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## **Three Essays on Entrepreneurship in China**

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## Abstract

This thesis delves into the realm of entrepreneurship, especially entrepreneurial decision-making, entrepreneurial performance, and innovation in China, a country that is experiencing vibrant entrepreneurial growth. Since the advent of its market transition in the late 1980s, China has witnessed a surge in vigorous private enterprise development. Recent years have seen a dedicated commitment from the Chinese government to nurture entrepreneurship and drive innovation. Notably, China embarked on extensive programs in 2004, specifically aimed at propelling entrepreneurship and innovation. Subsequent efforts in 2018 sought to bolster these initiatives, broadening their scope and intensifying support for start-ups. Consequently, China presents an intriguing and critical landscape for exploring pertinent research on entrepreneurship. The thesis is comprised by three essays that focus on entrepreneurial decision-making, entrepreneurial performance, and entrepreneurial innovation in the Chinese context.

The first paper, also the job market paper “*Better shelter, worse entrepreneurial performance: Evidence from China’s One-Child Policy*” revolves around probing into how entrepreneurs’ family resources impact their entrepreneurial performance. On the one hand, family resources help to improve entrepreneurs’ development chances; on the other hand, easy access to family resources may weaken their entrepreneurial capabilities and spirits. The paper navigates the theoretical tension between the “pro-family resources” and “anti-family resources” perspectives, leveraging China’s one-child policy as an extreme scenario to unearth evidence that either supports or challenges these viewpoints.

In the second paper “*The absorption of a scientific approach to entrepreneurial decision-making: Evidence from a field experiment in China*”, I delve into the treatment effects arising from a scientific approach to entrepreneurial decision-making, which characterized by clear formulation of problems, the development of theories about the implications of entrepreneurial actions, tests of these theories through systematic evidence, and rigorous evaluation of test results. This paper aims to uncover this paper aims to investigate whether these heterogeneous treatment effects are caused by the differences in individuals’ ability to absorb the scientific

approach and how the absorption of the scientific approach affects entrepreneurial performance.

Building upon the first paper, the third paper “*Stand by or come inside: The effect of entrepreneurs’ access to family resources and family involvement on innovation in start-ups*” investigates how entrepreneurs’ access to family resources impacts innovation investment in start-ups. This paper highlights the disparity between the availability of family resources and actual involvement of family when evaluating innovation investment in start-ups.

In summary, this thesis aims to contribute to a deeper understanding of entrepreneurial decision-making, entrepreneurial performance, and innovation in the Chinese context.

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In conclusion, I share a verse from the esteemed Chinese poet of the Tang dynasty, Bai Li, that resonates deeply with me:

*While both banks' gibbons cry calls still unceasing,  
my light boat has gone by many fold mountains*

May I traverse the trials of life yet return as youthful as ever.

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# **Better Shelter, Worse Entrepreneurial Performance: Evidence from China's One-Child**

## **Policy**

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## **Abstract**

**Research Summary:** Family resources play an influential role in entrepreneurship. However, what remains unclear is whether family resources benefit the performance of entrepreneurs. On one hand, family resources help to improve entrepreneurs' development chances; nevertheless, easy access to family resources may weaken their entrepreneurial capabilities and spirits. We use China's one-child policy as a "trick" to uncover the effect of access to family resources on entrepreneurial performance. We find that only-child entrepreneurs perform worse than non-only-child entrepreneurs. In particular, the higher risk aversion of only-child entrepreneurs serves as a mechanism; higher reliance on family resources is another mechanism, but it applies to firms outside of high-tech industries and self-employed businesses. Our analyses show significant disadvantages of only-child entrepreneurs, providing support to the anti-resource from a family view.

**Managerial Summary:** How do only-child entrepreneurs perform in comparison with non-only-child entrepreneurs? Thanks to China's one-child policy, we are able to examine the behavior and performance of only-child entrepreneurs, and find that they earn lower revenues. Two mechanisms explain this performance gap: first, they have lower risk preferences than

non-only-child entrepreneurs; second, they rely more on family resources, but this mechanism is applicable to non-high-tech industries and self-employed businesses. Therefore, for those who have no siblings and want to set up their own businesses, it is wise to bear in mind that being excessively conservative might hamper the growth of the enterprise. Moreover, only-child entrepreneurs should also avoid relying too much on the suggestions of their families.

**Keywords:**

Entrepreneurial performance; only-child entrepreneurs; China's one-child policy; risk preference; reliance on family resources



## INTRODUCTION

A growing body of scholarship in entrepreneurship demonstrates that family resources play an influential role in entrepreneurship. For instance, previous research has emphasized the importance of founders in support of resources provided by family members (Aldrich, 1999; Aldrich & Zimmer, 1986). Several studies indicate that, during the start-up process, family plays an important role in the mobilization of financial resources (e.g., Aldrich & Waldinger, 1990; Steier & Greenwood, 2000), human resources (Aldrich, Renzulli, & Langton, 1998), and so on. However, what remains unclear is how family resources affect the performance of entrepreneurs.

There has been a theoretical tension between the “pro-resource from family” and the “anti-resource from family” view. On one hand, without resource dilution from siblings, only children can access more resources from their families (Anastasi, 1956; Downey, 2001), which can help improve their entrepreneurial development chances (Downey, 2001; Dyer, 2003). On the other hand, easy access to more resources since childhood may make only children rely more on family resources and more risk-averse, which may weaken their entrepreneurial capabilities and spirits (Mueller, Wolfe, & Syed, 2017; Morris, Carlos, Kistruck, Lount, & Thomas, 2023; Chattopadhyay & Choudhury, 2017). Then, based on previous studies, it is unclear whether these family resources ultimately benefit the performance of entrepreneurs.

As only children perform differently from their non-only-child counterparts due to access to family resources, we use the only-child situation as a “trick” to uncover the effect of access to family resources on entrepreneurial performance. The key to this tension is to note what is

‘certain’ about having access to more family resources. Only child entrepreneurs will exhibit two crucial characteristics directly resulting from additional family resources. First, having access to more family resources since childhood, only children will be more sensitive to losses and exhibit lower risk preferences (Kahneman & Tversky, 1979; Cameron, Erkal, Gangadharan, & Meng, 2013; Yang & Yu, 2016). Moreover, only children tend to rely more on family resources since they are accustomed to receiving all kinds of support from their families. Thus, these two major characteristics, risk preference and reliance on family resources, will provide us with an angle to explore further the impacts of being an only child on entrepreneurial performance.

In this paper, we focus on the effect of being an only child on entrepreneurial performance rather than the antecedent of entrepreneurial performance, i.e., entering entrepreneurship. To identify the causal impact of being the only child on entrepreneurial performance, we use China’s one-child policy (OCP) as an exogenous shock. The OCP has created tens of millions of only children, which could be found in no other regions and only in specific periods in China. Thus, the OCP is an incomparable setting to identify the effect of being the only child. However, though the OCP was imposed nationwide, the strictness of the implementation varied by period, region, and social status (Scharping, 2003; Li, Yi & Zhang, 2011). In this paper, we pioneer using the heterogeneity of the implementation of the OCP between urban and rural areas and between parents who work in public and non-public sectors to identify the effect of the OCP to extract the effect of being an only child from other family traits.

We use the data from Enterprise Surveys for Innovation and Entrepreneurship in China (ESIEC), which is one of China’s core entrepreneurship investigation projects that obtain

micro data on the entrepreneurial patterns of Chinese enterprises conducted by Peking University. Using data on approximately 2,500 Chinese start-ups from ESIEC 2018, we found that only-child entrepreneurs perform worse than only-child entrepreneurs. In particular, only-child entrepreneurs exhibit lower risk preferences, which negatively impact their entrepreneurial performance. We also found that in non-high-tech start-ups and self-employed businesses, only-child entrepreneurs exhibit higher reliance on family resources, which also hurts their entrepreneurial performance. Our study contributes to understanding how access to family resources would affect entrepreneurial performance. Our results also provide support to the ‘anti-resources from family’ view and explain the behavioral mechanisms of why family resources would harm entrepreneurs.

## **THEORY AND HYPOTHESES DEVELOPMENT**

### **Only Children and Entrepreneurial Performance**

Previous research has demonstrated that the family has been thought of as defining objective background characteristics and resources that influence individual development (Belsky, Lerner, & Spanier, 1984; Rowe, 1990; Hoisl, Kongsted, & Mariani, 2022). Only children develop differently from their counterparts in family resources, and these differences may influence the values and behaviors of only children (Falbo & Polit, 1986; Blake, 1981; Downey, 2001; Trent & Spitze, 2011; Cameron et al., 2013).

On the one hand, the ‘pro-resources from family’ view holds that family resources are valuable to entrepreneurs and can improve their development chances (Dyer, 2003). The resources-dilution theory demonstrates that the increasing number of siblings and decreasing age gap among siblings dilute each child’s family resources, such as parental time, care, and

financial support (Anastasi, 1956; Downey, 2001). Without resource dilution from siblings, only children have access to more family resources (Anastasi, 1956; Downey, 2001). Family capital can add value to individuals as it is instrumental in helping them achieve their goals (Steier, 2001; Dyer, 2003). Consequently, only children have better development chances than non-only-children.

On the other hand, the ‘anti-resources from family’ view argues that easy access to more family resources may weaken entrepreneurial capabilities and spirits. Since childhood, only children are accustomed to receiving more resources and support from their families than their counterparts, which may have several consequences. First, only children may lack the opportunities to develop their entrepreneurial capabilities to tackle problems independently. Chattopadhyay and Choudhury (2017) have demonstrated that individuals deployed to more challenging contexts early in their lives experience faster career advancement in the future because challenging contexts provide them more opportunities to develop human capital skills and greater motivation to relocate out of the challenging context. Moreover, only children may have lower entrepreneurial resilience and grit that need to be sharpened through experiencing challenging situations and difficulties, which are critical to venture success (Mueller et al., 2017). Third, only children may also lack a growth mindset that needs to be developed in solving problems and failures, which are also essential to entrepreneurial action (Morris et al., 2022). Consequently, only children may have weaker entrepreneurial capabilities and spirits.

Based on these two competing streams, it is uncertain how being the only child may affect entrepreneurial performance. Thus, we develop competing hypotheses as follows.

**Hypothesis (H1a/H1b).** *Enterprises of only-child entrepreneurs will perform better/worse.*

### **The Mechanisms**

From the discussions mentioned above that lead to our research question, it is not difficult to notice a theoretical tension concerning the impact of the additional family resources enjoyed by only-child entrepreneurs. The optimistic side, or the “pro-resource” view, holds that more family resources allow only-child entrepreneurs to improve their development chances, while the pessimistic side, or the “anti-resource” view, argues that more family resources constitute a burden. So, how should we think about this issue?

We believe the key point is to note what is ‘certain’ about having more family resources. While the ultimate impacts are temporarily unclear, we found that only child entrepreneurs will have two crucial characteristics that directly result from additional family resources. First, only children will exhibit lower risk preferences mainly because of loss aversion; second, they subjectively attach more importance to family resources, which is also intuitive because family support plays a more significant part in their lives, and they are used to utilizing these resources. These two “certain” characteristics of only children provide us with an ideal springboard to explore further the impacts of being an only child on entrepreneurial performance. In the following part, we will elaborate on why these two characteristics are well-founded in literature and how they further underlie our hypotheses of the performance of only-child entrepreneurs.

#### ***Risk preference and entrepreneurial performance***

An obvious result of being only children is that they do not have to compete for parental

resources (e.g., time, energy, and financial resources) due to the absence of siblings (Blake, 1981; Anastasi, 1956; Downey, 2001). Therefore, only children can enjoy most of their parents' material and immaterial resources. Nevertheless, enjoying these resources may become a heavy mental burden for only children. Since only children are "unique" within the family, they are more likely to bear excessively high expectations from their parents psychologically. Such expectations will strengthen their pressure to pursue personal success and make them fear failure.

Additionally, as only children do not "lose" their parents' attention since childhood, the unreserved financial and emotional support from their parents will trigger a sense of loss aversion (Kahneman & Tversky, 1979), increasing their sensitivity to losses. As a result, only children may be inclined to avoid uncertainty and become risk-averse (Kahneman & Tversky, 1979). Empirical studies in China support this idea. Cameron et al. (2013) found that only children are more risk-averse; Yang and Yu (2016) examined the competitive behavior of only children and found that they tended to underestimate the probability of winning and avoid competition unless the uncertainty of relative performance was removed.

What remains a question is whether being risk-averse is good for entrepreneurial performance. When researchers investigated the influence of risk preference on entrepreneurial performance, the findings were mixed. Hvide and Panos (2014) found that firms started by more risk-tolerant individuals had lower sales and returns on assets, meaning that being less risk-averse caused entrepreneurs to perform worse. Nevertheless, previous research has also argued that entrepreneurs with lower risk preferences tend to embark on lower rewarding projects (Peng, Chang, and Liu; 2022), which would make their

entrepreneurial performance worse (Lumpkin & Dess, 1996; Runyan, Droge & Swinney, 2008; Putniņš & Sauka, 2020).

Despite the ambiguity, we predict that lower risk preferences will induce the disadvantages of entrepreneurs' performance. What needs to be emphasized is that the practical implications of risk preferences can vary by situation. In the context of Hvide and Panos (2014), being less risk-averse meant "accepting lower expected entrepreneurial returns for a given risk". This explanation matches the logic of an economist but is certainly not representative of the decision-making processes of entrepreneurs. In many cases, risk-taking means grasping opportunities and quickly responding to the changing market (Peng et al., 2022), which are beneficial for the long-term growth of entrepreneurial enterprises (Lumpkin & Dess, 1996; Runyan, Droge & Swinney, 2008). For example, a typical issue encountered by entrepreneurs is whether to launch an innovative project for which a "given" level of risk is never available. In this circumstance, more risk-averse entrepreneurs want to "play it safe" and will forgo many promising projects because the related risk is uncontrollable and unmeasurable. Thus, we hypothesize lower risk preferences of entrepreneurs will induce worse entrepreneurial performance.

**Hypothesis (H2).** *Only-child entrepreneurs will exhibit lower risk preferences, which negatively impacts the revenue of their enterprises than non-only-child entrepreneurs.*

### ***Reliance on family resources and entrepreneurial performance***

Another characteristic of only children is that they are accustomed to receiving resources and support from their families (Wang & Fong, 2009; Cameron et al., 2013). Thus, only children would attach more importance to family resources and rely more on family support. Empirical

studies in China also support this line of reasoning. The implementation of the OCP has created a generation of only children, who are often compared to “little emperors,” meaning that their parents will protect them as carefully as possible and keep them from facing any difficulty alone (Wang & Fong, 2009; Cameron et al., 2013).

We argue that higher reliance on family resources would negatively impact entrepreneurial performance for two reasons. Firstly, higher reliance on family resources may weaken an only child’s ability to be entrepreneurial and energetic. Entrepreneurs struggle continually over many years to build a business (Nambisan & Baron, 2013). As only children are accustomed to receiving resources and help when facing challenges, they may lack the ability to tackle problems independently as well as lack the opportunity to sharpen their growth mindset and entrepreneurial grit through failure (Dweck, 2006; Morris et al., 2022; Mueller, Wolfe & Syed, 2017). Thus, only child entrepreneurs may find it challenging to address issues and difficulties in the entrepreneurial process as they have weaker entrepreneurial spirits and capabilities.

Social network analysis can also reveal the disadvantages of only-child entrepreneurs immersed in closed family ties. Even if family members can offer suggestions, this “family-dependent” strategy does more harm than good. As a closed network, family ties increase the possibility that the entrepreneur will neglect new information sources where the ideas and practices would be new and valuable (Burt, 2007). Håkansson and Ford (2002) demonstrated that the inertia of the network structure would constrain the decision-maker’s ability to act and change within the company. Only-child entrepreneurs accustomed to doing business within a closed network are less likely to cooperate beyond their network (Burt, Opper, &



Holm, 2022) and are less successful in implementing long-run business plans (Opper & Burt, 2021). In summary, we expect only child entrepreneurs to perform worse due to higher reliance on family resources.

**Hypothesis (H3).** *Only-child entrepreneurs exhibit higher reliance on family resources, which negatively impacts the revenue of their enterprises than non-only-child entrepreneurs.*

### **The Heterogeneous Effects of the Two Mechanisms**

The two mechanisms discussed above may not equally apply to all entrepreneurial firms. We find it worthwhile to consider that risk preference patterns and reliance on family resources can vary in their effectiveness depending on some characteristics of the firm. Accordingly, we would like to demonstrate the circumstances under which the two mechanisms may be more effective.

#### ***The heterogeneous effect of risk preference***

When examining the situations in which the risk preference mechanism is more prominent, the crucial point is that if an entrepreneur's family members are among the key decision-makers, e.g., among one of the largest shareholders or initial investors of the entrepreneur's enterprise, they are expected to exert influence on the strategic moves of the firm. For only-child entrepreneurs, the impact of these family members can be more significant because only-child entrepreneurs exhibit higher reliance on family resources and are more likely to follow family members' suggestions. Thus, the entrepreneur's risk preferences will not be that significant in determining firm performance. Kraiczy, Hack, and Kellermanns (2015) supported this line of reasoning, documenting that high levels of ownership by family members of top management teams can weaken the relationship between CEO risk-taking

propensity and new product innovativeness. Therefore, we would like to pick out the firms influenced by the entrepreneur's family members and declare these firms as the "non-compliers" of our hypothesis regarding risk preference.

**Hypothesis (H4).** *The relationship between risk preference and entrepreneurial revenues of only-child entrepreneurs would be less significant if the entrepreneur's family members are among one of the largest shareholders or initial investors.*

#### ***The heterogeneous effect of the reliance on family resources***

Concerning the reliance on family resources, the inference is that in some circumstances, the vital importance of risk preference may, in turn, outweigh the influence of the reliance on family resources. One factor that boosts the significance of risk preference is the industrial context. For firms in the high-tech industry, the risk preference of the entrepreneur will be of great importance due to the highly risky nature of innovative activities. Firms in the high-tech sector must engage in massive R&D to keep up with the pace of technological progress. In such a situation where R&D can determine firm survival, the risk preference of the entrepreneur will be of great importance due to the highly risky nature of innovative campaigns. Cen and Doukas (2017) reported a positive association between CEO risk-taking and firm risk, where the measurement of the riskiness of firm policies also included R&D expenditures. The study indicates that the importance of the entrepreneur's risk preference partially depends on the importance of R&D activities in determining firm performance. Generally speaking, the higher the significance of firm riskiness, the lower the decisive power of the entrepreneur's reliance on family.

