decision-making power distribution and the corporate decision-making model lead to different innovation input decisions by family firms.

2.3.1. The Proportion of Family Directors

In the previous section, the direct influence of family ownership dispersion on firms' innovation input decisions was explored. The impact of family ownership differs depending on important governance conditions [47]. The relationship is likely to be affected by the distribution of seats for family members to participate in the board of directors, i.e., the proportion of family directors. Previous studies have focused on the supervisory function of the board; decision making is also one of the board's fundamental duties. Meanwhile, the Guidelines on the Articles of Association of Listed Companies, revised by the China Securities Regulatory Commission in 2016, indicates that "deciding on the company's business plan and investment plan" is one of the board of directors' most significant responsibilities (For details, see the Compilation of Company Law and Judicial Interpretations: IV. Corporate Governance—Guidelines on the Articles of Association of Listed Companies (Revised 2016) Article 107(3): The Board of Directors decides on the Company's business plans and investment decisions). In other words, the board of directors is the investment proposal decision-making body and will decide on investment proposals. According to the regulations for voting on the proposal, the approval of the investment plan is largely dependent on the voting outcome of the board of directors, which is closely tied to the composition of board seats [48]. The voting result is closely related to the structure of the board of directors. For family firms, the proportion of board seats occupied by family members reflects the different distribution of seats in the board, which directly affects the voting results of major innovation-investment motions and causes the board to make different innovation-investment decisions, leading to variations in innovation-investment preferences.

As family members become increasingly involved in major corporate decisions, altruism motivates family firms to prioritize family continuity and long-term profitability [49,50]. Family members on the board are committed to the long-term management and inter-generational-legacy goals of the family business, prompting the board to make investment decisions that are beneficial to the long-term development of the business [51]. In addition, family members are less inclined to make short-term return investments at the expense of long-term corporate value, as do shareholders and management under the supervision of family directors [52]. The oversight of family directors will also reduce the incentive and behavior of shareholders and management to prioritize short-term profits above long-term corporate value. When the proportion of family directors is higher, the interests of the decision-making team and the family are more aligned, which increases the decision-making team's governance attitude towards taking innovation risks and concentrating on the long-term development of the company. Moreover, when the proportion of family directors is high, the decision-making opinions of family directors are more likely to dominate, and the controlling family is more likely to exert pressure on the board to make innovation input decisions that are advantageous in the long-term. Family board members can discuss the family's long-term goals with non-family members [53], thus minimizing the growth opportunities associated with information asymmetries and fostering a consistent perception of risk [54].

However, when the proportion of family director seats is low, it will be difficult for the controlling family to influence the board to make innovation decisions that are advantageous in the long-term. Due to the differences in information and positions held by decision makers, communication costs are considerable. In order to maintain the long-term interests of the family and the company, family directors tend to communicate and coordinate more with non-family directors in innovation input decisions, with the expectation that group decisions will be consistent with the family-business's long-term business goals. However, it is easier for all parties to achieve a compromise or endorse a compromise choice under group decision making [55]. Wang [56] believed that the diverse opinions of board members typically result in a compromise decision outcome. If each decision maker chooses to protect their own interests in investment decisions, the final result may tend to support more conservative investment projects and fail to provide

financial and technical support for investment projects; the choice of the more conservative projects does not indicate inefficient investment, but is more likely to be a way for minority shareholders to prevent the loss of their own interests. It is more likely that a compromise strategy will be adopted by small and medium shareholders to protect their own interests. The choice of more conservative projects does not represent inefficient investment, but it is more likely a compromise strategy will be adopted by minority shareholders to prevent their own interests from being lost. Since family directors and non-family directors have different information and interests, and communication costs are high, the lower the proportion of family directors, the more difficult it is to coordinate communication, and the more divergent are the board's innovation investment decisions, the more parties will eventually compromise on the more conservative decisions.

In conclusion, we argue that, when the proportion of family directors is higher, the overall influence of the family is greater, the goal of continuing family control is more valued, and the long-term survival and development of the firm is of greater importance, while, when the family has higher discretion in the selection and implementation of innovation strategies, it will adopt a longer investment evaluation period, and prefer the type of product innovation investment that enhances the long-term competitiveness and environmental adaptability of the firm. As a result, Hypothesis 2 is proposed.

