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The inverted U-shaped relationship between charitable donations and innovation investment: The mediating role of financing capacity
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Cover Letter

November 11, 2023

Samuel Vigne
Chief Editor
Finance Research Letters

Dear Editor:

I would like to submit our manuscript entitled "The inverted U-shaped relationship between charitable donation and innovation investment: The mediating role of financial capacity" as an article to *Finance Research Letters* for consideration of publication.

Based on the mediating role of financial capacity, this study examines the correlation between charitable donations and innovation investments in China's private enterprises using a dataset spanning 14 years and comprising 26,458 samples. We find that there is an inverted U-shaped nonlinear effect of charitable donations on both innovation investments and financing capacity. We also find that financing capacity serves as a mediator in the U-shaped connection between charitable donations and innovation investments. Therefore, this study contributes fresh insights into the influence of enterprise charitable donations on innovation investments. Our study not only extends existing empirical studies in the area of financial capacity, but also deepens our understanding of the intrinsic complex mechanisms through which charitable donations influence enterprise innovation investment.

Furthermore, I anticipate that this manuscript will captivate the interest of the discerning readership of your journal due to its pioneering contributions to the realm of empirical economic research focused on charitable donations, financial capacity and enterprise innovation investment. These topics are presently at the forefront of both theoretical and practical discourse, aligning seamlessly with the journal's mission and scope within the field of *corporate governance*, *empirical finance, and empirical economic research*.

This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal. I have read and understood your journal's policies, and I believe that neither the manuscript nor the study violates any of these. There are no conflicts of interest to declare. All authors have approved this manuscript.

Thank you in advance for consideration of this manuscript.

Yours sincerely,
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The inverted U-shaped relationship between charitable donation and innovation investment: The mediating role of financial capacity

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Declaration of interest

The authors report there are no competing interests to declare.

The inverted U-shaped relationship between charitable donations and innovation investment: The mediating role of financing capacity

Abstract: This study examines the correlation between charitable donations and innovation investment in China's private enterprises using a dataset spanning 14 years and comprising 26,458 samples. The results demonstrate an inverted U-shaped nonlinear effect of charitable donations on both innovation investment and financing capacity. Moreover, financing capacity serves as a mediator in the Inverted U-shaped connection between charitable donations and innovation investment. This study contributes fresh insights into the influence of enterprise charitable donations on innovation investment.

Keywords: charitable donations; innovation investment; financing capacity; inverted U-shaped curve

1. Introduction

Charitable donations have been a subject of considerable research interest, yet a consensus on their effectiveness remains elusive. Many scholars contend that businesses can derive benefits from such philanthropic activities. Engaging in responsible behavior through charitable donations can enhance a company's brand image, bolster its value, and facilitate the acquisition of resources from various stakeholders such as customers, banks, and governments (Chen et al., 2015; Su & Sauerwald, 2018). As a form of corporate social responsibility, charitable donations can also effectively improve the decision-making and innovation ability of enterprise (Cook et al., 2018).

However, at the same time, there is an optimal threshold beyond which excessive donation may

replace the resources that could have been used for innovation investment (Zhang et al.,2021). Moreover, the presence of agency problems and managerial altruism introduces complexities. Managers may engage in excessive charitable donations to achieve short-term performance targets, potentially at the expense of long-term enterprise investment (Ho & Huang, 2017). Therefore, it is imperative to find out the complex internal mechanism between charitable donations and enterprise innovation investment with a more comprehensive insight.

The purpose of this study is to empirically explore the relationship between charitable donation and enterprises innovation by considering the mediating role of financing capacity. We consider that financing capacity, the ability of an enterprise to obtain external funds, can reflects its core competitiveness and promote its sustainable development. Under its intermediary influence, corporate donations might have an inverted U-shaped impact on innovation investment. We will empirically investigate this assumption using a dataset spanning 14 years and comprising 26,458 sample sizes of China's private enterprises.

This study makes several noteworthy contributions. Firstly, while most previous studies have examined the linear impact of charitable donations on enterprise innovation performance (Brav et al., 2018), our research contributes by elucidating and empirically validating the existence of an inverted U-shaped relationship from a novel perspective. Secondly, our study delves into the mediating role of financing capacity, thereby deepening our comprehension of the intricate mechanisms underlying the inverted U-shaped relationship between charitable donations and innovation investment. Thirdly, in light of a dearth of empirical research on the internal mechanisms linking charitable donations and innovation investment (Zhang et al., 2021), our study offers new evidence and theoretical insights, providing practical guidance for philanthropic endeavors by

enterprise and encouraging a nuanced perspective on the impact of charitable donations on enterprise innovation behavior.