On the contrary, some factors may increase the visibility of the entrepreneur's reliance on

family resources. For example, the type of the firm matters for whether the entrepreneurial revenue is significantly affected by the entrepreneur's reliance on family resources. Schölin, Broomé, and Ohlsson (2016) demonstrated that family factors strongly influence an individual's intention to become self-employed. Typically, self-employed businesses are more heavily impacted by family existence than non-self-employed businesses. For self-employed businesses, the family can dilute the influence of the entrepreneur's individual risk preferences in the decision process. A recent comparative study between family and non-family firms found that family firms were more likely to make decisions on a group basis and to diversify risk when making multiple decisions concerning corporate entrepreneurship (Fang, Memili, Chrisman, & Tang, 2021). Another study on female executives reported that family ownership was mitigating the positive impact of female executives on risk-taking in high-tech firms (Saeed, Mukarram, & Belghitar, 2021). These findings show that the context of self-employment can amplify the importance of the entrepreneur's reliance on family resources, even in high-tech industries.

The above discussion implies that firms are heterogeneous in their sensitivity to the entrepreneur's reliance on family resources. For firms in the high-tech industry or non-self-employed businesses, the entrepreneur's risk preferences will be a crucial driver of firm performance (with respect to family resources as stated in *H3*).

**Hypothesis (H5).** *The relationship between reliance on family resources and entrepreneurial revenues of only-child entrepreneurs would be less significant if the firm is in high-tech industries or non-self-employed businesses.*

## **RESEARCH CONTEXT: CHINA'S ONE-CHILD POLICY**

### **Background of China's One-Child Policy (OCP)**

China's OCP provides an incomparable context to test our hypotheses. As a unique, extreme population planning initiative, the OCP was conducted between 1980 and 2015 to curb China's population growth by allowing most Chinese families to have only one child (Peng, 1991; Scharping, 2003), creating tens of millions of only children in China. No similar policies with a comparable size can be found elsewhere in the world, and even China has already allowed all Chinese parents to have two or three kids since 2015. Therefore, China's OCP is a precious, unparalleled setting of which we can take full advantage to verify our reasoning.

China started to launch its family planning policies in the 1970s due to concerns over colossal population growth (Peng, 1991; Scharping, 2003). The OCP was imposed nationwide around 1980 and was officially written into the constitution of the People's Republic of China in 1982. The implementation of the OCP was led by the National Population and Family Planning Commission at the national level and specialized commissions at the provincial level (Scharping, 2003; Tian, 2009; Ebenstein, 2010). The local governments were given the discretionary power to adjust the policy strictness in response to demographic, social, and economic changes (Scharping, 2003; Tian, 2009; Ebenstein, 2010). Thus, though the OCP was imposed nationwide, the strictness of the implementation of the OCP varied by period, region, and social status (Li et al., 2011). For instance, minority groups were subject to much looser restrictions than the Han nationality (Peng, 1991; Scharping, 2003); geographically, the OCP was implemented most strictly in eastern, more developed provinces (Guo, Zhang, Gu, & Wang, 2013).

### **Two Distinguished Features Regarding the Implementation of the OCP**

Though the OCP is regarded as a natural experiment, we cannot use the temporal dummy of the implementation of OCP as the only “treatment” variable. This is because the OCP was implemented with varying strictness for different regions and social groups. Therefore, we identify two distinctive features (residence registration type and parents working in public sectors) regarding the rigor of the implementation of the OCP and build the interaction terms between these two features and the time dummy of OCP to measure the causal effect of the OCP.

### ***Residence registration type (RR)***

The OCP was more strictly enforced in urban areas than in rural areas (Peng, 1991; Kane & Choi, 1999; Zhang & Sturm, 1994). In the mid-1980s, rural families, particularly those with only one female child, strongly resisted the OCP as agricultural work required more labor force (Peng, 1991; Scharping, 2003). Considering the practical difficulties of rural areas, the Chinese central government loosened the OCP to make it more flexible in rural areas in the mid-1980s (Peng, 1991; Scharping, 2003), and rural residents were eligible for a second child if their first child was female (Peng, 1991). In contrast, urban residents were more heavily affected by government policies (Zhang, 2017). Urban residents who obeyed the OCP were financially rewarded, while those who violated the policy were punished, and their children incurred higher living costs for accessing education and health services (Peng, 1991; Zhang & Sturm, 1994). Consequently, the implementation of the OCP is much stricter in urban areas than in rural areas.

### ***Parent(s) working in public sectors (PW)***

People working in public sectors (e.g., government and state-owned enterprises) were more strictly restricted by the OCP than others, as they were directly affected by the central

government's policy (Zhang, 2017). If found having more than one child, they were punished with hefty penalties, such as dismissal and career restrictions (Scharping, 2003; Li et al., 2011; Zhang, 2017). The heavy punishment for noncompliance to the OCP constrained people working in the public sector and induced them to obey the OCP more strictly (Zhang, 2017). In all, as people working in the public sector are hired and affected by the government directly, people who work in the public sector typically obey the OCP faithfully (Zhang, 2017).

## **METHODOLOGY**

### **Data Sources**

We use the information on Chinese entrepreneurs gathered from a large-scale survey named ESIEC (Enterprise Survey for Innovation and Entrepreneurship in China). ESIEC is organized by the Institute of Social Science Survey, one of the key research institutes of Peking University. As a nationwide, long-lasting survey, ESIEC covers entrepreneurs' demographic characteristics, enterprises' general conditions, and details about how the entrepreneurs established the enterprises. In this paper, we use the first baseline survey of ESIEC, conducted in 2018, as our data source. The first baseline survey has generated the largest dataset of ESIEC so far and includes 6,198 enterprises from 117 counties or districts in six provinces. Due to missing values, the final number of observations in our regressions varies from 2,500 to 3,000.

### **Model Specification**

#### ***The effect of being the only child: the baseline 2SLS model***

This paper is interested in the performance of only-child entrepreneurs. We start from the basic model that estimates the direct effect of being the only child on entrepreneurial

performance. This model corresponds to *HI* and yields the baseline results of our study.

A particular family having only one child is not a random choice; it can be induced by the family's financial conditions, social status, religious beliefs, or other considerations. Therefore, a reasonable instrumental variable (IV) is necessary for the reliable estimation of the impact of being an only child. As an "exogenous" shock, the OCP serves as a seemingly satisfactory IV for being the only child. However, the OCP itself was not a clear-cut command; the stringency of its implementation varied by time, region, ethnic groups, and other factors. Accordingly, previous studies have avoided using the OCP as a single IV and developed various empirical strategies to estimate OCP's effect robustly. One solution is to switch to other econometric models. For example, Li, Yi, and Zhang (2011) leveraged the fact that the OCP did not apply to minorities and produced a difference-in-differences (DiD) estimator. Another solution is to stick to the IV model but look for a more reliable IV other than the OCP itself. Chen (2020) exploited the regional factor and used as IV the stringency of the implementation of OCP in different provinces.

We follow the IV strategy and design our model as a two-stage least squares (2SLS) model, with "being the only child" as the endogenous variable. The first-stage regression of the model includes two IVs, meaning that our 2SLS model is featured by overidentification. One of the IVs is the OCP itself, and the other is the interaction term between OCP and a specific factor *I* that influences the stringency of the implementation of OCP. The whole 2SLS model can be stated as:

$$\textit{Only child} = \gamma_0 + \gamma_1 \textit{OCP} + \gamma_2 \textit{OCP} \times I + \textit{control variables} \quad \textcircled{1}$$

$$\textit{Firm performance} = \beta_0 + \beta_1 \textit{Only child} + \textit{control variables} \quad \textcircled{2}$$

where  $I = (\text{parents working in the public sector})$  or  $(\text{residence registration type})$

The reasons for this overidentification structure are twofold. Firstly, by including the OCP itself, we recognize that the OCP was a crucial shock that significantly changed the probability of being an only child. Secondly, by including the interaction term, we account for the concern that the OCP was not purely exogenous and was not equally strictly implemented in different situations. Moreover, overidentification makes it more likely to obtain strong IVs because these two IVs can capture more information that predicts the probability of being the only child.

The selection of  $I$  is based on features that affect the stringency of OCP implementation. The OCP was more strictly enforced in urban areas and upon people who worked in public sectors. Accordingly, we use the following two factors as  $I$ : whether the focal entrepreneur's parents work in the public sector and whether the focal entrepreneur holds an agricultural registered residence.

### ***The exogeneity of OCP stringency factors on entrepreneurial performance***

The concern that the OCP stringency factors  $I$  may suffer from omitted variable bias (e.g., ability or resources) is worth discussing. We argue that the interaction term  $OCP \times I$  is exogenous. First, due to China's planned economy from 1952 to 1992 and the jurisdiction of the household registration (*hukou*) system, social mobility was restricted. It was difficult for parents to find jobs in the public sector without *guanxi*. Moreover, it was difficult for people to relocate to different regions/provinces and change their residence registration type before the 21st century. Thus, the parents' public jobs and the residence registration type were largely "given".



Second, the performance gap caused by unobserved benefits (e.g., ability or resources) between parents with and without public work was approximately the same before and after 1980. The logic also applies to the residence registration type. We also include the two variables (residence registration type and parents' public work) as controls in the regressions to reduce unobserved heterogeneity in the error. So, these two variables are basically random with respect to entrepreneurial performance. Thus, the IVs composed of interaction terms are unlikely to affect entrepreneurial performance through unmeasurable errors.

***The mechanism effects: the modified 2SLS model***

We need to design a modified model in order to test the mechanism effects (*H2* and *H3*). To ensure causality, we keep the 2SLS structure but instead treat the mechanism variable as the endogenous regressor. The corresponding IV is the predicted probability of being the only child, namely, the estimated value from equation ① in the baseline model. We are confident that this predicted probability satisfies the key requirements of an IV: the likelihood of being the only child is associated with the mechanisms since we have demonstrated that only children are systematically different in terms of risk preference and family reliance; the probability of being the only child is unlikely to affect firm performance through unknown mechanisms other than the characteristics of the entrepreneur. The modified model can be described as follows:

$$\begin{aligned} \text{Mechanism} = & \theta_0 + \theta_1 \text{Predicted probability of being the only child} \\ & + \text{control variables} \end{aligned}$$

$$\text{Firm performance} = \mu_0 + \mu_1 \text{Mechanism} + \text{control variables}$$

where *Mechanism* = (*risk preference*) or (*reliance on family resources*)

The selection of the mechanism is based on *H2* and *H3*. In particular, *H2* predicts that for

the mechanism of risk preference,  $\theta_1$  is negative, but  $\mu_1$  is positive; *H3* predicts that for the mechanism of family reliance,  $\theta_1$  is positive, but  $\mu_1$  is negative.

## **Variable Measures**

### ***Dependent and independent variables***

The dependent variable is *entrepreneurial income*, measured by the natural log of entrepreneurial revenue. The independent variable is *single child*, measured by a dummy variable if entrepreneurs are the single child or not. We also controlled for several main variables that could affect entrepreneurial performance, including but not limited to *firm type*, *firm age*, *residence registration type*, *parents working in the public sector*, and *entrepreneur parents*. The detailed descriptive statistics and definitions of the key independent variables, dependent variables, and control variables are shown in Table 1.

-----  
Insert Table 1 here  
-----

### ***Mechanism variables***

*Risk preference* is measured by a subjective self-evaluation question and an objective risk analysis game. The subjective self-evaluation question asks participants to rate from 1 to 10 on their risk preference. The objective risk analysis game includes several evolutionary coin-toss-or-not games where sequential decisions are made between risky and safe choices. The score of risk preference is computed by summing the self-evaluation score and the risk analysis game score.

*Reliance on family resources* is measured by the self-reported importance of family social status and economic conditions to one's success. If participants attach greater importance to family social status and economic conditions, they will rely more on family resources in their

entrepreneurial process.

*Family influence* is measured in two ways. Specifically, firms that do NOT have the entrepreneur's family members among the three largest shareholders or firms that were NOT initially financed by the entrepreneur's family members are regarded as not significantly influenced by family forces.

## RESULTS

### The Effect of Being the Only Child: The Baseline 2SLS Model

In this paper, we focus on the effect of being the only child on entrepreneurial performance rather than the antecedents of entrepreneurial performance, i.e., entering entrepreneurship. To be clear, note that the baseline model focuses on the direct effect of being the only child on entrepreneurial performance. The model can be described as follows:

$$\text{Only child} = \gamma_0 + \gamma_1 OCP + \gamma_2 OCP \times I + \text{control variables} \quad (1)$$

$$\text{Firm performance} = \beta_0 + \beta_1 \text{Only child} + \text{control variables} \quad (2)$$

where  $I = (\text{parents working in public sector})$  or  $(\text{residence registration type})$

In all models below, the errors are clustered by the industry and the province in which the focal start-up operates. Before the baseline 2SLS model, we first run the intention-to-treat (ITT) regressions on the effect of OCP. That is, we regard OCP as a random treat and run OLS regressions to see its direct impacts on entrepreneurial revenue. While this regression only represents preparatory analysis, it shows an initial glimpse of the patterns we propose. Table 2 shows the results of the ITT regressions with  $OCP$  and  $OCP \times I$ . Whichever the "OCP stringency factor"  $I$  is, OCP has a significantly negative coefficient. This pattern gives a hint that entrepreneurs born after the implementation of OCP tend to perform worse.

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Insert Table 2 here  
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Table 3 shows the two formal 2SLS models on entrepreneurial performance responding to our *RQI*. The left two columns show results when the “OCP stringency factor” *I* is whether the entrepreneur’s parent(s) work in the public sector; the right two columns show the results when the “OCP stringency factor” *I* is the entrepreneur’s residence type. Whichever *I* is, in stage 1, the coefficient of the interaction term (one of the IVs) shows that entrepreneurs who are more strictly affected by OCP are more likely to be only children. Correspondingly, the second stage shows that these only-child entrepreneurs perform worse than their peers.

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Insert Table 3 here  
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Jointly, the two models in Table 3 illustrate that an entrepreneur whose family is significantly influenced by OCP has a higher chance of being the only child and therefore earns lower revenue.

### **The Mechanism Effects of Risk Preference and Reliance on Family Resources**

In Table 4, we show the results of the ITT regressions with our mechanism variables. OLS regressions show that entrepreneurs born after the OCP with agricultural residence tend to be more risk averse (lower risk preference), while entrepreneurs born after the OCP with parent(s) working in the public sector tend to rely more on family resources.

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Insert Table 4 here  
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In *Hypothesis 2*, we predict that only-child entrepreneurs have lower risk preferences, which in turn leads to lower entrepreneurial revenue. Table 5 presents the corresponding results.

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Insert Table 5 here  
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We incorporate two 2SLS models with different “OCP stringency factor”  $I$  using the predicted probability of being the only child as IV in the first-stage regressions. That is, the IV in column 1 is the estimated value of the dependent variable from column 1 in Table 3, while the IV in column 3 is the estimated value of the dependent variable from column 3 in Table 3.

The 2SLS model in the first two columns yields no results. However, the other 2SLS model in the third and fourth columns yields significant results in both stages. The results indicate that those who are more likely to be the only child (because of their birth year and residence type) tend to be more risk averse and earn lower entrepreneurial revenue (note that risk preferences are positively associated with revenue in column 4). Thus, *Hypothesis 2* is supported when the “OCP stringency factor”  $I$  is the residence registration type.

In *Hypothesis 3*, we predict that only-child entrepreneurs exhibit higher reliance on family resources, which in turn leads to lower entrepreneurial revenue. Table 6 presents the results of the corresponding 2SLS models.

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Insert Table 6 here  
-----

The structure of Table 6 is extremely similar to that of Table 5, except that the mechanism in Table 6 is reliance on family resources. Basically, the two 2SLS models yield no meaningful results at the significance level of 0.05. However, in the first two columns, the result is almost significant in the same direction predicted by *Hypothesis 3*. Therefore, we cannot conclude that *Hypothesis 3* is supported, but there is some evidence that the mechanism of family reliance is in place. This justifies the necessity to test *Hypothesis 5*,

which is an extension of *Hypothesis 3*.

### **The Heterogeneity of the Mechanism Effects**

In *Hypothesis 4*, we argue that the mechanism effect of risk preferences will work for enterprises that were not significantly influenced by the entrepreneur's family members.

Therefore, we divide the sample by the criteria of family influence and re-run the models for *Hypothesis 2* on these sub-samples. The results are shown in Tables 7 and 8.

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Insert Tables 7 and 8 here  
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Tables 7 and 8 differ from Table 5 ONLY in sample size. When the "OCP stringency factor" *I* is residence registration type, models in Tables 7 and 8 yield results that are significant at the level of 0.10 but insignificant at the level of 0.05. Therefore, we cannot conclude that *Hypothesis 4* is supported, but there is evidence that the mechanism of *Hypothesis 2* is in place for firms that are NOT significantly influenced by the entrepreneur's family members.

In *Hypothesis 5*, we argue that the mechanism effect of reliance on family resources will work for enterprises that were not significantly influenced by the entrepreneur's risk preferences. In the context of our study, we propose that firms' revenues will be less affected by the entrepreneur's risk preferences if the firms DO NOT belong to high-tech industries or if the firm is a self-employed business. Therefore, we divided the sample by whether the firm was classified into high-tech enterprises and whether the enterprise was a self-employed business or a corporation. Then we re-run the models for *Hypothesis 3* on these sub-samples. We present the results for firms that do NOT fall in the high-tech category and firms that are labeled as self-employed businesses, respectively, in Tables 9 and 10.