Hypothesis 2. *The proportion of family directors has a positive moderating effect on the relationship between family ownership dispersion and innovation input decisions, such that family firms with a higher family directors' proportion and more concentrated family ownership are more likely to invest more in product innovation than in process innovation.*

2.3.2. Collective Decision Making

According to behavioral decision theory, when decision-making parties are confronted with a complex environment and information asymmetry, the more centralized the decision-making power of a corporate decision-making team, the higher the risk-taking level of the team; furthermore, the more decentralized the decision-making power of the decision-making team, the lower the risk-taking level. Previous studies have shown that, due to the differences in goals, capabilities, vision, and information adequacy of individual decision makers, when the power of decision makers is more dispersed, decision making is commonly a compromise between different viewpoints [55,57,58]. In a collective decision-making model, the outcome of the decision is usually a compromise of the majority viewpoints. For innovation input decisions, such a trade-off decision will lead the firm avoiding high-risk projects and shifting to innovation projects with less risk. When family firms adopt a collective decision-making model for major decisions, through multiple rounds of collective consultation and information sharing, the final decision results in avoiding high-risk projects as much as possible and maximizes the interests of all existing decision makers. The more divergent the decision-making opinions are, the more likely the decision result is to compromise on the more conservative innovation input projects.

At the same time, in the collective decision-making model, in addition to the role of ownership power in the communal decision-making paradigm, other powers such as structural power, expert power, and prestige power also serve as checks and balances [59]. Thus, consequently, the proportion of product innovation inputs with greater risk and return uncertainty may be reduced in the collective decision-making model, as stated by Hypothesis 3.

Hypothesis 3. *Collective decision making has a negative moderating effect on the relationship between family ownership dispersion and innovation input decisions; that is, when major family firm decisions are made collectively, family firms with concentrated family ownership are less likely to invest more in product innovation than process innovation.*

3. Research Methodology

3.1. Data and Sample

This paper is based on a national survey conducted in 2015 by the project "Evaluation of the Health of China's Non-public Economy". The survey was jointly organized by the All-China Federation of Industry and Commerce and Zhejiang University, and was conducted on private firms in 12 provinces (including Hebei, Anhui, Guangdong, Zhejiang, Yunnan and Xinjiang, etc.) across China. Specific questionnaires were distributed by first randomly selecting enterprises in counties and county-level cities according to their level of economic development, followed by a multi-stage stratified sampling of private firms of different sizes and industries based on urban and rural distribution. With the assistance of the Federation of Industry and Commerce of each province and the administration of industry and commerce, a total of 1500 questionnaires were distributed and 1256 questionnaires were collected at the end of 2015, with a recovery rate of 83.73%.

Based on previous studies, we define family firms as those with more than 50% family shareholding and at least two or more family members holding senior management positions (including chairman, directors and top management positions). After implementing the above sample selection criteria for family business, and in order to assure the representativeness of the data sample, we eliminated invalid questionnaires containing excessively missing data, duplicate responses, and contradictory information. Finally, the sample consists of 882 sample firms.

The questionnaire design is divided into an entrepreneur's questionnaire (QA) and a vice president of finance questionnaires (QB). The percentage of family executives and family information are filled out by the entrepreneurs themselves, while the R&D investment, major decision patterns, and financial data are filled out by the vice president of finance. Using paired samples approach to obtain data increase the data's reliability and efficacy, avoiding the issue of common method bias.

According to the sample's entrepreneurial characteristics, approximately 70% of the entrepreneurs are in the age of 40–60, which is consistent with the law of the times, according to which the first family firms are typically in the first- and second-generation transition period after the reform and opening up in China. Nearly 90% of the entrepreneurs in the sample are male, and the education level of entrepreneurs is high, with college and university degrees comprising 70% of the total. In terms of enterprise characteristics, 88% of the sample consists of small- and medium-sized family firms, of which 43.8% percent have fewer than 100 employees and 44.4% have 100–500 employees. More than 50% of the enterprises have existed for between 10 and 20 years; approximately 45% of the family firms in the sample are in the manufacturing industry; and in terms of regional distribution, 27.7% of the family firms in the sample are located in Zhejiang Province and 19.2% in Guangdong Province. The basic characteristics and distribution of the sample are detailed in Table 1.

Table 1. Sample characteristics description.