2. Research hypotheses

Charitable donations refer to the donations of a certain amount of money, products or services to the needy one, which can alleviate the shortage of public services and resources, and is one of the most representative CSR behavior of enterprises (Ni et al., 2022). For one thing, charitable donations can promote enterprise investment and innovations by enhancing the social reputation and social capital of donated enterprise. Charitable donations can also reduce the information asymmetry between managers and stakeholders, thus improving the decision-making ability and innovation ability of enterprise（Cook et al., 2018). For another, however, charitable donations will instantly reduce the internal cash flow of enterprise, which may lock enterprises into insufficient funds for investment in research and development, and thus inhibit corporate innovation (Manso, 2011; Masulis & Reza, 2023). According to Zhang et al. (2021), there is an optimal threshold beyond which excessive donations might displace resources that could otherwise be directed towards innovation investment, leading to an inverted U-shaped impact on innovation investment. Charitable donations that match the enterprise economic capacity can have a positive impact, while excessive charitable donations that exceed the enterprise economic capacity can have a negative impact. Therefore, we hypothesize that:

H1：There is an inverted U-shaped relationship between charitable donations and innovation input of private enterprise.

Financing capacity refers to the ability of an enterprise to obtain external funds, which

determines the amount, cost and speed of the enterprise to obtain funds, and can determine the development of the enterprise to a certain extent (Hu et al., 2018). Regarding the relationship between charitable donations and financing capacity, some scholars pointed out that there is a positive correlation between charitable donations and access to bank loans. Enterprise with more donations receive more loans, have fewer financing constraints, and have stronger financing capacity (Chen et al., 2015). As one of the behaviors of undertaking social responsibility, corporate charitable donation can reduce some losses of corporate reputation and reduce various risks of enterprises. Controlling these unfavorable factors can reduce the debt cost faced by enterprises in financing, alleviate financing constraints, and improve financing capacity (Oikonomou et al.2014; Ge & Liu 2015). However, some scholars believe that enterprise donations hinder managers from seeking external financing, especially debt issuance (Masulis & Reza, 2023). Moreover, charitable donations above a certain level might reduce the internal cash flow available (CFA) for capital expenditure, leading to underinvestment in innovation by enterprise (Masulis & Reza, 2023). According to Ye and Zhang (2011), there is an inverted U-shaped relationship between CSR and debt financing cost, indicating that there is an "optimal" level of CSR. In the long run, as a kind of enterprise social responsibility, there is likely to be an "optimal" level of charitable donations in its relationship with financing capacity.

H2：There is an inverted U-shaped relationship between enterprise charitable donations and financing capacity.

Combined with H1 and H2, our study further proposes that the inverted U-shaped relationship between charitable donations and innovation investment is mediated by financing capacity. Companies that engage in greater donations tend to attract more loans, experience fewer financing

constraints, and possess stronger financing capacity to promote their innovation investment. Nevertheless, excessive charitable donations may deter managers from seeking external financing (Masulis and Reza, 2023), diminishing their financing capacity, and thus decrease their innovation investment. Drawing on Ye and Zhang (2011), there likely exists an "optimal" level of charitable donations concerning its relationship with financing capacity. Given the protracted and resource-intensive nature of the innovation process (Cook et al., 2018), increasing charitable donations before a certain limit is conducive to improving the enterprise financing capacity, which is also conducive to improving the innovation investment of enterprises. Therefore, we believe that charitable donations up to a certain limit enhance enterprise financing capacity and consequently promote its innovation investment. However, surpassing this limit with increased charitable donations can diminish financing capacity, thereby diminishing innovation investment.

H3：Financing capacity plays a mediating effect in the inverted U-shaped relationship between charitable donations and enterprise innovation investment.

3.Research design

3.1. Samples and data

The primary dataset utilized in this study is derived from the China Private Enterprise Survey (CPES2002-2016). CPES is one of China's most extensive and reputable national sample surveys, renowned for its considerable sample size and broad geographic representation. In order to ensure the rigor and precision of our analysis, we have removed data points with missing values for key variables and have subsequently trimmed the dataset by 5% at both tails.

3.2. Variables and measures

Dependent variable

In the questionnaire, the question involving this variable is "the investment of the enterprise in technological innovation, process transformation, and new product research and development in the previous year is ____ ten thousand yuan." Innovation input is measured by the logarithm of innovation input per capita. we use the natural logarithm of innovation input per capita plus 1 as a metric.