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Insert Tables 9 and 10 here  
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Note that Tables 9 and 10 differ from Table 6 ONLY in sample size. When the “OCP stringency factor”  $I$  is whether the entrepreneur’s parent(s) work in the public sector, models in Tables 9 and 10 yield highly significant results. Therefore, we can conclude that *Hypothesis 5* is supported when  $I$  is whether the entrepreneur’s parent(s) work in the public sector.

### **Robustness Check**

Given that our study focuses on entrepreneurial firms, which inherently face a relatively high probability of failure, it is imperative that we address the issue of firm survival within our dataset. Some may argue that our findings are subject to “survival bias” because there is a conventional belief that high-growth strategies entail higher risks compared to low-growth strategies. Thus, if high-growth firms experience a higher rate of failure than low-growth firms, and if we only observe surviving firms, then we would see firms run by single-child entrepreneurs, with lower performance in general, being significantly overrepresented in our dataset. This narrative could lead to the same empirical patterns we present but suggest different interpretations, thereby posing the risk of “survival bias”. Therefore, we conduct a robustness check on this.

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Insert Table 11 here  
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In our dataset, we have two groups of people: entrepreneurs and individuals from other professions (such as managers). According to the survivor bias argument, enterprises of one-child entrepreneurs are more likely to survive because they follow more conservative strategies, so individuals who are only children will be overrepresented among entrepreneurs. However,

contrary to this expectation, the t-test presented in Table 11 indicates that the proportion of single-child individuals among entrepreneurs is significantly lower than that among the remaining respondents. Therefore, within our dataset, we find evidence of a lack of survivor bias.

In summary, the results indicate that only-child entrepreneurs perform worse than their non-only-child counterparts. Lower risk preferences of only-child entrepreneurs serve as a mechanism that explains their lower entrepreneurial revenue; higher reliance on family resources is another mechanism but only applies to firms outside of high-tech industries and self-employed businesses.

## **DISCUSSION**

The theoretical tension concerning the impact of having access to more family resources on entrepreneurial performance is worth exploring. Intuitively, having more family resources improves individual development chances and helps to achieve individual goals. However, as the old sayings say, ‘there is no such thing as a free lunch’, and ‘everything comes with a price’. More family resources can also constitute a burden. First, only children will exhibit lower risk preferences mainly because of loss aversion; second, they subjectively attach more importance to family resources and rely more on these resources because family support plays a more significant part in their lives, and they are used to utilizing these resources since childhood. Therefore, we should think dialectically about what family resources can bring to entrepreneurs.

Referring to the characteristics derived from having more family resources in the literature, we find that the disadvantages can outweigh the advantages. First, only-child



entrepreneurs are more risk-averse than non-only-child entrepreneurs. As we discussed above, an only child is instead more likely to avoid potential losses and uncertainty due to high expectations from their parents. Only child entrepreneurs will be inclined to “play it safe” and forgo many promising projects. Entrepreneurs with lower risk preferences tend to embark on lower rewarding projects, which will have a negative impact on their entrepreneurial performance.

Reliance on family resources also has a negative impact on entrepreneurial performance. The great Chinese philosopher Mencius points out that people live through adversity but die through ease (ref. 1, p. 170). The reliance on family resources has negative implications for their entrepreneurial capabilities and spirits, which are critical to entrepreneurial success. Entrepreneurs face continuous challenges and struggles over many years to build their businesses. Entrepreneurs deployed to more challenging contexts with fewer family resources may seem to fall behind at the starting line but may experience better entrepreneurial performance in the future. This is because challenging contexts give entrepreneurs more opportunities to develop their entrepreneurial capabilities and greater motivation to achieve entrepreneurial success.

Practically, this paper has critical implications for policymakers and training providers who aim to lend a hand to entrepreneurs. Our findings indicate that these supporters should carefully consider whether the entrepreneurs are only children and then design special training courses for the only-child entrepreneurs. In particular, teaching them to mitigate excessive risk aversion and reliance on family resources may improve the efficacy of the supportive policies and training in favor of the only children who wish to start their businesses.

## CONCLUSION

Our research investigates the impact of access to family resources on entrepreneurial performance. We use the only child story as a “trick” to uncover the effect of access to family resources on entrepreneurial performance. The finding is that only-child entrepreneurs perform worse than their non-only-child counterparts. Lower risk preferences of only-child entrepreneurs explain their lower entrepreneurial revenue; higher reliance on family resources is another mechanism but applies to firms outside of high-tech industries and self-employed businesses.

This study contributes to entrepreneurship research in three significant ways. First, it offers a comprehensive investigation into how access to family resources influences entrepreneurial performance. Our study contributes to the competing research on pro-resources and anti-resources from a family view. Our study uncovers two key mechanisms—risk preference and reliance on family resources—that shed light on how family resources impact entrepreneurial outcomes. These two mechanisms are based on the main characteristics of being the only child, presenting results that support the “anti-resource from family” view. Second, our research examines how a specific family characteristic, namely being the only child, influences entrepreneurial performance. By augmenting existing theories on the impact of family characteristics on entrepreneurial outcomes, we contribute to a deeper understanding of the determinants of entrepreneurial performance. Third, we innovate by leveraging the heterogeneity in the enforcement of OCP across urban and rural areas, as well as between parents employed in public and non-public sectors. This approach allows us to create two novel instrumental variables (IVs) to identify the effect of being an only child.

These two IVs help us deal with the endogeneity issue and provide reliable estimations of the impact of being an only child.

This study has some limitations that offer opportunities for future research. First, the generalizability of the negative relationship between only-child entrepreneurs and entrepreneurial performance is limited by the fact that the sample is restricted to the Chinese setting. Future studies assessing applicability, generalizability, and boundary conditions are necessary to address this limitation. Second, the heterogeneous effects of these two mechanisms need to be validated. For instance, future studies could explore further the mechanisms of risk preference and family reliance on entrepreneurial performance in different industry settings.

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**TABLE 1**  
**Descriptive statistics**

<i>VARIABLE</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Definition</i>
(1) Entrepreneurial income	2791	3.888	2.032	0	12.21	Natural log of entrepreneurial revenue
(2) Born after 1980 (included)	2791	0.501	0.500	0	1	Dummy equal to 1 if born no earlier than 1980
(3) Firm type	2718	1.347	0.476	1	2	1 if enterprise; 2 if self-employed business
(4) Firm age	2791	3.115	2.074	1	8	The number of years since the firm was established
(5) Birth year	2791	1978	10.06	1937	2000	Year of birth of the entrepreneur
(6) Gender	2791	1.240	0.427	1	2	1 if male; 2 if female
(7) Ethnicity	2791	1.057	0.231	1	2	1 if ethnic Han; 2 if minority
(8) Education	2791	4.497	1.708	1	9	Highest education obtained (larger numbers ↔ higher education)
(9) Political identity	2791	2.653	0.756	1	3	1 if member of CPC; 2 if member of other parties; 3 if no party affiliation
(10) Marriage status	2791	1.936	0.359	1	4	1 if unmarried; 2 if married; 3 if divorced; 4 if widowed
(11) Residence registration type	2791	1.416	0.578	1	3	1 if rural residence; 2 or 3 if urban residence
(12) Parents working in public sector	2791	0.137	0.344	0	1	Dummy equal to 1 if at least one of the entrepreneur's parents work in public sectors
(13) Entrepreneur parents	2791	0.0930	0.290	0	1	Dummy equal to 1 if at least one of the entrepreneur's parents is also an entrepreneur
(14) Single child	2791	0.118	0.323	0	1	Dummy equal to 1 if the entrepreneur is actually an only child

**TABLE 2<sup>1</sup>**

<b>Intention-to-treat regressions of entrepreneurial performance</b>		
VARIABLES	(1)	(2)
	Revenue	Revenue
<b>Single-child policy</b>	-0.446** (-3.73)	-0.356* (-2.51)
<b>Single-child policy * PW</b>	-0.008 (-0.07)	
<b>Single-child policy * RR</b>		-0.227 (-1.22)
Firm type	-1.018*** (-5.40)	-1.018*** (-5.44)
Birth year	0.032*** (7.01)	0.032*** (6.72)
Gender	-0.439** (-3.64)	-0.440** (-3.59)
Ethnicity	-0.254 (-1.43)	-0.257 (-1.41)
Education	0.148** (3.41)	0.148** (3.56)
Political identity	-0.034 (-0.40)	-0.037 (-0.43)
Marriage status	0.392** (2.93)	0.384** (2.90)
RR	0.138* (2.05)	0.224* (2.53)
PW	-0.092 (-0.69)	-0.095 (-0.67)
Entrepreneur parents	0.321** (2.70)	0.330** (2.69)
Firm age	0.000 (0.07)	0.000 (0.05)
Constant	-59.376*** (-6.33)	-58.140*** (-6.09)
Observations	2,718	2,718
R-squared	0.131	0.132

<sup>1</sup> Notes for all tables below: robust t-statistics in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; PW=parents working in the public sector, RR=Residence registration type.



**TABLE 3**  
**Performance of only-child entrepreneurs**

VARIABLES	Stage 1 Single child	Stage 2 Revenue	Stage 1 Single child	Stage 2 Revenue
<b>Single-child policy</b>	0.028* (1.73)		-0.017 (-0.55)	
<b>Single-child policy * PW</b>	0.190*** (2.73)			
<b>Single-child policy * RR</b>			0.186*** (5.02)	
<b>Single child</b>		-1.648*** (-4.79)		-1.941*** (-2.69)
Firm type	0.034** (2.27)	-0.962*** (-5.24)	0.035** (2.48)	-0.952*** (-5.38)
Birth year	0.003*** (5.66)	0.023*** (3.62)	0.004*** (5.31)	0.025*** (3.35)
Gender	-0.036** (-2.05)	-0.503*** (-3.96)	-0.038** (-2.18)	-0.514*** (-4.31)
Ethnicity	-0.003 (-0.05)	-0.265 (-1.07)	-0.007 (-0.11)	-0.268 (-1.02)
Education	0.018** (2.47)	0.171*** (6.79)	0.017** (2.47)	0.176*** (4.74)
Political identity	0.004 (0.28)	-0.033 (-0.89)	0.004 (0.34)	-0.032 (-0.90)
Marriage status	-0.038* (-1.92)	0.311*** (3.05)	-0.033* (-1.75)	0.300*** (2.65)
RR	0.059*** (5.46)	0.241*** (6.22)	-0.012 (-0.79)	0.258*** (9.53)
PW	-0.013*** (-3.55)	0.039 (0.35)	0.070** (2.32)	0.059 (0.52)
Entrepreneur parents	0.025 (0.94)	0.350*** (3.68)	0.015 (0.61)	0.357*** (3.23)
Firm age	-0.000** (-2.57)	-0.000 (-0.21)	-0.000** (-2.45)	-0.000 (-0.25)
Constant	-6.423*** (-4.86)	-41.537*** (-3.10)	-7.027*** (-4.76)	-44.628*** (-2.93)
Observations	2,718	2,718	2,718	2,718
R-squared		0.055		0.029

**TABLE 4**  
**Intention-to-treat regressions of mechanism variables**

VARIABLES	(1) Risk preference(total)	(2) Risk preference(total)	(3) Reliance on family resources	(4) Reliance on family resources
<b>Single-child policy</b>	-0.336 (-0.55)	0.024 (0.04)	-0.016 (-0.08)	0.017 (0.12)
<b>Single-child policy * PW</b>	-0.338 (-0.76)		0.394* (2.56)	
<b>Single-child policy * RR</b>		-0.994*** (-5.67)		0.073 (0.35)
Firm type	-0.756*** (-4.12)	-0.751*** (-4.19)	0.073 (0.71)	0.074 (0.76)
Birth year	0.125** (3.99)	0.123** (3.89)	0.003 (0.32)	0.003 (0.31)
Gender	-0.830 (-1.96)	-0.826 (-1.91)	0.042 (0.48)	0.036 (0.42)
Ethnicity	0.918** (2.65)	0.922** (3.85)	-0.266** (-2.94)	-0.279** (-2.83)
Education	0.069 (1.01)	0.070 (1.05)	-0.017 (-0.50)	-0.018 (-0.52)
Political identity	-0.355 (-1.86)	-0.370* (-2.06)	-0.066 (-1.10)	-0.069 (-1.16)
Marriage status	-0.297 (-0.97)	-0.331 (-1.12)	0.101 (0.48)	0.101 (0.49)
RR	0.095 (0.50)	0.495** (2.63)	0.013 (0.14)	-0.016 (-0.12)
PW	0.398 (0.69)	0.240 (0.60)	-0.063 (-0.42)	0.114 (1.17)
Entrepreneur parents	-0.826* (-2.06)	-0.789 (-1.89)	0.067 (0.63)	0.058 (0.59)
Firm age	0.000 (0.85)	0.000 (0.78)	0.000 (0.06)	0.000 (0.08)
Constant	-235.401** (-3.85)	-230.454** (-3.76)	1.522 (0.08)	1.959 (0.10)
Observations	2,504	2,504	2,622	2,622
R-squared	0.060	0.062	0.005	0.004

**TABLE 5**  
**The mechanism effect of risk preferences**

VARIABLES	<i>I = PW</i>		<i>I = RR</i>	
	Stage 1 Risk preference(total)	Stage 2 Revenue	Stage 1 Risk preference(total)	Stage 2 Revenue
<b>Predicted single child (with <i>PW</i>)</b>	-2.822 (-1.04)			
<b>Predicted single child (with <i>RR</i>)</b>			-5.432*** (-3.78)	
<b>Risk preference (total)</b>		0.579 (0.95)		0.358** (2.25)
Firm type	-0.672*** (-3.31)	-0.570 (-1.09)	-0.575*** (-3.58)	-0.740*** (-2.85)
Birth year	0.125*** (5.80)	-0.055 (-0.84)	0.140*** (10.64)	-0.031* (-1.75)
Gender	-0.933*** (-3.00)	0.030 (0.07)	-1.029*** (-4.16)	-0.151 (-0.72)
Ethnicity	0.910*** (2.84)	-0.831 (-1.41)	0.887*** (2.79)	-0.623*** (-3.01)
Education	0.118 (1.38)	0.107 (1.53)	0.165** (2.07)	0.122*** (2.93)
Political identity	-0.348** (-2.54)	0.165 (0.65)	-0.347** (-2.53)	0.087 (0.76)
Marriage status	-0.424 (-1.56)	0.619* (1.78)	-0.518 (-1.62)	0.548*** (3.28)
RR	0.261 (1.48)	0.072 (0.71)	0.436** (2.30)	0.094 (1.45)
PW	0.459 (1.09)	-0.222 (-1.25)	0.621** (2.12)	-0.166 (-1.15)
Entrepreneur parents	-0.813** (-2.16)	0.807 (1.23)	-0.754** (-2.16)	0.612*** (2.59)
Firm age	0.000 (0.87)	-0.000 (-1.06)	0.000 (0.75)	-0.000 (-0.88)
Constant	-234.325*** (-5.48)	105.431 (0.87)	-262.936*** (-10.19)	60.423* (1.86)
Observations	2,504	2,504	2,504	2,504
R-squared		-2.064		-0.673

**TABLE 6**  
**The mechanism effect of reliance on family resources**

VARIABLES	<i>I = PW</i>		<i>I = RR</i>	
	Stage 1 Reliance on family	Stage 2 Revenue	Stage 1 Reliance on family	Stage 2 Revenue
<b>Predicted single child (with <i>PW</i>)</b>	1.801** (2.15)			
<b>Predicted single child (with <i>RR</i>)</b>			0.438 (0.47)	
<b>Reliance on family</b>		-0.995* (-1.93)		-4.339 (-0.51)
Firm type	0.011 (0.09)	-0.951*** (-5.78)	0.058 (0.53)	-0.704 (-1.13)
Birth year	-0.005 (-0.75)	0.018** (2.31)	0.002 (0.33)	0.034 (0.77)
Gender	0.106* (1.66)	-0.410*** (-3.28)	0.053 (0.98)	-0.289 (-1.09)
Ethnicity	-0.261** (-2.19)	-0.539* (-1.84)	-0.276** (-2.16)	-1.479 (-0.55)
Education	-0.050 (-1.53)	0.125*** (3.18)	-0.025 (-0.90)	0.070 (0.34)
Political identity	-0.073 (-1.37)	-0.109 (-1.38)	-0.070 (-1.34)	-0.342 (-0.53)
Marriage status	0.166 (1.12)	0.512* (1.95)	0.116 (0.73)	0.848 (0.69)
RR	-0.092 (-1.30)	0.174* (1.76)	-0.014 (-0.19)	0.212 (0.86)
PW	-0.014 (-0.14)	0.035 (0.27)	0.082 (0.76)	0.407 (0.38)
Entrepreneur parents	0.020 (0.14)	0.324** (2.26)	0.052 (0.38)	0.531 (1.01)
Firm age	0.000 (0.54)	0.000 (0.29)	0.000 (0.31)	0.000 (0.30)
Constant	17.790 (1.32)	-23.868* (-1.66)	3.389 (0.25)	-28.255 (-0.78)
Observations	2,622	2,622	2,622	2,622
R-squared		-0.651		-15.105

TABLE 7

The mechanism effect of risk preferences for firms that do NOT have the entrepreneur's family members among the three largest shareholders

VARIABLES	<i>I = PW</i>		<i>I = RR</i>	
	Stage 1 Risk preference(total)	Stage 2 Revenue	Stage 1 Risk preference(total)	Stage 2 Revenue
<b>Predicted single child (with PW)</b>	-3.118 (-1.14)			
<b>Predicted single child (with RR)</b>			-4.521*** (-3.81)	
<b>Risk preference (total)</b>		0.694 (0.97)		0.400* (1.90)
Firm type	-0.701*** (-3.68)	-0.345 (-0.54)	-0.649*** (-4.12)	-0.583** (-2.10)
Birth year	0.134*** (6.16)	-0.071 (-0.87)	0.142*** (12.79)	-0.037 (-1.47)
Gender	-1.063*** (-3.09)	0.182 (0.31)	-1.115*** (-3.87)	-0.094 (-0.34)
Ethnicity	0.821*** (3.14)	-0.793 (-1.42)	0.810*** (3.00)	-0.542** (-2.30)
Education	0.098 (1.17)	0.130* (1.92)	0.125 (1.38)	0.141*** (4.15)
Political identity	-0.398*** (-2.78)	0.269 (0.85)	-0.400*** (-2.81)	0.149 (1.13)
Marriage status	-0.202 (-0.79)	0.502** (1.99)	-0.250 (-0.85)	0.477*** (3.24)
RR	0.249 (1.06)	0.092 (0.67)	0.345* (1.87)	0.114 (1.16)
PW	0.621 (1.42)	-0.327 (-1.03)	0.695** (2.13)	-0.207 (-1.13)
Entrepreneur parents	-0.906* (-1.95)	0.955 (1.06)	-0.872* (-1.91)	0.670* (1.76)
Firm age	-0.000 (-0.38)	-0.000 (-0.19)	-0.000 (-0.47)	-0.000 (-0.32)
Constant	-252.177*** (-5.88)	136.138 (0.89)	-267.204*** (-12.33)	71.918 (1.54)
Observations	2,207	2,207	2,207	2,207
R-squared		-3.190		-0.916