Features	Sample Size	Percentage	Features	Sample Size	Percentage
Entrepreneurial characteristics					
Age			Education level		
30 years old and below	25	2.8	High School and below	190	21.5
31~40 years old	49	5.5	College	325	36.8
41~50 years old	408	46.2	Undergraduate	292	33.1
51~60 years old	207	23.5	Graduate	75	8.5
Over 60 years old	193	21.9			

Table 1. *Cont.*

Features	Sample Size	Percentage	Features	Sample Size	Percentage
Gender					
Male	784	89.0			
Female	98	11.0			
			Firm Characteristics		
Size			Industry		
Less than 100 people	387	43.8	Manufacturing	394	44.6
100~500 people	392	44.4	Wholesale and retail trade	118	13.3
501~1000 people	48	5.4	Agriculture, forestry and fisheries	48	5.4
1001~2000 people	37	4.2	Real estate	46	5.2
More than 2000 people	18	2.0	Other	276	31.2
Firm Age			Location		
5 years and below	118	13.3	Zhejiang	245	27.7
6~10 years	174	19.7	Guangdong	170	19.2
11~15 years	274	31.0	Fujian	72	8.1
16~20 years	179	20.2	Anhui	98	11.1
More than 20 years	137	15.5	Other	297	33.6

(N = 882).

3.2. Variables

The measurements and descriptions of the variables are shown in Table 2, and the subjective variables were measured using recognized and appropriate instruments.

Dependent variable: As an operational definition of R&D intensity, we also employed the indicator of R&D as a share of sales, which has been widely utilized in prior research. The amount from the questionnaire item "In 2014, the amount of new investment in improving and developing new products and services in your company was (million yuan)" was taken as the total amount of investment in product innovation, while the amount from the question item "In 2014, the amount of new investment in improving production processes and procedures in your company was (million yuan)" was considered as the total amount of investment in process innovation. After the above two values were obtained, they were divided by the enterprise sales in 2014, and the resulting percentages are the proportion of product innovation input and the proportion of process innovation input. The difference between the proportions of product innovation investment and process innovation investment was obtained by subtracting the proportions of product innovation investment and process innovation investment.

Independent variable: Based on earlier research that examined the team's power distribution [60,61], we calculated the shareholding ratio of the first natural person shareholder of the company based on the answer of the questionnaire "The shareholding ratio of the first natural person shareholder of the company is _____%, and the shareholding ratio of other family shareholders is _____%" to measure the concentration of ownership within the family. The larger the value, the greater the shareholding of the first natural person shareholder, and the greater the concentration of ownership within the family; conversely, the smaller the value, the smaller the shareholding of the first natural person shareholder, the lower the concentration of ownership within the family.

Moderating variables: (1) The proportion of family directors to the total number of shares (FB). Calculated by dividing the number of family directors by the total number of board members. (2) Collective decision making (GD). Drawing on previous research, there are eight possible answers to the question "Who makes major decisions in your business (limit one)": (A) the business owner himself, (B) the shareholders' meeting, (C) the board of directors, (D) the business owner and top management team, (E) the business owner and the party branch, (F) the business owner and the labor union, (G) the business owner and family members, and (H) others. If the enterprise's important decisions are made solely

by the owner, the major decision is not made collectively was set to 0, and the remaining options were set to 1, to indicate that the major decisions are made collectively.

Table 2. Variable Description.

Variable Type	Variable	Variable Code	Measurement Instructions
Dependent variable	Product innovation	PI1	The amount of product investment divided by the sales
	Process innovation	PI2	The amount of process investment divided by the sales
Independent variable	Family ownership Dispersion	PD	The difference between the shareholding of the first shareholder and the average shareholding of other family members
Moderating variables	Percentage of family directors	FB	Proportion of family-member directors to the total number of board members
	Collective decision making	GD	Who makes the major decisions in the firm
Control variables	Entrepreneur gender	Gender	Dummy variable, male = 1, female = 0.
	Entrepreneur age	Age	Business owners' age in 2015.
	Entrepreneurial education level	Edu	1 = high school and below, 2 = college, 3 = bachelor's degree, 4 = master's degree.
	Leadership turnover	Turnover	Set to 1 if there has been a previous change of leadership in the company, otherwise 0.
	Firm age	Firm age	Number of years of business existence as of 2015.
	Firm size	Firm size	Total enterprise assets (CNY million), taking the natural logarithm.
	Board size	Bodsize	The total number of board of directors.
	Family voting rights	FV	Total family ownership.
	Percentage of family executives	FT	The number of family executives as a percentage of the total number of executives.
	Duality	Dual	Set to 1 if the chairman is also the CEO, otherwise 0.
	Past performance	Roa	Return on assets (ROA) of the company in 2014.
	Industry	Industry	The financial sector was used as the control group, and agriculture, forestry, animal husbandry and fishery, mining, and manufacturing were set up. 18 dummy variables, such as manufacturing industry.