Core independent variable

This paper uses charitable donations to measure enterprise philanthropy behavior. In the questionnaire, the question involving this variable is "The total amount donated to public welfare undertakings such as poverty alleviation, disaster relief, environmental protection and charity in the previous year is ____ yuan." Charitable donations is measured as the log value of charitable donations per capita.

Mediating variables

The question of financing ability in the questionnaire is "The loan amount of enterprise from joint-stock commercial banks, Internet finance and other institutions at the end of the previous year is ____ CNY."

Control variables

Referring to the existing literature, this paper incorporates variables such as enterprise type, enterprise size, profit rate per capita at the enterprise level, gender, educational level, annual income of entrepreneurs, and political connections at the entrepreneur level into the regression model. At the same time, the province, industry and marketization level where the enterprise is located are

added to control the economic development degree at the macro level and the impact of the market

environment.

The definitions of the variables are shown in Table 1.

Table 1
Variable description.

Name	Variables	Definition
Dependent variable		
Innovation input	*lnII*	ln（Total innovation input/Number of employees+1）
Independent variable		
Charitable donation	*lnCD*	ln（The amount given to charity last year/Number of employees+1）
Mediating variables		
Financing capacity	*lnLO*	ln（total financing//Number of employee+1）
Control variables		
Entrepreneur gender	*sex*	The value is set to 1 for males and 0 for females
Entrepreneur age	*age*	Year of response - year of birth
Educational level	*education*	Elementary school and below is set to 1, middle school is set to 2, high school is set to 3, university is set to 4, and graduate school is set to 5
Entrepreneur's annual salary	*lnsalary*	ln（Entrepreneur's annual personal income+1）
Political connection	*politicaltie*	If you are an NPC deputy or CPPCC member, set this parameter to 1. Otherwise, set this parameter to 0
Duration of establishment	*register*	Year of response - Year of registration
Enterprise scale	*lnNE*	ln（Number of employees+1）
Per capita yield	*lnperprofit*	ln（retained profits/Number of employees+1）
Type of enterprise	*businesstype*	The sole proprietorship is set to 1, the partnership is set to 2, the liability company is set to 3, and the corporation is set to 4

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province	*province*	Province dummy variable
industry	*industry*	Industry dummy variable
Marketization index	*market*	Regional marketization level

3.3. Models setting

The current three-step mediating effect test is inadequate for confirming the presence of an inverted U-shaped relationship between charitable donations and financing capacity, which subsequently impacts innovation input and contributes to the inverted U-shaped association between charitable donations and innovation input. This limitation prevents a clear elucidation of the mediating effect pathway involving third-party variables situated between independent and dependent variables. To address this, our study employs the moderating path analysis method developed by Edwards and Lambert (2007) to substantiate our research hypothesis. This method provides a comprehensive understanding of the moderating influence on all potential paths in the non-linear mediating model, effectively illustrating the relationships between the variables as follows:

$$Y = \alpha_1 + \alpha_2 X + \alpha_3 M + \alpha_4 Z + \alpha_5 XZ + \alpha_6 MZ + e \tag{1}$$

$$M = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 XZ + e \tag{2}$$

where Y represents the dependent variable, innovation input; X is the independent variable, charitable donations; M is the mediating variable, financing capacity, and Z denotes the moderating variable.

Equation (1) is employed to evaluate the inverted U-shaped relationship between charitable donations and innovation investment and assess the mediating impact of financing capacity. Simultaneously, Equation (2) is employed to examine the inverted U-shaped relationship between

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charitable donations and financing capacity.

4.Empirical analysis

4.1. Descriptive statistics

Table 2 lists the key variable descriptive statistics.

Table 2
Descriptive Statistics of Main Variables.

Variable	Obs	Mean	Std.dev.	Min	Max
lnII	25637	0.244	0.512	0	3.056
lnCD	25004	0.125	0.398	0	5.812
lnLO	25640	0.895	1.228	0	5.525
sex	26380	0.844	0.363	0	1
age	26326	45.13	8.693	15	84
education	26019	3.535	0.797	1	5
lnsalary	26458	1.964	1.130	0	5.263
politicaltie	26458	0.348	0.476	0	1
register	26348	8.301	5.554	0	43
lnNE	26421	3.667	1.602	0	7.596
lnperprofit	24419	0.751	0.971	-4.710	11.51
businesstype	25995	2.621	0.872	1	4
province	26383	13.72	7.462	1	31
industry	24345	6.203	4.018	1	15
market	26458	7.873	1.883	-0.106	11.22

4.2. Hypothesis testing results

Table 3 lists the analysis results.