**TABLE 8**  
**The effect of risk preferences for firms that were NOT initially financed by the**  
**entrepreneur's family members**

VARIABLES	<i>I = PW</i>		<i>I = RR</i>	
	Stage 1 Risk preference(total)	Stage 2 Revenue	Stage 1 Risk preference(total)	Stage 2 Revenue
<b>Predicted single child (with PW)</b>	-5.121 (-1.54)			
<b>Predicted single child (with RR)</b>			-6.770*** (-4.99)	
<b>Risk preference (total)</b>		0.271 (1.11)		0.284* (1.88)
Firm type	-0.377 (-1.42)	-0.777*** (-2.80)	-0.315 (-1.35)	-0.770*** (-3.14)
Birth year	0.131*** (5.09)	-0.021 (-0.85)	0.141*** (9.77)	-0.022 (-1.40)
Gender	-1.003*** (-2.68)	-0.168 (-0.60)	-1.057*** (-3.49)	-0.158 (-0.67)
Ethnicity	1.057** (2.36)	-0.556 (-1.63)	1.030** (2.35)	-0.571** (-2.41)
Education	0.135 (1.60)	0.115*** (2.75)	0.166** (2.05)	0.114*** (2.67)
Political identity	-0.322** (-2.05)	0.037 (0.29)	-0.323** (-2.06)	0.041 (0.36)
Marriage status	-0.446* (-1.88)	0.493*** (2.81)	-0.498* (-1.74)	0.497*** (3.06)
RR	0.374* (1.74)	0.129* (1.66)	0.492*** (3.03)	0.128 (1.60)
PW	0.540 (1.57)	-0.125 (-0.87)	0.622*** (3.12)	-0.128 (-0.91)
Entrepreneur parents	-1.300*** (-3.01)	0.626 (1.64)	-1.251*** (-2.94)	0.644** (2.20)
Firm age	0.000* (1.81)	-0.000 (-1.02)	0.000* (1.66)	-0.000 (-1.04)
Constant	-246.510*** (-4.86)	42.615 (0.94)	-266.618*** (-9.46)	45.107 (1.52)
Observations	1,945	1,945	1,945	1,945
R-squared		-0.342		-0.389

**TABLE 9**

**The effect of reliance on family resources for firms NOT in the high-tech category**

VARIABLES	<i>I = PW</i>		<i>I = RR</i>	
	Stage 1 Reliance on family	Stage 2 Revenue	Stage 1 Reliance on family	Stage 2 Revenue
<b>Predicted single child (with <i>PW</i>)</b>	2.293** (2.30)			
<b>Predicted single child (with <i>RR</i>)</b>			0.232 (0.19)	
<b>Reliance on family</b>		-1.204*** (-3.42)		-13.048 (-0.20)
Firm type	-0.068 (-0.71)	-1.237*** (-9.60)	0.000 (0.00)	-1.139 (-1.04)
Birth year	-0.002 (-0.20)	0.027** (2.51)	0.009 (1.07)	0.151 (0.22)
Gender	0.048 (0.48)	-0.601*** (-3.27)	-0.035 (-0.32)	-1.128 (-0.32)
Ethnicity	-0.330* (-1.86)	-0.657** (-2.18)	-0.351* (-1.93)	-4.849 (-0.21)
Education	-0.049 (-1.15)	0.183*** (4.37)	-0.011 (-0.33)	0.102 (0.14)
Political identity	-0.029 (-0.49)	-0.119 (-1.19)	-0.022 (-0.39)	-0.369 (-0.21)
Marriage status	0.279 (1.33)	0.662** (2.31)	0.201 (0.98)	2.958 (0.21)
RR	-0.140 (-1.20)	0.183 (1.13)	-0.024 (-0.21)	0.048 (0.03)
PW	-0.044 (-0.37)	-0.005 (-0.04)	0.094 (0.70)	1.295 (0.18)
Entrepreneur parents	-0.145 (-0.81)	0.058 (0.27)	-0.090 (-0.51)	-0.955 (-0.17)
Firm age	-0.000 (-0.03)	-0.000 (-0.32)	-0.000 (-0.30)	-0.000 (-0.15)
Constant	11.213 (0.68)	-38.274* (-1.92)	-10.371 (-0.61)	-190.405 (-0.23)
Observations	1,576	1,576	1,576	1,576
R-squared		-1.057		-152.502

**TABLE 10**

**The effect of reliance on family resources for firms that are self-employed businesses**

VARIABLES	<i>I = PW</i>		<i>I = RR</i>	
	Stage 1 Reliance on family	Stage 2 Revenue	Stage 1 Reliance on family	Stage 2 Revenue
<b>Predicted single child (with <i>PW</i>)</b>	3.525*** (3.86)			
<b>Predicted single child (with <i>RR</i>)</b>			2.529* (1.81)	
<b>Reliance on family</b>		-1.124*** (-3.16)		-0.902 (-1.21)
Firm type	-0.017*** (-2.98)	0.028*** (5.04)	-0.011 (-1.58)	0.028*** (5.27)
Birth year	0.032 (0.53)	-0.541*** (-4.12)	0.008 (0.12)	-0.520*** (-3.80)
Gender	-0.378 (-1.22)	-0.705** (-2.00)	-0.347 (-1.08)	-0.621 (-1.54)
Ethnicity	-0.078 (-1.10)	0.098 (1.41)	-0.068 (-1.28)	0.100* (1.70)
Education	0.028 (0.26)	-0.002 (-0.02)	0.028 (0.27)	-0.010 (-0.12)
Political identity	0.283 (1.37)	0.422 (1.45)	0.232 (0.96)	0.388 (1.56)
Marriage status	-0.054 (-0.64)	0.371*** (3.03)	0.015 (0.13)	0.339** (2.16)
RR	-0.199 (-1.62)	0.009 (0.04)	-0.133 (-0.65)	0.001 (0.01)
PW	0.424** (2.36)	0.742*** (2.81)	0.458*** (2.83)	0.632 (1.62)
Entrepreneur parents	0.000 (0.41)	0.000 (0.24)	0.000 (0.30)	0.000 (0.29)
Firm age	-0.017*** (-2.98)	0.028*** (5.04)	-0.011 (-1.58)	0.028*** (5.27)
Constant	41.816*** (3.63)	-43.886*** (-4.60)	29.889** (2.25)	-45.390*** (-5.67)
Observations	892	892	892	892
R-squared		-1.787		-1.137

**TABLE 11**

**Robustness check**

	N	Proportion of single child	Difference	SD	T-value	P-value
Entrepreneurs	4234	0.126				
Others	1266	0.179	-0.053	0.011	-4.85	0



# **The absorption of a scientific approach to entrepreneurial decision-making: Evidence from a field experiment in China**

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## **Abstract**

Previous experimental studies have demonstrated that a scientific approach to entrepreneurial decision-making (thereafter, the scientific approach) – characterized by clear formulation of problems, the development of theories about the implications of entrepreneurial actions, tests of these theories through systematic evidence, and rigorous evaluation of test results – can improve entrepreneurial performance. Moreover, these studies surfaced significant cross-firm and cross-individual variation in the effects of teaching the scientific approach to entrepreneurs. Nevertheless, these studies have not examined the determinants of such heterogeneous treatment effects. Building on this research gap, this paper aims to investigate whether these heterogeneous treatment effects are caused by the differences in individuals' ability to absorb the scientific approach and how the absorption of the scientific approach affects entrepreneurial performance. In order to test these, we develop measures of absorption embedded in a short survey that detect, using a hypothetical case study as a reference, the constitutive elements of the scientific approach. We also develop a moderator of absorption, *traditional Chinese*

*medicine* based on exogenous propensities of individuals to be open to the scientific approach. The empirical part of the research rests on an RCT involving around 200 Chinese start-ups. The findings presented in this paper are derived from the data collected during the initial five rounds of the RCT. Preliminary results indicate that show that the moderator of *traditional Chinese medicine* affects the absorption of the scientific approach, and absorption affects entrepreneurial performance. The heterogeneous effects also show that absorption matters on the demand side (the trainee effect) and the supply side (the mentor effect). Our research contributes to understanding the mechanism of the scientific approach effect and, more broadly, general entrepreneurship training.

**Keywords:** Entrepreneurial decision-making; The scientific approach; Absorption; Mentor effect; Field experiment; Entrepreneurial training

## **1. Introduction**

Identifying business ideas is critical to start-ups' success, but predicting the quality and value of business ideas is difficult (Eisenhardt & Brown, 1998; Camuffo et al., 2020; 2021; 2022). Thus, acquiring information and knowledge about the potential outcomes of the business idea is essential for any entrepreneurial decision (Delmar & Shane, 2003). Other conditions being equal, different decision-making methods might make a difference in entrepreneurial outcomes, and adopting effective entrepreneurial decision-making methods might reduce such waste and positively affect various individual and collective economic and social outcomes. One of the effective entrepreneurial decision-making methods, the scientific approach to entrepreneurial decision-making (hereafter, the scientific approach), rests on a precise formulation of problems, the development of theories about the implications of entrepreneurial actions, tests of these theories through systematic evidence, and rigorous evaluation of test results. Previous research has shown that when entrepreneurs adopt the scientific approach, they make more effective decisions regarding false-positive avoidance, a better adaptation of business ideas to emerging information (more focused pivoting) and higher revenues (Camuffo et al., 2020; 2021, Agarwal et al. 2023).

The scientific approach is labelled 'scientific' because it is similar to scientists' approach to developing new knowledge (Camuffo et al., 2020; 2021). Generally, scientists develop theories, test them through experiments and data, and modify their theories according to the results of the experiments. Like the approach adopted by scientists, the scientific approach is an entrepreneurial decision-making routine that can be learned and taught in the form of a disciplined way of thinking and acting comprising specific steps (theory, hypothesis, evidence,

evaluation, and decision) (Camuffo et al., 2020; 2021). Decision-makers are first taught to define the problem, articulate the theory clearly, and then explicitly formulate hypotheses based on these theories (Zenger, 2016). In addition, they are advised to conduct empirical testing of hypotheses based on systematic facts and data they collect and rigorously evaluate and interpret tests' outcomes (Murray & Tripsas, 2004; Kerr et al., 2014; Foss & Klein, 2012; Pfeffer & Sutton, 2006).

Previous research also shows many heterogeneous treatment effects of the scientific approach. For instance, more significant effects have been found on entrepreneurs with less managerial or industry experience, less education, or younger ages (Camuffo et al., 2021). Nevertheless, previous research has not examined why there are such heterogeneous effects and where these heterogeneous effects come from. In this paper, we investigate whether these heterogeneous effects are caused by the differences in individuals' ability to absorb the scientific approach. Since the paper uses training as an intervention, building on extant training literature (Baldwin & Ford, 1988; Alliger & Janak, 1989; Kirkpatrick, 1976), it defines absorption as the extent to which the knowledge and skills acquired in the training program have become an integrative part of the stock of knowledge and skills of participants.

More broadly, entrepreneurship training has been proven to be an effective method of promoting entrepreneurship and improving entrepreneurial performance (Martinez et al., 2010; Glaub & Frese, 2011; Henry, Hill & Leitch, 2005; Harper & Finnegan, 1998). Moreover, previous literature has demonstrated that the training needs of an individual vary according to different entrepreneurial stages, such as awareness, pre-startup, start-up, growth and maturity (McMullan & Long, 1987; Monroy, 1995; O'Gorman & Cunningham, 1997; Bridge et al., 1998).

Despite the importance of entrepreneurial training, previous research has rarely touched upon the absorption issue. Thus, we have no clue how the absorption of entrepreneurship training would impact entrepreneurial performance.

Building upon the research gap, this paper aims to investigate whether these heterogeneous treatment effects are caused by the differences in individuals' ability to absorb the scientific approach and how the absorption of the scientific approach (hereafter, absorption) affects entrepreneurial performance. In order to test whether absorption contributes to explaining why the effects of teaching the scientific approach vary, we develop measures of absorption embedded in a short survey that detect, using a hypothetical case study as a reference, the constitutive elements of the scientific approach. We also create a moderator of absorption, *traditional Chinese medicine* is based on exogenous propensities of individuals to be open to absorbing the scientific approach depending on their general bent and favourable psychosociological predisposition to science.

The empirical part of the paper rests on a field experiment involving about 200 Chinese start-ups. More specifically, it hinges on a three-arm experimental research design, comparing the pre-and post-performance effects of entrepreneurs randomly assigned to two experimental groups ("scientific" and "lean") and a control group (no intervention). In the randomized control trial (RCT), we teach the scientific treatment group both the theory and empirics components of the scientific approach (i.e., to formulate the problem scientifically and to develop and test theories about their actions), while the lean treatment group the empirics component of the scientific approach (i.e., hypothesis testing and experimentation). There is also a pure control group receiving no training, but we still collect data from this group. We collect 8 data points

on the decision-making and performance of all entrepreneurs for 16 months.

The findings presented in this paper are derived from the data collected during the initial five rounds of the RCT. Preliminary results show that the moderator of *traditional Chinese medicine* affects the absorption of the scientific approach, and the absorption of the scientific approach affects entrepreneurial performance. The heterogeneous effects also show that absorption matters both on the demand and supply sides. The demand side indicates that entrepreneurs need to be open to absorbing the scientific approach, and the supply side suggests that mentors play a significant role in the absorption of the scientific approach. Our research contributes to understanding the mechanisms of the scientific approach effect and, more broadly, general entrepreneurship training.

## **2. Theory and Hypotheses Development**

### **2.1 The scientific approach to entrepreneurial decision-making**

The scientific approach can be seen as an overarching framework that comprises two main recent developments and findings in entrepreneurship theory and practice. One stream underlines the importance of mental representations, theory development, and hypotheses formulation. This stream of literature argues the importance of theories before crafting experiments to test their hypotheses, as theories provide mechanisms that lead observations and shape what people see in scientific research and economic practices (Csaszar & Levinthal, 2016; Felin & Zenger, 2017; Felin & Zenger, 2020). It is reflected by what Einstein said, “Whether you can observe a thing or not depends on the theory which you use” (Polanyi, 1974, p. 604). Without theories, things in the world often remain hidden and outside people’s awareness, even the most obvious observations (Felin & Zenger, 2017).

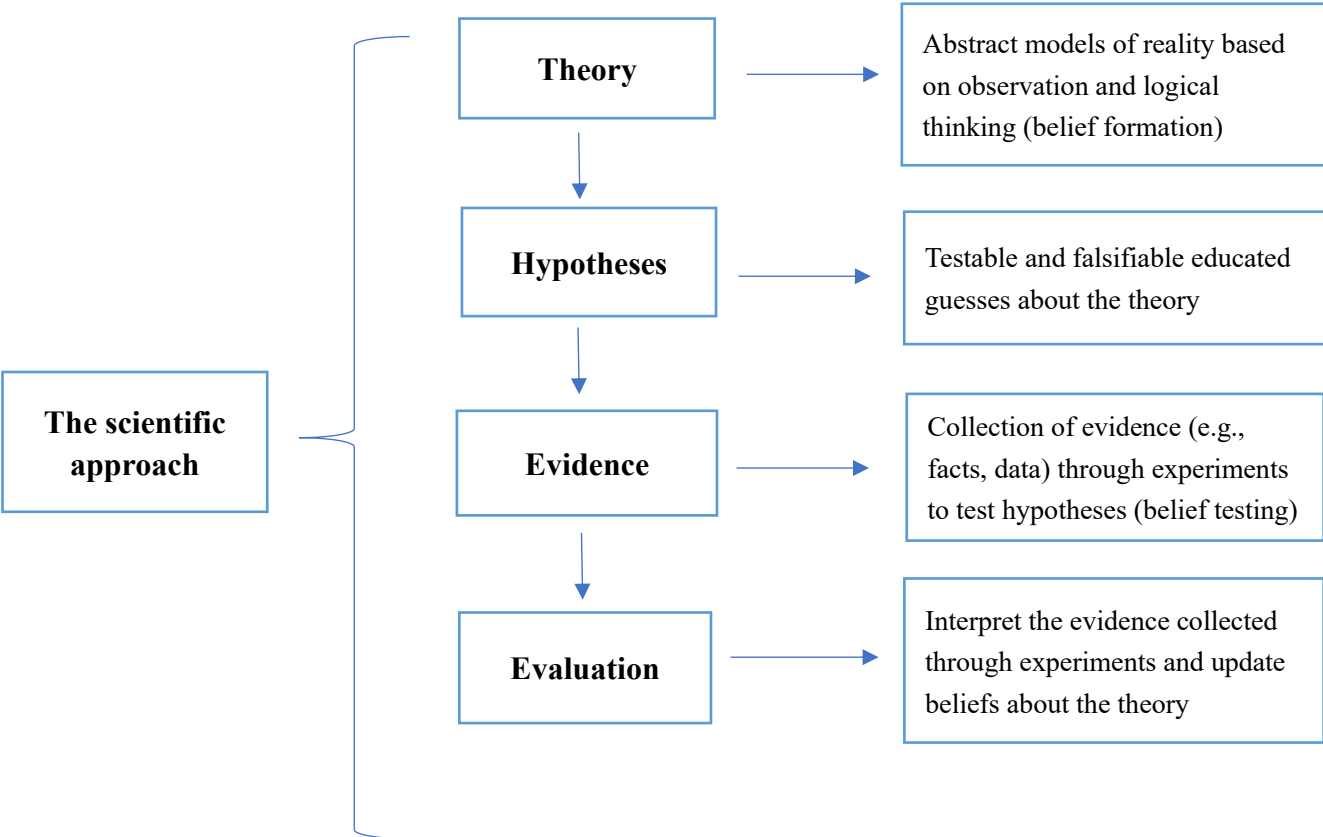
Economic theories of value are the same in shaping what is observed in this world. Theories will lead entrepreneurs to decide which activities they should engage in, what resources they need, and how they will create value for the business (Felin & Zenger, 2009; 2017). Theories will also provide entrepreneurs with the underlying instruments and mechanisms for identifying previously unseen sources of value (Felin & Zenger, 2017). Entrepreneurs could use theoretical frameworks to identify connections between the signals they received in the past and will receive in the future (Camuffo et al., 2020; 2021). A well-constructed theory reveals the nature and impact of data and experiments unobservable to others and enables the composition of critical experiments that allow unique and more precise conclusions about a start-up's theory (Felin & Zenger, 2017; Felin et al., 2020). Consequently, novel or "great" strategies come from theories grounded on a general or causal understanding of a problem (Zenger, 2016; Camuffo et al., 2020).