Control variables: Innovation research has fully demonstrated the effects of entrepreneurial education level, age, firm size, firm age, industry, debt ratio, high-tech industry, operating efficiency, and board size on R&D investment [8]. Based on previous studies, we select entrepreneur gender (Gender), entrepreneur age (Age), and entrepreneur education (Edu) as control variables at the entrepreneurial characteristics level. In addition, Firm age, Firm size, Roa, and Turnover were examined as control variables at the

firm-characteristics and performance levels. Family-level and board-level control variables were examined through board size (Bodsize), family executive ratio (FT), family voting power (FV), and duality (Dual). Finally, dummy variables were converted to control for the industry in which the firm was located. The operational definitions of specific variables can be found in Table 2.

3.3. Data Processing

After coding and analyzing the variables, we found that the set of variables containing independent, moderating and control variables corresponded to a maximum variance inflation factor of 1.33, which indicated that the sample data did not have multiple co-variance problems [62]. In order to avoid the problem of common method bias caused by the same information source, this set of questionnaires was filled out in a paired way, i.e., the entrepreneur's questionnaires (QA) was filled out by the entrepreneur himself, mainly containing basic information such as entrepreneurial characteristics and family shareholding, and the vice president of finance's questionnaires (QB) was filled in by the vice president of finance with data on enterprise innovation investment and performance. We utilized SPSS 25.0 and STATA 14.0 for statistical data analysis. It comprises descriptive statistical analysis and *t*-tests of dependent variables using SPSS, followed by hierarchical regression using STATA to assess the main effect of intra-family ownership concentration and the moderating influence of family director ratio and collective decision making.

4. Results

4.1. Descriptive Statistics and Correlation Analysis

Table 3 presents the means, standard deviations, and correlation coefficients of the most important variables. It is observed that there is a significant difference between the means of product innovation and process innovation inputs (3.6% and 2.3%, respectively), a high degree of intra-family ownership concentration (0.678), and a mean value of 32.6% for the proportion of family executives; the degree of intra-family ownership dispersion and product innovation are significantly positively correlated, and also significantly positively correlated with process innovation, but the relationship with the difference between the two needs further validation. According to the criteria for evaluating multicollinearity (0.6), the issue of multicollinearity among variables in this study was effectively controlled.

4.2. Hypotheses Testing

Hierarchical regression was utilized to examine the hypotheses. Before conducting the empirical analysis, the data were processed as follows: (1) By centering the interaction term variables, the problem of multicollinearity was avoided. (2) Variance inflation factor (VIF) diagnostics were conducted, and the findings indicated that the VIF values were all less than 2, which was significantly less than the criteria of 10, showing that there was no multicollinearity between all explanatory and control variables.

T-test for difference of dependent variables: Table 4 shows the results of the *t*-test, for comparing the difference between product innovation and process innovation inputs. When the concentration of ownership within the family is high, the product-innovation inputs of firms is significantly greater than the process-innovation inputs ($\beta = 0.017$, $p < 0.01$); when the concentration of ownership within the family is low, there is no significant difference between product-innovation inputs and process-innovation inputs ($\beta = 0.006$, $p > 0.1$)

Table 3. Descriptive statistics and correlations of the main variables.

Variable	Mean	Standard Deviation	1	2	3	4	5	6	7
1. PI1	0.036	0.027	1.000						
2. PI2	0.023	0.011	−0.095 **	1.00					
3. PD	0.678	7.541	0.122 ***	0.091 **	1.000				
4. FB	0.362	9.742	0.041 *	0.027	0.235 *	1.000			
5. GD	0.382	1.092	0.152 ***	0.113 ***	0.084 **	−0.012	1.000		
6. Gender	0.891	0.323	0.052	−0.012	0.061	−0.037	0.076 +	1.000	
7. Age	47.621	8.112	0.021	−0.034	0.548	−0.038	0.036	0.175 **	1.000
8. Edu	2.350	0.896	0.055	0.033	0.101 **	0.032	−0.051	−0.032	−0.191 ***
9. Firm age	14.050	8.112	0.027	0.003	−0.031	−0.032	0.053	0.071 *	0.352 ***
10. Firm size	8.471	1.902	0.153 ***	0.062 +	0.083 **	0.077 *	0.029	0.137 ***	0.192 ***
11. Dual	0.423	0.495	−0.065 +	−0.024	−0.057	−0.038	0.055	0.043	0.042
12. Bodsize	3.411	3.110	0.075 *	−0.021	0.053	−0.043	0.021	0.062 +	0.164 ***
13. FT	0.236	8.722	0.061 *	0.027	0.235 *	0.042	0.023	0.033	0.032
14. FV	0.724	4.234	0.244 **	−0.051	0.063	−0.323	0.1231	0.162	0.574
15. Roa	0.078	0.124	−0.01	0.033	0.073 *	−0.112 **	0.061	−0.072 *	−0.043
16. Turnover	0.115	0.352	0.026 +	−0.021	0.089 **	0.048 *	0.032	−0.011	−0.025
Variable	8	9	10	11	12	13	14	15	16
8. Edu	1.000								
9. Firm age	−0.011	1.000							
10. Firm size	0.029 **	0.216 ***	1.000						
11. Dual	−0.027 *	0.081 *	−0.023	1.000					
12. Bodsize	0.130 ***	0.128 ***	0.252 ***	0.121 ***	1.000				
13. FT	0.038 *	0.031	0.059 **	0.072	0.237 ***	1.000			
14. FV	0.037	0.295 *	0.072	0.033	0.321	0.044	1.000		
15. Roa	−0.041	−0.024	−0.132 ***	0.021	0.012	0.024	−0.025	1.000	
16. Turnover	0.061 +	0.117 **	0.019 **	−0.037 *	0.056 +	0.034	−0.045	−0.245	1.000

(N = 882). Note: +, *, **, *** indicate that the statistic is significant at the 10%, 5%, 1%, and 0.1% levels, respectively.

Table 4. *T*-test for difference of dependent variable.

	High Ownership-Concentration Degree of Family Business	Low Ownership-Concentration Degree of Family Business
Product-innovation intensity	0.037	0.032
Process-innovation intensity	0.020	0.026
Difference	0.017 **	0.006
T-value	t = 1.842	t = 2.150

Note: The median family ownership concentration is 0.703. ** indicates that the statistic is significant at the 1% levels.

Table 5 reports the regression results for the difference between product and process innovation as the dependent variable and the degree of ownership concentration within the family as the independent variable. Model 1 is the baseline model, which includes all control and moderating variables. Based on Model I, Model II is a test model that includes the independent variables. The results indicate that family ownership dispersion is significantly and positively related to the structure of innovation investment (β = 0.117, $p < 0.01$), and the results in Models 3, 4 and full Model 5 indicate that the results remain robust after the subsequent inclusion of moderating variables, indicating that the higher the degree of intra-family ownership concentration, the more likely the product innovation input proportion is likely to be greater than the process innovation input. Therefore, Hypothesis 1 is supported.

Table 5. Regression analysis results.

	Model 1	Model 2	Model 3	Model 4	Model 5
PD		0.117 ** (0.037)	0.118 ** (0.037)	0.112 ** (0.037)	0.111 ** (0.037)
PD × FB			0.055 * (0.026)		0.048 + (0.027)
PD × GD				−0.066 * (0.032)	0.067 * (0.032)
Gender	0.035 (0.089)	0.038 (0.088)	0.039 (0.088)	0.037 (0.088)	0.027 (0.088)
Age	−0.003 (0.005)	−0.002 (0.005)	−0.004 (0.005)	−0.002 (0.005)	−0.005 (0.005)
Edu	0.025 * (0.032)	0.023 * (0.031)	0.025 * (0.031)	0.024 * (0.031)	0.027 * (0.031)
Firm age	−0.003 (0.006)	−0.001 (0.002)	−0.004 (0.003)	−0.003 (0.003)	−0.002 (0.003)
Firm size	0.048 ** (0.016)	0.046 ** (0.016)	0.047 ** (0.016)	0.047 ** (0.016)	0.047 ** (0.016)
Dual	−0.093 + (0.056)	−0.089 (0.055)	−0.090 (0.055)	−0.083 (0.055)	−0.085 (0.055)
Bodsize	0.009 (0.010)	0.010 (0.009)	0.011 (0.009)	0.010 (0.009)	0.011 (0.009)
FT	−0.131 (0.321)	−0.127 (0.319)	−0.128 (0.319)	−0.104 (0.319)	−0.131 (0.318)
FV	0.112 (0.421)	0.117 (0.417)	0.118 (0.419)	0.114 (0.412)	0.111 (0.419)
Roa	0.023 ** (0.229)	0.004 ** (0.228)	0.011 ** (0.228)	0.000 ** (0.228)	0.007 ** (0.227)
Turnover	0.069 (0.078)	0.078 (0.077)	0.080 (0.077)	0.074 (0.077)	0.080 (0.077)
Industry	Control	Control	Control	Control	Control
FB	0.043 * (0.017)	0.039 * (0.017)	0.032 + (0.017)	0.038 * (0.017)	0.030 + (0.017)
GD	0.105 ** (0.025)	0.095 ** (0.025)	0.092 ** (0.025)	0.093 ** (0.025)	0.089 ** (0.025)
Constant	1.898 *** (0.260)	1.532 *** (0.283)	1.541 *** (0.282)	1.538 *** (0.282)	1.569 *** (0.282)
$AdjustedR^2$	0.051	0.060	0.063	0.063	0.068
N	882	882	882	882	882