Another stream of literature, epitomized by the lean start-up approach, instead emphasizes data, experiments, and actions. The lean start-up approach leads managers and entrepreneurs to undertake structured experiments based on an underlying hypothesis and directly incorporate feedback from these experiments into rapid iteration and innovation (Ries, 2011; Blank, 2013). The approach has also incorporated several valuable tools and concepts for discussing start-up activities, including the business model canvas (BMC), the minimum viable product (MVP), customer development and validation, and pivoting (Ries, 2011; Blank, 2013), and has become the most widely diffused approach adopted in entrepreneurship education and centres throughout the world (Felin et al., 2020). The lean treatment is similar to the lean start-up approach, emphasizing quick and iterative learning through experimentation and feedback,

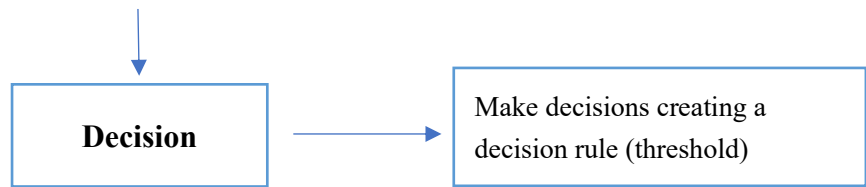
quitting or changing the business ideas when they prove them wrong (Ries, 2011; Blank, 2013; Felin et al., 2020).

Similar to the approach adopted by scientists, the scientific approach is a decision-making routine that can be learned and taught through a disciplined way of thinking and acting (Camuffo et al., 2020; 2021; 2022). Furthermore, the scientific approach implies a structured process for entrepreneurial decision-making (Figure 1) comprising a sequence of five phases or steps: a) theory, b) hypotheses, c) evidence, d) evaluation, and e) decision (Camuffo et al., 2022). First, participants are taught to define the problem, articulate the theory clearly, and then explicitly formulate hypotheses based on these theories (Zenger, 2016). In addition, they are advised to conduct empirical testing of hypotheses based on systematic facts and data they collect and rigorously evaluate and interpret tests' outcomes (Murray & Tripsas, 2004; Kerr et al., 2014; Foss & Klein, 2012; Pfeffer & Sutton, 2006).

**Figure 1: The components of the scientific approach to entrepreneurial decision-making (Camuffo et al., 2022)**







Generally, the scientific approach improves entrepreneurial decision-making and performance because it enhances the process of belief formation, testing, and updating, improving decision-making and, eventually, performance (Camuffo et al., 2020; 2021; Zellweger & Zenger, 2022). Specifically, adopting the scientific approach improves entrepreneurs' beliefs about the value of their ideas, mitigating the risk of false positives or negatives (Camuffo et al., 2020; 2021). Thus, entrepreneurs are less likely to make mistakes when they abandon their project, keep pursuing it, or pivot to another idea (Camuffo et al., 2020; 2021). The empirical studies in several countries, Italy, UK, India, and Tanzania suggest that when entrepreneurs adopt the scientific approach, they are more likely to terminate projects with negative returns, commit to projects with positive returns, or pivot to projects with higher returns.

### **2.1 The trainee effect on the absorption of the scientific approach (demand side)**

While entrepreneurship training programs are targeted at stimulating entrepreneurship within a small business or opportunity-seeking managers within companies (Colton, 1990), to be effective, entrepreneurs need to be open to absorbing the training contents. Furthermore, three critical characteristics of entrepreneurs identified in previous literature are knowledge, skills and attitudes (Garavan & O'Connell, 1994). In most training scenarios, the first characteristic is treated thoroughly, and the second characteristic receives sketchy attention, while the third is

hardly addressed (Garavan & O’Cinneide, 1994). Nevertheless, the characteristic of attitudes, the psycho-social forces of the individual and the cultural context is of prime importance in influencing entrepreneurial behaviour patterns (Garavan & O’Cinneide, 1994).

Though many aspects of entrepreneurship can be taught, it also requires a certain flair or attitude towards absorbing training content. For the scientific approach training to be effective, entrepreneurs need to be open to absorbing the scientific approach. The scientific approach parallels the behaviour of entrepreneurs to that of scientists who advance knowledge about reality by developing new theories and testing them, gathering and analyzing facts and data (Camuffo et al., 2022). Then whether entrepreneurs are open to absorbing the scientific approach may depend on their general bent and favourable psychol-sociological predisposition to science since there is high similarity and correlation between each other. Consequently, the more favourable the psycho-sociological predisposition of participants to science, the more participants will absorb the scientific approach.

The variable we identify to proxy participants’ absorption of the scientific approach is participants’ attitudes towards traditional Chinese medicine since we believe it captures individuals’ psycho-sociological predisposition to science. Traditional Chinese medicine has thousands of years of history in China, and its practices include different forms of herbal medicine, acupuncture, cupping therapy, massage (*tui na* in Chinese), exercise (*qigong* in Chinese), and dietary therapy (NCCIH, 2015). One of the basic principles of traditional Chinese medicine is that the vital energy (*qi* in Chinese) of people’s bodies circulates through channels called meridians, having branches connected to organs and functions of the body (e.g., NCCIH, 2015; Barrett, 2013). Take widely practiced acupuncture as an example. The theories of

acupuncture argue that the human body acts as a small universe connected by channels and that by physically simulating these channels, practitioners can promote the human body's self-regulating functions (Beal, 1999; Kaptchuk, 200). By inserting the needles into points on these channels, the simulation by practitioners aims at restoring the human body's balance and treating disease (Beal, 2000; Kaptchuk, 2002; UNESCO, 2009).

Though traditional Chinese medicine has been widely practised in China, there has been consistent debate over traditional Chinese medicine and Western medicine for a long time. Compared to Western medicine, which is more based upon scientific knowledge, traditional Chinese medicine has been criticized by some people as 'fraught with pseudoscience' regarding its scientific credentials as well as its clinical and therapeutic practices, mainly for the following two reasons.

First, it has been criticized that there is no scientific evidence for traditional Chinese medicine concepts such as *qi*, *meridians*, and acupuncture points, and no logical mechanism of action in its treatments (e.g., Barrett, 2013; Singh & Ernst, 2008). For instance, the central theory of acupuncture is *qi*, which is "an untranslatable word that in essence signifies the potential to transform from one state to another state and each state's interconnectedness" but is mainly described as the body's "vital energy" (Vander Ploeg & Yi, 2009:2). *Qi* is believed to flow through the human body from deep organs to the superficial skin by interconnecting meridians (Beal, 2000; Kaptchuk, 2002). However, in modern medicine, practitioners have struggled to understand the concept of *qi*, given a lack of anatomic and histological evidence supporting its existence (Beal, 2000; Kaptchuk, 2002; Vander Ploeg & Yi, 2009).

Second, there is disagreement among traditional Chinese medicine practitioners on what

diagnosis and treatments should be used for any given person, which means that its treatment cannot be quantified (Barrett, 2013; Nature, 2007). For instance, in herbal medicine, while using a basic formulation, practitioners would move or add drugs to the composition, trying to meet the individual characteristics of the pathological situation being dealt with (Obringer, 2011). Thus, given the same symptom, patients might get different treatments and prescriptions from different practitioners. Consequently, traditional Chinese medicine finds itself in paradoxical situations regarding its scientific nature and practices (Vander Ploeg & Yi, 2009).

To sum up, it could be derived that the absorption of the scientific approach first comes from the demand side, and trainees need to be open to absorbing it. The more favourable the psychol-sociological predisposition of participants to science, the more participants will absorb the scientific approach. Thus, if participants favour traditional Chinese medicine, they are more likely to absorb the scientific approach less.

*Hypothesis 1: Entrepreneurs more favourable to traditional Chinese medicine absorb the scientific approach less than entrepreneurs less favourable to traditional Chinese medicine.*

## **2.2 The absorption of the scientific approach to entrepreneurial performance**

As mentioned earlier, we found heterogeneous treatment effects of the scientific approach in previous RCTs. For instance, more significant effects have been found on entrepreneurs with less managerial or industry experience, less education, or younger ages (Camuffo et al., 2021). However, previous research has not focused on the heterogenous effects and examined where these effects come from. Nevertheless, these heterogeneous effects are critical to understanding the scientific approach. As this paper embeds its research design in a field experiment that uses entrepreneurial decision-making training as an intervention, intuitively, whether participants

have learned or absorbed the training contents would be a logical and chronological antecedent of entrepreneurial outcomes.

In training literature, Kirkpatrick's (1976) four-level approach demonstrates that training mainly focuses on four levels, i.e., trainees' reactions to a training program and its content, evaluating the acquisition of knowledge or skills, as well as the extent to which trainees can execute desired training-related behaviours and the extent to which trainees' job behaviours change and result in increased organizational effectiveness (Alliger & Janak, 1989). The first and second levels focus on whether participants have learned or absorbed the training contents, while the third and fourth levels focus on whether participants could apply the knowledge and skills acquired in the training program to decisions and behaviours in their working environment. The first and second levels are the antecedents of the third and fourth levels.

Building on training literature, we define absorption as the extent to which the knowledge and skills acquired in the training program have become an integrative part of participants' stock of knowledge and skills. Moreover, to measure the heterogeneous economic effects, appropriate measures could include businesses started or saved, revenue generation and growth, financing obtained, and profitability (McMullan, Chrisman & Vesper, 2001). For entrepreneurial firms, assessing whether businesses started and revenue generation is critical. Thus, we use these two variables to represent the heterogeneous effects of the scientific approach.

Following the mainstream approach to entrepreneurial training and education, it can be derived that absorption is a logical and chronological antecedent of entrepreneurial outcomes. As the scientific approach could improve entrepreneurial performance, we hypothesize that

entrepreneurs who absorb the scientific approach more would exhibit higher entrepreneurial performance.

*Hypothesis 2: Entrepreneurs who absorb the scientific approach more will exhibit better entrepreneurial performance than entrepreneurs who absorb the scientific approach less.*

### **2.3 The mentor effect on the absorption of the scientific approach (supply side)**

Allen, Poteet, Russell, and Dobbins (1997) define mentors as more experienced persons who support, train or sponsor others in their careers. Previous literature has demonstrated that mentors could improve trainees' knowledge, competencies and business skills (e.g., St-Jean & Audet, 2009; Bisk, 2002; Sullivan, 2000). In the entrepreneurship field, previous research has found that entrepreneurs with mentors exhibit a higher ability to recognize opportunities (Ozgen & Baron, 2007), increased entrepreneurial self-efficacy (Hulela & Miller, 2006; Nandram, 2003), and leadership (Kempster & Cope, 2010). Moreover, previous research has also found that mentors with different intervention styles would exhibit different entrepreneurial outcomes, especially for early-stage entrepreneurs (St-Jean & Audet, 2009). The mentoring effect is maximized when the mentor exhibits a maieutic approach and significant involvement (Gravells, 2006). Thus, mentors play a significant role in the development of entrepreneurs.

The mentors in our intervention are experienced entrepreneurs who provide training on entrepreneurial decision-making to entrepreneurs. We would argue that the effect of the scientific approach instructed by different mentors in the intervention is not homogeneous. First, the scientific approach requires mentors to put effort into absorbing, and different mentors may absorb the scientific approach differently. Second, mentors with different intervention styles may influence trainees' absorption of the scientific approach. It could be argued that instructed

by different mentors will exhibit significantly different levels of absorption of the scientific approach. Moreover, since the absorption of the scientific approach may affect entrepreneurial performance, entrepreneurs instructed by different mentors will exhibit significantly different entrepreneurial performances.

*Hypothesis 3a: Entrepreneurs instructed by different mentors exhibit significantly different levels of absorption of the scientific approach.*

*Hypothesis 3b: Entrepreneurs instructed by different mentors exhibit significantly different entrepreneurial performances.*

### **3. Methodology and Data**

#### **3.1 Research design**

To understand our research questions, we conduct a randomized control trial (RCT) embedded in a field experiment that provides entrepreneurs with two months of free entrepreneurship training courses. The study targets participants through an online call for applications of two types: founders who want to develop a new venture or small business owners or managers who intend to develop an innovation project within their firms. We target these two types because they face similar high-uncertainty situations within venture creation or their existing firms. We conduct this field experiment in China because China is a critical economic center with a vibrant entrepreneurial ecosystem, thus an ideal testbed for the scientific approach research.

The study recruits 194 Chinese entrepreneurs and managers. These participants are randomly assigned to two experimental and one pure control group. Balance checks have been done to ensure that the participants in these three groups are balanced. The first experimental group is the full scientific treatment group, receiving training in the scientific approach's theory

and empirics components. This complete scientific treatment includes teaching the theory behind hypothesis development, rigorous test design processes, hypothesis testing, and experimentation. The second group undergoes a different treatment called the lean treatment. It focuses on the empirics component of the scientific approach, emphasizing hypothesis testing and experimentation, with less attention to the theory. Finally, a pure control group receives no training, but we still collect data from this group, including the pre-sample questionnaire for their characteristics.

Participants in the two experimental groups receive six sessions of in-presence training related to entrepreneurial decision-making, and the duration of each session is the same. Moreover, topics covered in the two experimental groups' training programs are the same except for the different treatments (theory plus empiricis versus empiricis only). These differences account for approximately 25% of the intervention. Due to the COVID-19 pandemic, the intervention sessions took place online every one or two weeks from December 2021 to February 2022.

#### **4.2 Data collection**

The data collection process occurred before, during, and after the intervention. Before the intervention, the baseline survey filled by participants in the application stage included various questions related to founders' and firms' characteristics and other related variables. During and after the intervention, participants were asked to complete the regular survey and take the regular interview. Research assistants were hired to collect data on all participants within three groups through telephone interviews. The research assistants were trained extensively to familiarize themselves with this program's contents and the interview questions they asked.



Research assistants regularly called participants starting eight weeks after the beginning of the training program. This process allows us to collect panel data for 194 observations for eight data collection points on the decision-making and performance of all entrepreneurs for 16 months. The findings presented in this paper are derived from the data collected during the initial five rounds of the RCT.

### **4.3 Variable measures**

#### **4.3.1 Dependent variable: absorption**

The most critical assessment of entrepreneurship training programs is that the knowledge and skills of participants are assessed through examination (Wyckham, 1989). In order to measure how the absorption of the scientific approach affects entrepreneurial performance, the paper develops the measure of *overall absorption* to capture to what extent participants have learned the training contents. To achieve this, we develop a hypothetical case study that mimics the scientific processes of developing business ideas to measure the variable *overall absorption* (see Appendix 1).

The case study is composed of seven questions in total that cover different steps of the scientific approach. Those questions are multiple-choice questions with two or three correct answers, which creates precision on whether participants have absorbed the contents of this training program. The case study is tested among three groups in each round of data collection. In each round, we get the absorption score of the full scientific approach. Repeated data collection on the same questions will ensure the measure's validity.

Aside from the direct measure of absorption, we also use the variable *traditional Chinese medicine* as the moderator to proxy the absorption of the scientific approach. The moderator of

*traditional Chinese medicine* could be used to identify the effects of absorption and teases out the performance effects attributable to absorption of the scientific approach. We measure the variable *traditional Chinese medicine* by asking to what extent participants believe that traditional Chinese medicine helps cure disease and promote health. This way, we can get information about participants' attitudes towards traditional Chinese medicine.

#### **4.3.2 Independent variables: entrepreneurial performance**

For entrepreneurial performance, assessing whether businesses started and revenue growth is critical. Thus, we use the variables *cumulative sales* and *positive sales* to indicate entrepreneurial performance. The variable *cumulative sales* is measured by the sales cumulated since the start of 2021. The variable *positive sales* is a dummy equal to 1 if participants have generated sales from their ideas or projects.

#### **4.3.3 Control variables**

The variable *firm type* is a dummy equal to 0 if participants are entrepreneurs who want to start their businesses and equal to 1 if participants are small business owners or managers who intend to develop an innovation project within their firms.

The descriptive statistics of the critical independent, dependent, and control variables are shown in Table 1.

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Insert Table 1 about here  
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## **4. Empirical results**

We have a total of eight rounds of data collection. The following preliminary results are based on the previous five round data points, and the last three round data points are to be cleaned.

### **4.1 The effect of moderator *traditional Chinese medicine* on absorption**

In hypothesis 1, we predict that entrepreneurs more favourable to traditional Chinese medicine absorb the scientific approach less than entrepreneurs less favourable to traditional Chinese medicine. Table 3 shows the effect of moderator *traditional Chinese medicine* (M) on absorption by running differences in differences regressions. We can see that the moderator of *traditional Chinese medicine* significantly affects *overall absorption* with an estimated impact of -0.084. It yields results that are significant at the level of 0.05. Thus, *traditional Chinese medicine* is a good proxy for *overall absorption*. Hypothesis 1 is supported.