Note: +, *, **, *** indicate that the statistic is significant at the 10%, 5%, 1%, and 0.1% levels, respectively; standard errors are in parentheses.

The results from Model 3 show that there is a significant positive relationship between the interaction term of family ownership dispersion and family directorship and the difference between product innovation and process innovation (β = 0.055, $p < 0.05$), and the result remains robust in the subsequent full Model 5, indicating that family directorship

enhances the positive effect of intra-family ownership concentration on innovation input decisions positively, and Hypothesis 2 is supported.

The results from Model 4 show that there is a significant negative relationship between the interaction term of family ownership dispersion and collective decision making and the difference between product and process innovation ($\beta = -0.066$, $p < 0.05$), which remains robust in the subsequent full Model 5. Thus, collective decision making mitigates the positive influence of intra-family ownership concentration on innovation input decisions, supporting Hypothesis 3.

Following the approach of Aiken, West and Reno [62], the moderating effect of proportion of family directors and collective decision making was further analyzed by visualizing the moderating effect (Figures 1 and 2). As depicted in Figure 1, the positive effect of intra-family ownership concentration on the product innovation and process innovation differentials is more amplified when the proportion of family director is large. As depicted in Figure 2, the collaborative decision-making model reduces the positive impact of intra-family ownership concentration on product-innovation and process-innovation differentials in family firms.

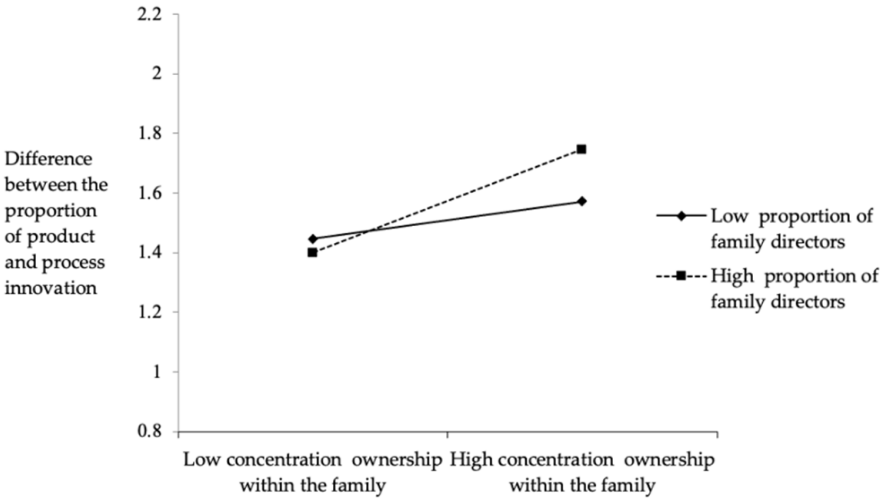

Figure 1. The role of family-director ratio regulation.