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Insert Table 2 about here  
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#### **4.2 The effect of absorption on entrepreneurial performance**

In hypothesis 2, we predict that entrepreneurs who absorb the scientific approach more will exhibit better entrepreneurial performance than entrepreneurs who absorb the scientific approach less. Table 3 shows the effect of *overall absorption* on *cumulative sales* by running difference in differences regressions. We can see that even though the moderator *traditional Chinese medicine* does not affect *cumulative sales* directly, however, when the moderator *traditional Chinese medicine* interacted with the mentor and treatment, the estimated effect of the interaction term *scientific\_mentor3\_post* on *cumulative sales* is 421.657 with the significant level of 0.1. The estimated effect of the interaction term *scientific\_mentor3\_post\_M* is -70.132 with a significant level of 0.1. Thus, hypothesis 2 is supported.

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Insert Table 3 about here  
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#### **4.3 The effect of mentor on absorption and entrepreneurial performance**

In Table 2, we also use the variable mentor to interact with treatment and the moderator of

*traditional Chinese medicine* to explore the effect of mentor on absorption. We can see from Table 2 that participants instructed by mentor 3 exhibit the highest level of overall absorption. The estimated value of the interactive term *scientific\_mentor3\_post* on *overall absorption* is 1.532 with a significant level of 0.05. The estimated value of the interactive term level of *scientific\_mentor3\_post\_M* on *overall absorption* is -0.287 with a significant level of 0.01.

In Table 3, we use the variable *mentor* to interact with treatment and the moderator of *traditional Chinese medicine* to explore the effect of mentor on entrepreneurial performance. We can see from Table 3 that participants instructed by mentor 3 exhibit the highest entrepreneurial performance. The estimated value of the interactive term *scientific\_mentor3\_post* is 1.532 with a significant level of 0.05. The estimated value of the interactive term of *scientific\_mentor3\_post\_M* is -0.287 with a significant level of 0.01. The results show that mentors play a significant role in the absorption of the scientific approach and participants' entrepreneurial performance. Thus, hypothesis 3 is supported.

#### **4.4 Difference in differences IV regressions**

In Tables 4 and 5, we also run difference in differences IV and probit regressions even though these regressions may suffer from the fact that when the variable *traditional Chinese medicine* acts as the instrument, the instrument does not vary across two periods. Nevertheless, we would argue that these two regressions provide insight into understanding the effect of absorption on entrepreneurial performance.

In Table 4, we can see that the estimated value of *traditional Chinese medicine* on *overall absorption* is -0.070 with a significant level of 0.05, and the estimated value of *overall absorption* on *cumulative sales* is 1,884.312 with a nearly significant level of 0.1. The results

indicate that participants who absorb the scientific approach more (as indicated by an increase of 1 point in the score of the absorption test) earn 1,884.312 higher revenue than entrepreneurs who absorb the scientific approach less.

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Insert Table 4 about here  
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In Table 5, we can see that the estimated value of *traditional Chinese medicine* on *overall absorption* is -0.065 with a significant level of 0.1, and the estimated value of *overall absorption* on *positive sales* is 1.249 with a significant level of 0.1. The results indicate that participants who absorb the scientific approach more (again, as indicated by an increase of 1 point in the score of the absorption test) are 1.249 times more likely to generate positive revenue than entrepreneurs who absorb the scientific approach less.

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Insert Table 5 about here  
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## **5 Conclusion**

### **5.1 Theoretical contributions and practical implications**

Using a field experiment with 194 entrepreneurs attending entrepreneurial decision-making training, we aim to examine the extent to which entrepreneurs absorb the scientific approach and the effect of the absorption of the scientific approach on entrepreneurial performance. The findings presented in this paper are derived from the data collected during the initial five rounds of the RCT. Preliminary results show that the moderator of *traditional Chinese medicine* affects the absorption of the scientific approach, and the absorption of the scientific approach affects entrepreneurial performance. Our research complements the existing scientific approach research and contributes to understanding the mechanisms of the scientific approach effect.

This paper shows that the heterogeneous treatment effect of the scientific approach comes from participants' different absorption levels of the scientific approach. It demonstrates that absorption matters both on the demand side as well as the supply side. The demand side indicates that participants need to be open to absorbing the scientific approach. Moreover, the supply side suggests that mentors play a significant role in the absorption of the scientific approach. More broadly, our research contributes to general entrepreneurial training as well. In order to achieve the expected entrepreneurial training effect, participants and mentors should both prepare themselves for the entrepreneurial training program.

The paper also has practical implications. First, the paper highlights the importance of managerial practices and contributes to the decision-making processes for entrepreneurs and managers under uncertainty. Practically, the paper help identifies to whom the scientific approach is more valuable and beneficial. Furthermore, as this field experiment is conducted in China, it also sheds light on the new venture creation in a cultural context different from the Western cultural context.

## **5.2 Limitations and future research**

This study has some limitations that offer opportunities for future research. First, our last difference in difference IV regressions may suffer from the fact that the instrument (*traditional Chinese medicine*) does not vary across two periods. Future research could address this issue. Second, we find that participants whom different mentors instruct exhibit significantly different levels of absorption of the scientific approach. Future research could explore the mechanisms behind the mentoring effect. For instance, how the intervention style of mentors affects participants' absorption of the scientific approach. Finally, we conducted this field experiment

in China. Future studies could also examine the effect of absorption of the scientific approach in different country settings to generalize the effect of absorption.

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**TABLE 1**  
**Descriptive statistics**

<i><b>VARIABLE</b></i>	<i><b>N</b></i>	<i><b>Mean</b></i>	<i><b>SD</b></i>	<i><b>Min</b></i>	<i><b>Max</b></i>	<i><b>Definition</b></i>
(1) <b>Cumulative sales</b>	1033	173.822	928.274	0	14000	The sales cumulated since the start of 2021.
(2) <b>Positive sales</b>	1033	0.388	0.488	0	1	Dummy equals to 1 if participants have generated sales.
(3) <b>Overall absorption</b>	652	1.312	0.552	0.143	3	The overall score of the case study composed of different steps of the scientific approach.
(4) <b>Traditional Chinese medicine</b>	194	5.84	1.08	1	7	From 1 to 7, to what extent do participants believe that traditional Chinese medicine helps cure disease and promote health?
(5) <b>Firm type</b>	194	0.28	0.451	0	1	Dummy equals to 0 if participants are entrepreneurs who want to start their business and equals to 1 if participants are small business owners or managers who intend to develop an innovation project within their firms.

**TABLE 2**

**Difference in differences regressions of overall absorption**

<b>Variables</b>	<b>Overall absorption</b>
<b>Traditional Chinese medicine (M)</b>	<b>-0.084**</b>
	<b>(-1.97)</b>
Lean_mentor1_post	0.358 (0.78)
Lean_mentor1_post_M	-0.050 (-0.70)
Lean_mentor2_post	-0.453 (-0.94)
Lean_mentor2_post_M	0.117 (1.22)
Lean_mentor3_post	-0.048 (-0.07)
Lean_mentor3_post_M	0.013 (0.12)
<b>Scientific_mentor3_post</b>	<b>1.532**</b> <b>(2.05)</b>
<b>Scientific_mentor3_post_M</b>	<b>-0.287***</b> <b>(-2.60)</b>
Scientific_mentor1_post	-0.295 (-0.78)
Scientific_mentor1_post_M	0.062 (0.91)
Scientific_mentor2_post	-0.725** (-2.44)
Scientific_mentor2_post_M	0.079 (1.60)
Constant	1.678*** (6.21)
Time dummy	yes
Observations	648
Number of participants	174

Robust z-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**TABLE 3**

**Difference in differences regressions of entrepreneurial performance**

<b>Variables</b>	<b>Cumulative Sales</b>
<b>Traditional Chinese medicine (M)</b>	<b>-110.808</b> <b>(-0.77)</b>
Lean_mentor1_post	86.209 (0.70)
Lean_mentor1_post_M	-15.932 (-0.84)
Lean_mentor2_post	-44.513 (-0.56)
Lean_mentor2_post_M	26.352 (0.44)
Lean_mentor3_post	313.061 (0.36)
Lean_mentor3_post_M	-50.009 (-0.35)
<b>Scientific_mentor3_post</b>	<b>421.657*</b> <b>(1.89)</b>
<b>Scientific_mentor3_post_M</b>	<b>-70.132**</b> <b>(-1.99)</b>
<b>Scientific_mentor1_post</b>	<b>934.793*</b> <b>(1.75)</b>
<b>Scientific_mentor1_post_M</b>	<b>-190.054*</b> <b>(-1.72)</b>
Scientific_mentor2_post	-56.385 (-0.19)
Scientific_mentor2_post_M	26.352 (0.44)
Constant	842.421 (0.98)
Time dummy	Yes
Observations	1,033
Number of participants	194

Robust z-statistics in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**TABLE 4**  
**Difference in differences IV regressions of entrepreneurial performance (cumulative sales)**

Variables	(1) Overall absorption	(2) Cumulative sales
<b>Traditional Chinese medicine</b>	<b>-0.070**</b> <b>(-2.05)</b>	
<b>Lean</b>	0.134 (1.13)	-290.955 (-0.87)
<b>Scientific</b>	<b>0.239*</b> <b>(1.96)</b>	-437.099 (-1.06)
Round5	0.035 (0.19)	-154.039 (-0.36)
Lean_round5_mentor1	-0.057 (-0.22)	55.351 (0.09)
Lean_round5_mentor2	0.295 (1.05)	-558.968 (-0.76)
Lean_round5_mentor3	0.128 (0.49)	-2.211 (-0.00)
Scientific_round5_mentor1	-0.209 (-0.77)	399.011 (0.57)
Scientific_round5_mentor2	-0.282 (-1.14)	919.027 (1.32)
Scientific_round5_mentor3	-0.411 (-1.62)	646.385 (0.82)
Firm type	-0.105 (-1.25)	595.716*** (2.66)
<b>Overall absorption</b>		<b>1,884.312</b> <b>(1.61)</b>
Constant	1.622*** (7.06)	-2,207.200 (-1.55)
Observations	218	218
R-squared		-1.333

Robust z-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**TABLE 5**

**Difference in differences IV probit regressions of entrepreneurial performance (positive sales)**

Variables	(1) Positive sales	(2) Overall absorption	(3) /
<b>Overall absorption</b>	<b>1.249*</b> <b>(1.69)</b>		
<b>Lean</b>	-0.026 (-0.09)	0.130 (1.16)	
<b>Scientific</b>	-0.321 (-0.97)	0.232* (1.85)	
round5	0.175 (0.53)	0.051 (0.31)	
Lean_round5_mentor1	0.254 (0.64)	-0.100 (-0.50)	
Lean_round5_mentor2	-0.267 (-0.48)	0.275 (1.14)	
Lean_round5_mentor3	-0.095 (-0.20)	0.104 (0.47)	
Scientific_round5_mentor1	0.334 (0.65)	-0.206 (-0.84)	
Scientific_round5_mentor2	0.769* (1.73)	-0.286 (-1.28)	
Scientific_round5_mentor3	0.716 (1.38)	-0.444* (-1.94)	
<b>Traditional Chinese medicine</b>		<b>-0.065*</b> <b>(-1.66)</b>	
athrho2_1			-0.968 (-1.28)
Insigma2			-0.644*** (-13.10)
Constant	-1.784** (-2.45)	1.566*** (6.18)	
Observations	218	218	218

Robust z-statistics in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Appendix 1: Measures of absorption

As part of Idea to Start-up Bootcamp, you need to go through a small **hypothetical** case study and answer some questions about it. We simulate the process of starting a new venture, which would be helpful for you to reflect on your own experience and help capture what you learn in this program.

Two university students in Shaanxi province observed that rural Shaanxi housewives spend an estimated 10-20% of their monthly income on coal, even though it is a dirty fuel. We mimic their process of starting a new company, Juneng Technology, focusing on transitioning rural Shaanxi housewives from coal into gas-based cooking.

**Instruction:** the following questions have 1 to 3 correct answers to be chosen. Please mark the answer(s) that you believe is/are correct.

1. As all other start-ups do, Juneng's founders started with an intuition they needed to develop before starting a real company. What advice would you give them as regards how to pursue their business idea?
  - A. Articulate their business idea into its logical building blocks.
  - B. Often go back to their business idea, rethink and adjust it.
  - C. Develop and test their idea as a whole, always considering all its elements concurrently.
  
2. At the early stage of business idea development, which of the following aspects would you recommend Juneng's founders focus on?
  - A. Observe Shaanxi rural housewives and develop alternative explanations of what they see.
  - B. Articulate the reason why the problem their business idea aims to solve is vital for potential customers.
  - C. Jump as soon to estimate how much money they can potentially earn from this business idea.
  
3. While exploring their business idea, Juneng's founders decided to write down some hypotheses they believe are true about their potential customers. One of the hypotheses is:



“Shaanxi rural housewives use coal for cooking and have issues using it.” Which of the following sentence best represents the characteristics of the above hypothesis?

- A. It is a good hypothesis because it may be formulated based on real-world observation.
- B. It is a good hypothesis because it is testable and falsifiable.
- C. It is a bad hypothesis because it contains multiple statements, which are hard to test together.

4. While exploring their business idea, Juneng’s founders felt they did not know enough about their potential customers and market. To better understand them, they decided to collect some data and wondered how to do it. Which of the following initiatives would you recommend them to make?

- A. Interview female friends and acquaintances in Shannxi about their cooking habits and ask them if they like their idea or not.
- B. Spend one week in Shaanxi rural villages and document a small sample of housewives about their cooking habits.
- C. Spend another week in Shaanxi rural villages and have a large sample of housewives compile a detailed questionnaire about their cooking habits.

5. Juneng’s founders spent one week in Shaanxi rural villages documenting, for 20 women (housewives and non-housewives), what they actually do (how much time they spend on cooking, how much coal they use, etc.). The results are encouraging. Basically, all of the respondents provided data supporting the presence of an unsatisfied customer need. Which of the following suggestions would you give to Juneng’s founders?

- A. Since the respondents are not all housewives, they should weigh whether the evidence they gathered is conclusive before making any decisions.
- B. Since the respondents are all Shaanxi women residents, their data is likely to be very accurate. Thus, they should proceed swiftly to develop their idea further.
- C. Since the feedback is positive and the hypothesis is corroborated, they should proceed swiftly to develop their idea further.

6. Juneng’s founders eventually started developing their business idea based on the hypothesis that “Shaanxi rural housewives rely on coal because they cannot afford gas.” Their initial belief

related to their hypothesis was that at least 50% of women would agree with it. In a large survey of 200 questionnaires collected from Shaanxi rural housewives, 38% of respondents replied that this is because gas is more expensive than coal, while 53% responded that this is because coal can be bought in small quantities only when needed. Which of the following implications should Juneng's founders draw from these results?

- A. There is good evidence to prove that housewives rely on coal because they cannot afford gas.
- B. Gas is more expensive than coal as a consequence of the non-divisibility of gas. Hence solving the divisibility problem can solve the cost problem.
- C. They need to change their business idea to make it more relevant to this new problem they had found.

7. Juneng's founders finally figured out that the customer problem is that gas cannot be bought in small quantities and has high upfront costs. Based on the problem they figured out, which of the following solutions should Juneng's founders opt for?

- A. Develop a technology that allows people to buy gas in small batches only when needed.
- B. Develop an MVP for a standard LPG canister with a meter to track usage.
- C. Use an A/B test to check whether different payment systems would increase customers' usage of their solution.

**Stand By or Come Inside: The effect of entrepreneurs' access to family resources and family involvement on innovation in start-ups**

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**Abstract**

Exploring the determining factors of innovation investment has been a central issue in the behavioral studies of the firm. Yet, what has been left out in these discussions is the fact that the owner is not an isolated person but a member of his or her family. In this paper, we trace back to how entrepreneurs' access to family resources affects innovation investment in start-ups. Since only children perform differently from their non-only-child counterparts due to access to family resources, we use the only-child "trick" to uncover the effect of access to family resources on innovation investment. China's one-child policy is used as an exogenous shock to reveal the effect of being only children. We also investigate whether there are changes in innovation investment when family members actually involve in the start-ups by providing initial financing or monitoring strategic choices as major shareholders. Using data on approximately 2,150 Chinese start-ups, we find that only-child entrepreneurs invest in less innovation, and their lower risk preference serves as an explanatory mechanism. However, when their family members significantly involve in the start-ups, the effect of lower risk preferences of only-child entrepreneurs on innovation investment disappears. Our analyses highlight the difference between the availability of family resources and actual involvement

of family resources when evaluating innovation investment in start-ups.

**Keywords:**

Innovation investment; family resources; family involvement; only-child entrepreneur;

China's One-child Policy; start-ups

## 1. INTRODUCTION

As an important performance indicator of the firm, the level of innovation bears significant implications in evaluating a firm's competence and potential development (Porter, 1992; Loukil et al., 2020). Especially for start-ups, innovation plays a critical role in determining the survival chance of start-ups. Though start-ups are the most exposed to risk of failure (Geroski, 1995; Caves, 1998), innovation plays a positive and significant effect on increasing the survival probabilities for start-ups across most industrial sectors (Cefis & Marsili, 2005; 2006). Empirically, start-ups that innovate have a 23% greater probability of surviving in the market than those that do not (Cefis & Marsili, 2005; 2006). Moreover, start-ups benefit more from the returns to innovation than established firms (Criscuolo, Nicolaou & Salter, 2012).

Entrepreneurs' investment in innovation is a critical factor on start-ups level of innovation. Previous studies have discovered some determining factors of innovation investment. For instance, CEOs' overconfidence and their attitude towards uncertainty have been recorded as key determinants of corporate innovation behavior (Malmendier & Tate, 2005; Galasso & Simcoe, 2011; Hirshleifer, Low & Teoh, 2012; Nowak, 2018). Nevertheless, most previous research is limited to the psychological and mental states of the owner as a single individual. What has been left out in these discussions is the fact that the owner is not an isolated person but a member of his or her family. In other words, the individual characteristic of the owner is not "given" but (at least partially) shaped by the features of the family to which he or she belongs. Thus, it is critical that we trace back to the family of the owner to understand how entrepreneurs' family affect their preferences on innovation investment.