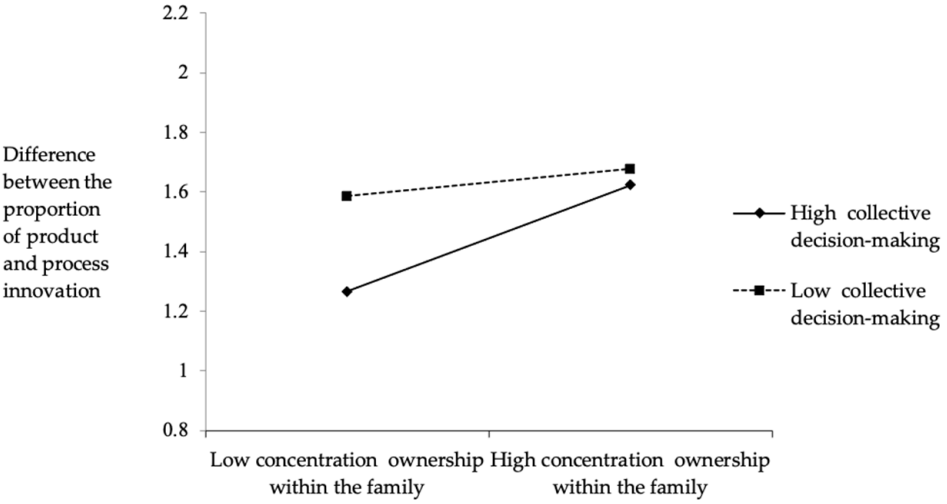

Figure 2. Moderating role of collective decision making.

5. Robustness Test

To test the robustness of the results, we replaced the regression analysis of the model with the ratio of innovation inputs to total assets as an alternative measure of product and process innovation. Table 6 reports the robustness results. From Model 7, it can be seen that

the degree of intra-family ownership concentration is significantly and positively correlated with the difference between the product innovation and process innovation proportion after replacing the measure ($\beta = 0.115$, $p < 0.01$); from Model 8, there is a significant positive correlation between the interaction term of intra-family ownership concentration and family-director proportion and the difference between product innovation and process innovation ($\beta = 0.032$, $p < 0.05$); from Model 9, there is a significant negative correlation between the interaction term of the degree of intra-family ownership concentration and collective decision making and the difference between product innovation and process innovation ($\beta = -0.061$, $p < 0.05$). Hypotheses 1, 2, and 3 remain supported.

Table 6. Robustness test results for replacing the product and process innovation input measures.

	Model 7	**Model 8**	**Model 9**	**Model 10**
Control variables	Control	Control	Control	Control
PD	0.115 ** (0.061)	0.114 ** (0.067)	0.113 ** (0.065)	0.112 ** (0.069)
PD × FB		0.032 * (0.019)		0.030 * (0.018)
PD × GD			−0.061 * (0.030)	−0.061 * (0.030)
Constant	1.535 *** (0.232)	1.549 *** (0.232)	1.542 *** (0.232)	1.553 *** (0.232)
$AdjustedR^2$	0.047	0.051	0.053	0.056
N	882	882	882	882

Note: *, **, *** denote statistics significant at the 5%, 1%, and 0.1% levels, respectively; standard errors are in parentheses.

6. Discussion and Conclusions

We analyzed the impact of intra-family ownership dispersion on firms' innovation input decisions from the perspective of power distribution in family firms, and further explored the moderating effect of decision contextual factors, i.e., the proportion of family directors and collective decision-making model, on the relationship between family ownership dispersion on firms' innovation input decisions. It is found that (1) the distribution of ownership within the family firm affects the innovation input decision of the family firm. The distribution of ownership affects family firms' goal preferences, risk taking and resource allocation in making innovation input decisions. The greater the concentration of family members' ownership, the more likely the proportion of product innovation input exceeds the proportion of process innovation. (2) The proportion of family directors and collective decision making play a moderating role in the relationship between family-firm ownership distribution and innovation input decisions. Family firms with more concentrated ownership are more likely to have a higher share of product input than process innovation when the share of family directors is higher; when family firms adopt a collective decision-making model, the positive effect of ownership concentration on the proportion of product innovation over process innovation is diminished.

The above findings lead to the subsequent contributions.