Family resources play a critical role in influencing entrepreneurship. For instance, previous research has emphasized the importance of founders in support of resources provided by family members (Aldrich, 1999; Aldrich & Zimmer, 1986). Several studies indicate that, during the start-up process, family plays an important role in the mobilization of financial resources (e.g., Aldrich & Waldinger, 1990; Steier & Greenwood, 2000), human resources (Aldrich, Renzulli & Langton, 1998), and other resources. Nevertheless, there is few research on how entrepreneurs' access to family resources affects their preferences of innovation investment and why. Thus, it is critical to expanded upon the role that family resource play in innovation investment in start-ups.

We use the only child story as a “trick” to uncover the effect of access to family resources on innovation investment as only children perform differently from their non-only-child counterparts due to access to family resources. On the one hand, without resource dilution from siblings, only children can enjoy more family resources that can help them invest in more innovations in start-ups. On the other hand, easy access to more resources will make them more risk averse as a decision-maker (Kahneman & Tversky, 1979; Cameron et al., 2013; Yang & Yu, 2016). Thus, the only child story is an angle to explore the effect of family resources on innovation investment.

It is also critical to disentangle the difference between access to family resources and family involvement. When we talk about access to family resources, we are referring to potential resource availability to entrepreneurs. Entrepreneurs may use or not use family resources within the venture creation process. In contrast, family involvement refers to the owner families directly involve in the new venture creation and their ability to influence firm

behavior. This is consistent with previous studies on family influence on corporate behavior (Kellermanns, Eddleston, Barnett, & Pearson, 2008; Miller & Le Breton-Miller, 2006). For instance, their family can determine whether to provide initial funding to entrepreneurs or directly involved in the operation or key decision making. By distinguishing access to family resources and actual family involvement, we intend to offer a more comprehensive insight into the effect of family on innovation investment in start-ups.

Building on this research gap, we examine how access to family resources and family involvement could affect innovation investment in start-ups. We use the only child “trick” to uncover the effect of access to family resources on entrepreneurial performance, and China’s one-child policy as an exogeneous shock to reveal the only child “trick. Subsequently, to investigate if there is any change when their families involve in start-ups, we examine two different types of family involvement in start-ups. in which we believe family members will impose significant direct effects on the strategic move of start-ups, i.e., whether family members provided initial financing for these start-ups, and whether they are involved in ratifying and monitoring strategic choices as major shareholders.

We use the data from Enterprise Surveys for Innovation and Entrepreneurship in China (ESIEC), which is one of China’s core entrepreneurship investigation projects that aims to obtain micro data on the entrepreneurial patterns of Chinese enterprises. Using data on approximately 2,150 start-ups from ESIEC 2018, we find that generally single-child entrepreneurs tend to invest in less innovation because of their lower risk preferences. Then in the sub-sample analysis, whichever criterion of family involvement we use, the effect of being only child disappears when family members are significantly involved in the start-ups. These

findings suggest that family members' actual involvement in the start-up can rectify the excessive conservativeness of single-child entrepreneurs.

This study contributes to entrepreneurship research by deepening our understanding of the role of entrepreneurs' family resources and family involvement in innovation investment. It shows that entrepreneurs' access to family resources could impact their risk preferences and therefore influence their innovation investment. It also shows that entrepreneurial innovativeness is one of the critical characteristics of start-up firms that could be influenced by the degree of family involvement, providing a perspective that parallels to the analysis of R&D activities in family firms. Practically, our study reminds policymakers of the necessity to consider the lower risk preference of the only-child entrepreneurs, as well as the role played by the entrepreneurs' family members in start-up operations. These findings may serve as the rationale for relevant policies aimed to encourage the innovative activities of these start-up firms.

## **2. THEORY AND HYPOTHESES DEVELOPMENT**

### **2.1 Only Children and Innovation Investment**

Previous research demonstrates that the family has been thought of as a defining objective background characteristic and a provider of resources that influences individual development (Belsky, Lerner, & Spanier, 1984; Rowe, 1990; Hoisl, Kongsted, & Mariani, 2022). Only children perform differently from their non-only-child counterparts due to access to family resources, and these differences may influence the values and behaviors of only children in return (Falbo & Polit, 1986; Blake, 1981; Downey, 2001; Trent & Spitze, 2011; Cameron et al., 2013), including their investment decisions in innovation.



On the one hand, only children can access to more family resources that can help them invest in more innovations in start-ups than their counterparts with siblings. The resources-dilution theory demonstrates that the increasing number of siblings and decreasing age gap among siblings dilute each child's family resources, such as parental time, care, and financial support (Anastasi, 1956; Downey, 2001). Without resource dilution from siblings, only children can access to more family resources than their counterparts (Anastasi, 1956; Downey, 2001), and the additional family capital can add value to individuals as the capital is instrumental in helping the individual achieve their goals (Steier, 2001; Dyer, 2003). Consequently, only children can potentially allocate more family resources to the investment in innovation in their start-ups.

On the other hand, easy access to resources since childhood may also weaken only children's entrepreneurial spirits and make them less enthusiastic for risky activities. For instance, Cameron et al. (2013) experimented with individuals born just before and just after the OCP and found that only children are more risk averse, less competitive, and more pessimistic. More recently, Chen (2020) demonstrated that the OCP had reduced the critical "entrepreneurial spirit" of the young generation in China. Based on the above elaborations, it is uncertain how being the only child may affect entrepreneurial innovation because evidence from both sides is present in the literature. Thus, we develop two competing hypotheses concerning this issue, as the following.

*Hypothesis 1a. Enterprises of only-child entrepreneurs invest in more innovation than enterprises of non-only-child entrepreneurs.*

*Hypothesis 1b. Enterprises of only-child entrepreneurs invest in less innovation than*

*enterprises of non-only-child entrepreneurs.*

## **2.2 Only Children, Risk Preference, and Innovation Investment**

From the discussions mentioned above that lead to our research question, it is not difficult to notice a theoretical tension concerning the impact of family resources accessed by only-child entrepreneurs. While the ultimate impacts are temporarily unclear, through literature, we found that one characteristic directly result from being only children is that they do not have to compete for parental resources (e.g., time, energy, and financial resource) due to the absence of siblings (Blake, 1981; Anastasi, 1956; Downey, 2001). Therefore, only children can access to most of their parents' material and immaterial resources, which seemingly implies that they have higher potential resource availability to engage in more innovation.

Nevertheless, enjoying parents' resources may become a heavy mental burden for only children as they are likely to bear excessively high expectations of their parents psychologically. Such expectations will strengthen their pressure of pursuing personal success and make them fear failure. Therefore, only children may tend to act in a more risk averse manner as a decision-maker. This reasoning is in line with the evidence provided by existing empirical studies. Cameron et al. (2013) found that only children are more risk-averse than non-only-children. Moreover, Yang and Yu (2016) examined the competitive behavior of only children and found that they tended to underestimate the probability of winning and avoid competition unless the uncertainty of relative performance was removed.

Intuitively, corporate innovative activities such as R&D are beneficial for the long-term growth of entrepreneurial enterprises (e.g., Lumpkin & Dess, 1996; Runyan, Droge & Swinney, 2008); but meanwhile, these activities are also featured by high level of risks

because the returns of R&D investments are uncontrollable and unmeasurable. The riskiness of innovative activities is a piece of old wisdom that originates from Schumpeter (1934; 1939), who emphasised that entrepreneur is to manage the uncertainty and risky conditions to make new combinations of factors or innovations in a new venture; more recently, relevant literature typically agrees that corporate innovation entails high levels of risks (Berglund, 2007; Janeway, 2012; Keizer, Vos, & Halman, 2005; Van Gelderen, Frese, & Thurik, 2000). Therefore, we can confidently assume that innovation investment is equivalent to incurring significant risks for the entrepreneurs. Considering only children's tendency of risk aversion, we expect an only child who does start a business is less likely to make risky investments in R&D and other forms of innovation than an entrepreneur growing up with sibling(s).

*Hypothesis 2. Only-child entrepreneurs will exhibit lower risk preferences, which negatively impact on the amount of investment in innovation of their enterprises than non-only-child entrepreneurs.*

### **2.3 The Heterogeneous Effect of Risk Preference Based on Family Involvement**

The mechanism effect discussed above may not apply to all entrepreneurial firms equally, as there exist various factors that can weaken the impact of the entrepreneur's risk preference. One important factor of this kind is to disentangle between access to family resources and family involvement. When we talk about access to family resources, we are referring to potential resource availability to entrepreneurs. Entrepreneurs may use or not use family resources within the venture creation process. In contrast, family involvement refers to the owner families directly involve in the new venture creation and their ability to influence firm behavior. For instance, their family can determine whether to provide initial funding to

entrepreneurs or directly involved in the operation or key decision making in the start-ups.

Once the concept of family involvement is clear, we can argue that the presence of family involvement will make the characteristics of only-child entrepreneur less salient. The crucial point here is that when the entrepreneur's family members are significantly involved in the operations of the start-up, the influence of family members may cover up the impact of the entrepreneur's risk preferences as shaped by being only children. The literature on family firms indicates that when the owner's family members are significantly involved in executive management, the firm will exhibit different features. For instance, when the owner's family members are significantly involved, the firms are typically more motivated and have longer-term planning horizons, tend to involve more with their local communities, and tend to be more innovative (Friedland & Kaslow, 2022). The same logic may also apply to start-ups.

Basically, if an entrepreneur's family members are among the key decision-makers of the entrepreneur's enterprise, they are expected to exert influence on the strategic moves of the firm, and we believe this influence will be in the opposite direction of the impact exerted by the entrepreneur's risk preference. Notably, one key characteristic of firms with family involvement is the typical tendency of long-term orientation, because the family members of the entrepreneur tend to have longer planning and investment horizons than professional managers (Miller & Le Breton-Miller, 2006). Out of the concerns of the long-term survival and sustainable growth of the enterprises, the owner's family members are usually more patient and willing to wait for the positive effects of long-term investment to materialize. Meanwhile, innovation is a key determining factor of a firm's ability to develop competitive advantages (Greve, 2009) and ultimately, of its overall competitiveness (Galunic & Rodan,

1998) and survivability (Carrasco-Hernández & Jiménez-Jiménez, 2012). Therefore, the entrepreneur's family members are expected to promote strategic investment in R&D and other innovative activities to pursue their long-term goals of firm growth.

For only-child entrepreneurs, the impact of these family members can be even more significant because only children are accustomed to receiving resources and help from their families since childhood. Thus, they are more likely to follow family members' suggestions. So, the entrepreneur's risk preferences will be insignificant in determining firm innovativeness. Kraiczy, Hack, and Kellermanns (2015) supported this line of reasoning by documenting that high levels of ownership by family members of top management teams can weaken the relationship between CEO risk-taking propensity and new product portfolio innovativeness. Therefore, we would like to pick out the firms that are significantly influenced by the entrepreneur's family members and declare these firms as the "non-compliers" of our hypothesis regarding risk preference shaped by being only children. In this way, we can find out the heterogeneous impacts of the mechanism of risk preferences on specific groups of firms.

*Hypothesis 3. The association between the lower risk preference of only-child entrepreneurs and innovation investment would be less significant in enterprises with significant family involvement.*

### **3. METHODOLOGY**

#### **3.1 Research Context: China's One-Child Policy (OCP)**

As we mentioned above, the situation of only children is used by us as a "trick" for uncovering the impacts of different level of access to family resources, because only children

uniquely enjoy the highest level of availability of family resources (regardless of the absolute amount of resources that their families have) in comparison with children with siblings.

Therefore, for examining the behavioral patterns of only children, what we need to find is a special situation where people are somehow “forced” to become only children, so that the endogeneity caused by self selection is avoided. In other words, we intend to identify a case where the choice of having only one child is enforced by an exogenous shock.

China’s one-child policy (OCP) provides an ideal context of this kind. As a unique, extreme population planning initiative, the OCP was implemented nationwide between 1980 and 2015 to curb China’s population growth. Basically, the policy required most Chinese families to have only one child (Peng, 1991; Scharping, 2003), thereby creating tens of millions of only children in China. No similar policies with a comparable size can be found elsewhere in the world, and even China has already allowed all Chinese parents to have two or three kids since 2015. Moreover, as the OCP itself is supported by national-level political power, it is unlikely that ordinary families would have any discretion in the enforcement of this policy. Therefore, China’s OCP is a precious, unparalleled “exogenous shock” setting, of which we can take full advantage to verify our reasoning.

China’s national leaders started to seriously discuss its demographic planning policies in the 1970s due to concerns over colossal population growth (Peng, 1991; Scharping, 2003). Subsequently, after the start of the reform and opening-up, the OCP was implemented nationwide around 1980 and was officially written into the constitution of the People’s Republic of China in 1982. The implementation of the OCP was led by the National Population and Family Planning Commission at the national level and specialized

commissions at the provincial and local levels (Scharping, 2003; Tian, 2009; Ebenstein, 2010).

Despite the fact that the OCP was designed as a nationwide policy, it is worth noting that the strictness of the implementation of the OCP varied by period, region, and social status (Li, Yi & Zhang, 2011). That is, not all Chinese families were required to have only one child; instead, families satisfying certain conditions were allowed to have more children. At the provincial level or lower levels of political administration, local governments were given the discretionary power to adjust the policy strictness according to different demographic, social, and economic status of people (Scharping, 2003; Tian, 2009; Ebenstein, 2010). For instance, minority groups were subject to much looser restrictions than the Han nationality (Peng, 1991; Scharping, 2003); geographically, the OCP was implemented most strictly in eastern, more developed provinces (Guo, Zhang, Gu, & Wang, 2013).

The difference in the strictness of OCP implementation indicates that we cannot solely use OCP itself as the only independent variable. Instead, we need to interact OCP with factors that determine policy strictness to make sure that our model capture those people that were most significantly affected by the policy. In particular, we use two indicators that have been proven to alter the level of policy strictness: *residence registration type (RR)* and *parental work in public sectors (PW)*.

***Residence Registration Type (RR)***. The OCP was more strictly enforced in urban areas than in rural areas (Peng, 1991; Kane & Choi, 1999; Zhang & Sturm, 1994). In the mid-1980s, rural families, particularly those with only one female child, strongly resisted the OCP as agricultural work required a larger family with more labor force (Peng, 1991; Scharping,

2003). Considering the practical difficulties in the policy implementation within rural areas, the Chinese central government loosened the OCP to make it more flexible in rural areas in the mid-1980s (Peng, 1991; Scharping, 2003), and rural residents were eligible for a second child if their first child was female (Peng, 1991). In contrast, urban residents were more heavily affected by government policies (Zhang, 2017). Urban residents who obeyed the OCP were financially rewarded, while those who violated the policy were punished, and their children incurred higher living costs for accessing education and health services (Peng, 1991; Zhang & Sturm, 1994). Consequently, the implementation of the OCP is much stricter in urban areas than in rural areas. Due to the existence of the household registration (*hukou*, “户口”) system in China, it is easy for us to identify those who were born in rural areas (yes if the household registration was labeled as “rural”).

***Parental Work in Public Sectors (PW)***. People working in the public sector (e.g., in the government or state-owned enterprises) were more strictly restricted by the OCP than others, as people working in public sectors were directly affected by the central government’s policy (Zhang, 2017). If found having more than one child, people working in the public sector were punished with hefty penalties, such as dismissal and career restrictions (Scharping, 2003; Li et al., 2011; Zhang, 2017). The heavy punishment for noncompliance to the OCP constrained people working in the public sector and induced them to obey the OCP more strictly (Zhang, 2017). In all, as people working in the public sector are hired and affected by the government directly, people who work in the public sector typically obey the OCP faithfully (Zhang, 2017). To understand whether one’s family was significantly influenced by the OCP due to the public work of the parents, we need to acquire information on the attributes of his or her



parents' jobs.

### 3.2 Model Specification

We have emphasized that we need to construct the interaction term between the OCP and the determining factor of policy strictness, rather than use the OCP alone as the independent variable. Therefore, we are going to use the two following interaction terms:  $OCP \times RR$  and  $OCP \times PW$ . Moreover, these two variables should not be directly used as independent variables, either. This is because individuals who satisfied the conditions specified by these interactions terms were not necessarily only children. In fact, there was a possibility that their families decided to receive the punishment anyway and have more children, or that they managed to escape the punishment without being discovered. Therefore, meeting the conditions of the two interaction terms only means that there is a much higher probability that the focal individual is an only child, but the probability is not 1.

This explains why we use the 2SLS model rather than the OLS model. Specifically, in our 2SLS model, the indicator of being an only child is treated as an endogenous variable (the dependent variable in the first stage). This is to recognize the fact that the implementation of OCP, even in a strict manner, only increased the probability of seeing only children but did not guarantee that all children born under the corresponding condition would be only children. Accordingly the two interaction terms we mentioned above serve as the instrumental variables (IVs) in our model.

***The effect of being the only child: the baseline 2SLS model.*** We start from the basic model that estimates the direct effect of being the only child on entrepreneurial innovation. This model corresponds to *H1* and yields the baseline results of our study.

We follow the IV strategy and design our model as a two-stage least squares (2SLS) model, with “being a single child” as the endogenous variable. The first-stage regression of the model includes three IVs, meaning that our 2SLS model is featured by overidentification. One of the IVs is the OCP itself, while the other two are the interaction terms,  $OCP \times RR$  and  $OCP \times PW$ . The whole 2SLS model can be stated as follows:

$$Single\ child = \gamma_0 + \gamma_1 OCP + \gamma_2 OCP \times RR + \gamma_3 OCP \times PW + control\ (stage\ 1)$$

$$Innovation\ Investment = \beta_0 + \beta_1 Only\ child + control\ variables\ (stage\ 2)$$

The reasons for this overidentification structure are twofold. Firstly, by including the OCP itself, we recognize that the OCP was a crucial shock that significantly changed the probability of being an only child. Secondly, by including the interaction terms, we account for the concern that the OCP was not equally strictly implemented in different situations. Both factors have been carefully elaborated in the paragraphs above. Moreover, overidentification makes it more likely to obtain strong IVs because these three IVs can capture more information that predicts the probability of being the only child.