First, we contribute to the expansion of knowledge regarding the antecedents of innovation inputs in family firms. In previous studies on the still-controversial nature of family firm innovation, the literature holds the view that either family firms help promote innovation or family firms hinder innovation. Studies based on the subjective perspective tended to treat innovation inputs as homogeneous wholes by default, ignore the internal differences in different types of innovation inputs, and fail to explore the relationship between family firms and different types of innovation inputs. From the perspective of intra-family ownership power distribution, we examine whether and how ownership dispersion affects firms' innovation inputs and the weights of two different types of innovation inputs, product innovation and process innovation. This provides a new insight into the innovation input decisions of family firms as a unique organizational structure. This is useful to help us understand the characteristics of the different types of innovation input

decisions and the relationship between ownership distribution and these characteristics within family firms. Patel and Chrisman [20] analyzed the different types of innovation inputs that family firms participate in under varying performance conditions. This study takes this issue one step further by looking at the impact of the distribution of ownership within family firms on different types of innovation input decisions, as well as the attitudes of different family firms when dealing with different types of innovation decisions. Product and process innovations differ in terms of risk level, benefits and cost amortization strategies [14–18]; when innovation input decisions need to be made, family firms will seek the best combination of risks and benefits between different types of innovation input decisions based on their own stage of development, with too much risk threatening family firms preservation and development of social-emotional wealth and too little risk losing the possibility of promoting firm growth. This illustrates the different ways in which family firms with varied ownership distributions carefully balance the family's goals with the firm's economic goals [63,64].

Second, we examined whether ownership distribution affects firms' innovation inputs and how it affects the weight of two different types of innovation inputs, product innovation and process innovation, from the perspective of intra-family ownership power allocation, which compensates for the fact that most previous studies on innovation inputs in family firms examined the impact of family involvement on innovation inputs from the family as a homogeneous whole. This rectifies a shortcoming that the majority of prior research treats the family as a whole and fails to differentiate between the goals of individual family members and their distinct preferences for innovation input decisions.

Third, we explore the boundary conditions of the role of intra-family ownership distribution on innovation input decisions from the perspectives of decision power distribution and decision mode, i.e., the proportion of family directors and collective decision making, which are comprehensive decisions made by the core coalition with decision power in the firm. Even under the same intra-family ownership distribution, differences in the proportion of family directors and decision-making patterns have distinct effects on the innovation input decisions of family firms, revealing the moderating factors of the innovation input analysis framework.

Finally, we enrich the study of family firm heterogeneity by demonstrating that, within family firm groups, different distributions of family ownership influence family-firms' goal preferences, risk taking, and resource-allocation discretion when making innovation input decisions, thereby allowing for the emergence of family-heterogeneous innovation input behavior. Moreover, even with the same ownership distribution, differences in the distribution of decision-making power and decision-making patterns might influence the differences in family-firms' innovation input decisions. Calabrò et al. [65] encourage scholars to take into account innovation heterogeneity as a promising direction for future studies aimed at more fully understanding FF innovation. The preceding findings support the heterogeneity of family firms and the necessity to examine them.

There are several practice implications. First, innovation aids family businesses in maintaining a competitive advantage. Family businesses are uniquely positioned to innovate, and family involvement in ownership, management, and governance may result in the development of unique resources that can influence technological innovation. By gaining a deeper understanding of the types and characteristics of technological innovations, decision makers can leverage technological innovation for transformation and upgrading. Second, family firms can consciously adjust their power distribution according to the growth stage of the family and the firm, initiate institutional construction in family governance as early as possible, standardize institutional arrangements for the coordination of the behavior and interests of various members within the family, across the family, and between the family and the firm, and establish a comprehensive, rational, and reciprocal governance structure. By optimizing power distribution, effective supervision and restraining power will be established within the family firm.

7. Limitations and Future Research Directions

There are some limitations in this paper that need further improvement in future research. We examined the impact of ownership distribution within family firms on innovation input decisions, which may not be comprehensive. Subsequent research can differentiate and compare power types and investigate the multidimensional impact of power distribution on innovation input decisions. This can be accomplished by continuing to explore the corresponding effects of different power structures, such as ownership, management, and control, on innovation input decisions. Second, we distinguished innovation input into product innovation and process innovation, which may not be a perfect division and may not accurately reflect the attitudes and selection preferences of family firms toward different types of innovation. Future research can distinguish other types of innovation, such as disruptive innovation and incremental innovation, or sustaining or radical innovation, based on innovation content and characteristics, so as to better explore the heterogeneous behavior of family firms' innovation input decisions. In addition, we used cross-sectional data and were unable to consider the impact of time-series changes on firms' innovation inputs. Future studies can undertake tracking research on organizations, utilize time-series data, and integrate approaches such as case studies to evaluate the causal relationship between power distribution and innovation input decisions for more credible study findings.

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