Some might argue that our OCP stringency factors  $I$  suffer from omitted variable bias (e.g., ability or resources), but we would argue that our instruments composed of the interaction terms are exogenous. It is to take advantage of the fact that the gap in unobserved benefits (e.g., ability or resources) of parents with or without public work was approximately the same before and after 1980. The logic also applies to the residence registration type, which mainly concerns urban-rural differences.

***The mechanism effects: the modified 2SLS model.*** Next, we need to design a modified model in order to test the mechanism effect of risk preferences ( $H2$ ). To ensure causality, we

keep the 2SLS structure but instead, treat **risk preference (RP)** as the endogenous regressor.

The corresponding IV is the predicted probability of being the only child, namely, the estimated value from **stage 1** in the baseline model. We are confident that this predicted probability satisfies the key requirements of an IV: the likelihood of being the only child is associated with RP since we have demonstrated that only children are systematically different in terms of risk preference; the probability of being the only child is unlikely to affect firm performance through unknown mechanisms other than the characteristics of the entrepreneur.

The modified model can be described as follows:

$$RP = \theta_0 + \theta_1 \text{Predicted probability of being a single child} + \text{control variables}$$

$$\text{Innovation Investment} = \mu_0 + \mu_1 RP + \text{control variables}$$

Obviously *H2* predicts that  $\theta_1$  is negative, but  $\mu_1$  is positive.

***The heterogeneous effects induced by family involvement.*** For testing the heterogeneous effect caused by family involvement (*H3*), we use the same model as used in testing *H2*. What we do is to divide the sample (2,011 start-ups) into two sub-samples, one with significant family involvement and the other without. To ensure robustness, we use two different indicators as the thresholds of “having significant family involvement”. This means that we will divide our sample twice and test *H3* twice as well.

### **3.3 Data and Variables**

***Data Sources.*** We use the information on Chinese entrepreneurs gathered from a large-scale survey named ESIEC (Enterprise Survey for Innovation and Entrepreneurship in China). We use the first baseline survey of ESIEC that includes 6,198 enterprises from 117 counties or districts in six provinces. Due to missing values and the existence of unreasonable responses

that indicate the low reliability of some data points, the final number of observations in our regressions was slightly over 2,000. In particular, when testing *H1* we have 2,149 observations; in subsequent regressions, the number of observations is further reduced to 2,011 due to the missing values in risk preferences.

**Variables.** In the following paragraphs we briefly introduce the meaning of the key variables in our models. *Risk preference (RP)* is measured by a subjective self-evaluation question and an objective risk analysis game. The subjective self-evaluation question asks participants to rate from 1 to 10 on their risk preference. The objective risk analysis game includes several evolutionary coin-toss-or-not games where sequential decisions are made between risky and safe choices. The score of risk preference is computed by summing up the self-evaluation score and the risk analysis game score. *Innovation investment* is measured by the ratio of the firm's innovation expenses to the gross revenue in 2017.

*Family involvement* is measured with two separate indicators. First, family involvement is considered as present if the entrepreneur's family members are among the five largest shareholders of the start-up. Alternatively, start-ups that are initially funded by the entrepreneur's family members are also treated as firms with significant family involvement. We use these two criteria independently, so that we can test *H3* twice to ensure robustness.

*Other variables.* Apart from the variables mentioned above, *Single child*, *RR* and *PW* are self-reported by the entrepreneurs. *OCP* is a dummy equal to 1 if the entrepreneur was born in 1980 or later, because OCP was introduced in 1979 and went into effect in 1980.

*Control variables.* We control for variables *firm type*, *birth year*, *gender*, *ethnicity*, *education*, *political identity*, *marriage status*, *residence registration type*, *parents working in*

*public sector*, and *entrepreneur parents*. The residues are clustered according to the industry that the start-up operates in and the province where the start-up is located. The detailed descriptive statistics and definitions of the key independent variables, dependent variables, and control variables are shown in Table 1.

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 Insert Table 1 about here  
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#### 4. EMPIRICAL RESULTS

##### 4.1 The Effect of Being the Only Child: The Baseline 2SLS Model

To be clear, note that the baseline model focuses on the direct effect of being the only child on entrepreneurial performance. The model can be described as follows:

$$Single\ child = \gamma_0 + \gamma_1 OCP + \gamma_2 OCP \times RR + \gamma_3 OCP \times PW + control\ (stage\ 1)$$

$$Innovation\ Investment = \beta_0 + \beta_1 Only\ child + control\ variables\ (stage\ 2)$$

Table 2 shows the results from the 2SLS model for testing *H1*. In stage 1, the positive coefficient of the two interaction terms shows that entrepreneurs who are more strictly affected by OCP are more likely to be an only child. Correspondingly, in the second stage, the negative coefficient of *Single child* shows that these only-child entrepreneurs invest less in innovation than their peers.

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 Insert Table 2 about here  
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##### 4.2 The Mechanism Effects of Risk Preference

In *Hypothesis 2*, we predict that only-child entrepreneurs have lower risk preferences, which in turn leads to lower entrepreneurial investment in innovation. Table 3 presents the corresponding results. Note that the IV in stage 1 is the estimated value of the dependent

variable from stage 1 in Table 2, namely the estimated value of the probability of being an only child from the baseline model.

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Insert Table 3 about here  
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The results indicate that those who are more likely to be the only child tend to be more risk averse and invest less in entrepreneurial innovation (note that risk preferences are positively associated with innovation investment). Thus, *Hypothesis 2* is supported.

**4.3 The Heterogeneity of the Mechanism Effects of Risk Preference**

In *H3*, we argue that the mechanism effect of risk preferences will become insignificant when the entrepreneur’s family members are significantly involved in start-up operations.

Therefore, we divided the sample by whether the firm was featured by significant family involvement. Then we re-run the models for *Hypothesis 2* on these sub-samples. Because we separately use two different thresholds for family involvement, we repeat the process of testing *H3* twice to ensure robustness. The results for these two tests are presented, respectively, in Tables 4 and 5.

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Insert Table 4 and 5 about here  
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Note that Tables 4 and 5 differ from Table 3 ONLY in sample size. Table 4 shows the results when we look at whether the start-ups have the entrepreneur’s family members as major shareholders. For the 240 firms that meet this threshold, the results were insignificant; meanwhile, for the remaining 1,771 firms, the results were still significant. Table 5 shows the results when we look at whether the entrepreneur received initial funding from family members. Similarly, for the 456 firms that meet this threshold, the results were insignificant;

meanwhile, for the remaining 1,555 firms, the results were still significant. Therefore, we can conclude that *Hypothesis 3* is supported.

## **5. DISCUSSION**

From the above analysis, we can see that only-child entrepreneurs invest in less innovation, and their lower risk preference serves as an explanatory mechanism. Due to the absence of siblings, only-child do not have to compete for family resources (Blake, 1981; Anastasi, 1956; Downey, 2001) and can enjoy most of their family resources. Nevertheless, enjoying parents' resources may become a heavy mental burden for only children as they are likely to bear excessively high expectations of their parents psychologically. Such expectations will strengthen their pressure of pursuing personal success and make them fear failure. Therefore, only children may tend to act in a more risk-averse manner as a decision-maker.

This paper also demonstrates that the degree of family involvement, which describes the owner family's ability to influence firm behavior, is positively related to investment in innovation activities. When family members are significantly involved in start-ups (providing initial funds for these start-ups, or ratifying & monitoring strategic choices as major shareholders), single-child entrepreneurs' lower risk preferences no longer influence the firm's investment in innovation. The reason might be that firms with family involvement is featured by the typical tendency of long-term orientation, because the family members of the entrepreneur tend to have longer planning and investment horizons than professional managers (Le Breton-Miller & Miller, 2006). Out of the concerns of the long-term survival and sustainable growth of the enterprises, the owner's family members are usually more patient and willing to wait for the positive effects of long-term investment to materialize.

It is necessary to differentiate between the availability of family resources and actual involvement of family resources when evaluating innovation investment in start-ups. The availability of family resources is about potential resource availability to entrepreneurs, and the entrepreneurs may or may not use family resources within the venture creation process. In contrast, family involvement refers to the fact that the owner's families directly involve in the new venture creation and they have the ability to influence firm behavior. For instance, the family members can choose whether to provide initial funding to entrepreneurs, or they can directly participate in the operations or key decision making processes in the start-ups. Thus, it is critical to consider the actual involvement of the entrepreneur's families in entrepreneurship studies as a unique feature of start-up firms.

## **6. CONCLUSION**

This paper investigates how the availability of family resources and actual family involvement affect innovation investment in start-ups. We use the only child policy to uncover the effect of access to family resources on innovation investment in start-ups. We find that in general, only-child entrepreneurs invest less in innovation, and their lower risk preference serves as an explanatory mechanism. However, when their family significantly involves in the start-ups, the effect of lower risk preferences of only-child entrepreneurs on innovation investment disappears. Our analyses highlight the difference between the availability of family resources and actual involvement of family resources when evaluating innovation investment in start-ups and shows that innovativeness is one of the critical characteristics that differs between firms with varying levels of family involvement.

This study contributes to entrepreneurship research in three ways. First, this study is among



the first ones to provide the investigation of how access to family resources affect innovation investment in start-ups. We uncover the mechanism of risk preference of how the access to family resources affect innovation investment in start-ups. Second, this research distinguishes between the availability of family resources and actual involvement of family resources when evaluating innovation investment in start-ups, providing a more comprehensive understanding of the determinants of innovation investment in start-ups. We examine two different types of family involvement in start-ups and their impact on innovation, i.e., whether family members are involved in financing these start-ups as well as ratifying and monitoring strategic choices as major shareholders. Third, we are pioneering using the heterogeneity in the enforcement of OCP between urban and rural areas and between parents who worked in public and non-public sectors and created two new instrumental variables (IVs) to identify the effect of OCP. These two IVs help us deal with the endogeneity issue and provide reliable estimations of the impact of being an only child.

This study has some limitations that offer opportunities for future research. First, the generalizability of the results is limited by the fact that the sample is restricted to the Chinese setting. Future studies assessing the boundary conditions of our findings may consider repeating our analysis using data obtained in different contexts to address this limitation. Second, in addition to the two types of family involvement (i.e., providing initial funding and being large shareholders) that we investigate in this research, future studies could explore how other types of family involvement influence the behavioral pattern of start-up owners. Third, future studies may also try to delineate the subtle differences between “family firms” and “firms with family involvement”, especially within the cohort of start-up firms.

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**TABLE 1**  
**Descriptive statistics**

<i>VARIABLE</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Definition</i>
Innovation investment	3,957	0.540	10.464	0	333.333	The ratio of the firm's innovation expenses to the gross revenue in 2017
One-child policy (OCP)	3,957	0.512	0.450	0	1	Dummy equal to 1 if born no earlier than 1980
Family involvement-1	3,957	0.101	0.301	0	1	Dummy equal to 1 if family members are among the five largest shareholders
Family involvement-2	3,957	0.217	0.412	0	1	Dummy equal to 1 if the start-ups is initially funded by family members
Firm type	3,957	1.332	0.471	1	2	1 if enterprise; 2 if self-employed business
Birth year	3,957	1978.45	9.918	1937	2000	Year of birth of the entrepreneur
Gender	3,957	1.267	0.443	1	2	1 if male; 2 if female
Ethnicity	3,957	1.057	0.231	1	2	1 if ethnic Han; 2 if minority
Education	3,957	4.484	1.717	1	9	Highest education obtained (larger numbers ↔ higher education)
Political identity	3,957	2.668	0.742	1	3	1 if member of CPC; 2 if member of other parties; 3 if no party affiliation
Marriage status	3,957	1.93	0.363	1	4	1 if unmarried; 2 if married; 3 if divorced; 4 if widowed
Residence registration (RR)	3,957	1.424	0.578	1	3	1 if agricultural; 2 or 3 if non-agricultural
Parents working in public sector (PW)	3,957	0.139	0.347	0	1	Dummy equal to 1 if at least one of the entrepreneur's parents work in public sectors
Entrepreneur parents	3,957	0.086	0.280	0	1	Dummy equal to 1 if at least one of the parents is also an entrepreneur
Single child	3,957	0.126	0.332	0	1	Dummy equal to 1 if the entrepreneur is actually an only child

**Table 2**  
**The lower investment in innovation of only-child entrepreneurs (H1)**

VARIABLES	(1) Single child	(2) Innovation investment
Single-child policy	-0.028 (-1.01)	
Single-child policy * Parents working in the public sector	0.114*** (2.80)	
Single-child policy * Residence registration type	0.190*** (7.10)	
Single child		-0.103** (-2.51)
Firm type	0.046*** (5.04)	-0.013 (-1.48)
Birth year	0.004*** (4.40)	0.001*** (2.95)
Gender	-0.037** (-2.33)	-0.013** (-2.40)
Ethnicity	-0.011 (-0.48)	0.008 (0.59)
Education	0.017*** (2.99)	0.004 (1.52)
Political identity	-0.004 (-0.38)	-0.001 (-0.27)
Marriage status	-0.027 (-1.19)	-0.017 (-1.27)
Residence registration type	-0.000 (-0.04)	0.000 (0.08)
Parents working in the public sector	0.028 (1.36)	0.008 (1.18)
Entrepreneur parents	0.012 (0.56)	-0.010 (-1.02)
Constant	-7.114*** (-4.32)	-2.067*** (-2.69)
Observations	2,149	2,149
R-squared		-0.031

**Table 3**  
**Only-child entrepreneurs' risk preferences as the mechanism (H2)**

VARIABLES	(1) Risk preference(total)	(2) Innovation investment
Predicted single child (with <i>both interaction terms</i> )	-4.347*** (-2.79)	
Risk preference (total)		0.021* (1.77)
Firm type	-0.567*** (-2.70)	-0.000 (-0.04)
Birth year	0.138*** (7.40)	-0.002 (-1.33)
Gender	-0.863** (-2.44)	0.006 (0.41)
Ethnicity	0.939*** (2.87)	-0.010 (-0.46)
Education	0.124 (1.32)	0.001 (0.58)
Political identity	-0.242 (-1.23)	0.006 (1.01)
Marriage status	-0.535* (-1.73)	-0.008 (-0.60)
Residence registration type	0.586*** (2.60)	-0.014** (-2.10)
Parents working in public sector	0.731** (2.06)	-0.009 (-0.76)
Entrepreneur parents	-0.781** (-2.51)	0.005 (0.27)
Constant	-260.174*** (-7.05)	3.911 (1.34)
Observations	2,011	2,011
R-squared		-0.649

**Table 4**  
**The effect of family involvement - family members as major shareholders (H3)**

VARIABLES	(1) Risk preference(total)	(2) Innovation investment	(3) Risk preference(total)	(4) Innovation investment
Predicted single child (with <i>both interaction terms</i> )	-4.080 (-0.66)		-4.111*** (-3.29)	
Risk preference (total)		0.019 (0.29)		0.023** (2.18)
Firm type	-2.700*** (-3.31)	0.042 (0.22)	-0.618*** (-2.71)	0.004 (0.40)
Birth year	0.041 (0.50)	0.001 (0.60)	0.149*** (10.90)	-0.003* (-1.75)
Gender	0.479 (0.50)	-0.030 (-0.57)	-0.979** (-2.44)	0.011 (0.82)
Ethnicity	0.961 (0.56)	-0.026 (-0.31)	0.900*** (3.95)	-0.009 (-0.48)
Education	0.461** (2.40)	-0.013 (-0.46)	0.100 (1.02)	0.002 (0.82)
Political identity	0.224 (0.53)	-0.009 (-0.62)	-0.300 (-1.60)	0.008 (1.20)
Marriage status	-2.966*** (-3.30)	0.057 (0.29)	-0.254 (-0.83)	-0.016 (-0.95)
Residence registration type	0.894 (1.15)	-0.017 (-0.49)	0.473** (2.14)	-0.013* (-1.82)
Parents working in public sector	0.055 (0.04)	-0.001 (-0.02)	0.886** (2.32)	-0.013 (-0.76)
Entrepreneur parents	-0.187 (-0.20)	0.003 (0.06)	-0.852* (-1.90)	0.004 (0.23)
Constant	-68.119 (-0.41)	-2.270 (-0.68)	-281.663*** (-10.40)	5.127* (1.76)
family members as major shareholders	YES	YES	NO	NO
Observations	240	240	1,771	1,771
R-squared		-0.310		-0.810



**Table 5**  
**The effect of family involvement - family members providing initial funding (H3)**

VARIABLES	(1) Risk preference(total)	(2) Innovation investment	(1) Risk preference(total)	(2) Innovation investment
Predicted single child (with <i>both interaction terms</i> )	2.904 (0.54)		-5.653*** (-4.25)	
Risk preference (total)		-0.015 (-0.46)		0.017** (2.09)
Firm type	-1.367** (-2.33)	-0.037 (-0.88)	-0.353 (-1.30)	-0.007 (-0.98)
Birth year	0.116** (2.51)	0.003 (0.75)	0.142*** (8.42)	-0.002* (-1.65)
Gender	-0.265 (-0.61)	0.004 (0.14)	-0.995** (-2.58)	-0.002 (-0.19)
Ethnicity	0.393 (0.48)	-0.008 (-0.52)	1.017** (2.11)	-0.001 (-0.05)
Education	0.141 (0.68)	-0.001 (-0.12)	0.098 (1.01)	0.004 (1.63)
Political identity	-0.183 (-0.52)	-0.026*** (-2.75)	-0.267 (-1.20)	0.011*** (2.68)
Marriage status	-0.253 (-0.45)	-0.035 (-1.11)	-0.516 (-1.62)	-0.006 (-0.42)
Residence registration type	0.349 (0.50)	0.010 (0.44)	0.660*** (3.10)	-0.014*** (-2.59)
Parents working in public sector	0.493 (0.45)	-0.018 (-0.49)	0.728** (2.54)	0.001 (0.13)
Entrepreneur parents	0.838 (1.38)	0.004 (0.13)	-1.343*** (-3.30)	0.009 (0.42)
Constant	-216.640** (-2.34)	-5.939 (-0.73)	-268.863*** (-8.03)	3.257* (1.65)
Financed by family members	YES	YES	NO	NO
Observations	456	456	1,555	1,555
R-squared		-0.387		-0.391