Model 1 incorporates control variables, while Model 2 introduces charitable donations and the square of charitable donations. The results reveal a positive correlation between charitable donations and innovation investment (r=0.266, p<0.001), whereas the square of charitable donations demonstrates a negative correlation with innovation investment (r=-0.070, p<0.001). These results support the existence of an inverted U-shaped relationship between charitable donations and innovation investment. Consequently, H1 is confirmed, suggesting that private enterprise with moderate charitable donations capacities exhibit higher levels of innovation investment.

Additionally, the study identifies a significant positive correlation between charitable donations and financing capacity (r=0.700, p<0.001). Conversely, the square of charitable donations displays a negative correlation with financing capacity (r=-0.091, p<0.001). This indicates the presence of an inverted U-shaped relationship between charitable donations and financing capacity. In line with this, H2 is validated, indicating that private enterprise with moderate charitable donations capacities exhibit stronger financing capabilities.

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As the current three-step mediating effect test cannot be used to verify that "charitable donations of private enterprise affect its financing behavior through the inverted U-shaped curve effect, which further affects its innovation input behavior and contributes to the inverted U-shaped relationship between charitable donations and innovation input". To address this, our study employs the moderating path analysis method developed by Edwards and Lambert (2007) to substantiate our research hypothesis.

Expanding on Model 2, Model 5 includes financing capacity and the interaction term between charitable donations and financing capacity. Table 3 displays the model verification results. These results reveal a positive correlation between financing capacity and enterprise innovation investment (r=0.064, p<0.001). However, the coefficient of the square term of charitable donations in innovation investment is negative (r=-0.062, p<0.001), reaffirming the existence of an inverted U-shaped relationship between charitable donations and enterprise innovation investment. Furthermore, the interaction term between charitable donations and financing capacity in Model 7 exhibits a low coefficient effect on enterprise innovation investment (r=-0.008, p<0.001). This suggests that financing capacity and enterprise innovation investment are minimally influenced by the variability in charitable donations. Drawing from the regression analyses of Models 1 through 5, the inverted U-shaped relationship between charitable donations and financing capacity impacts enterprise innovation investment through the intermediary role of financing capacity. Thus, H3 is supported.

The corresponding graphical representation of the inverted U-shaped relationships is illustrated in Figures 1 and 2 below.
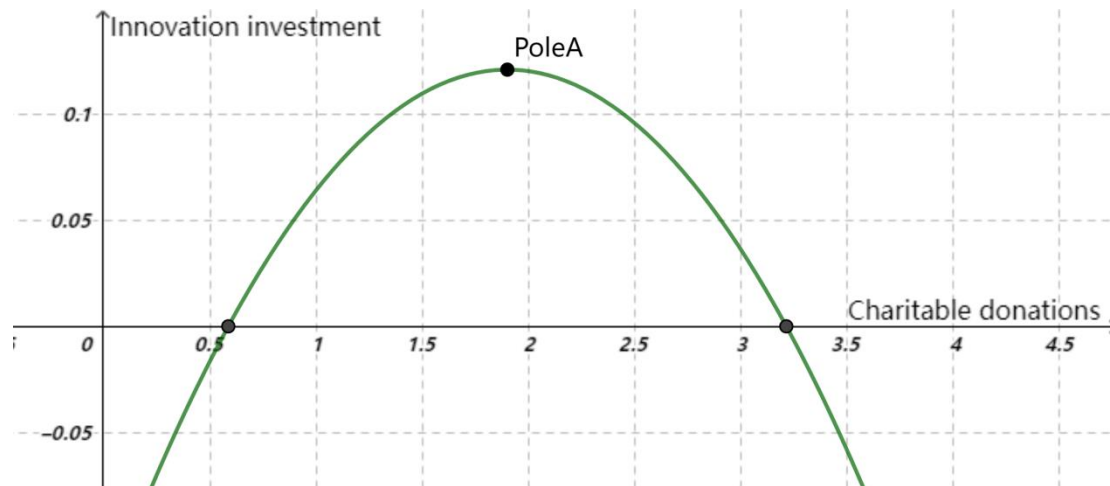
Table 3

Hypothesis testing regression analysis results.

Variables	Innovation investment		Financing capacity		Innovation investment
	M1	*M2*	*M3*	*M4*	*M5*
Donation	—	0.266****	—	0.700****	0.230****
	—	12.23	—	13.83	10.45
Donation^2	—	-0.070****	—	-0.091****	-0.062****
	—	-8.60	—	-4.79	-7.54
Financing capacity	—	—	—	—	0.064****
	—	—	—	—	20.52
Donation* Financing capacity	—	—	—	—	-0.008**
	—	—	—	—	-1.76
Sex	0.024**	0.020**	0.156****	0.145****	0.01
	2.54	2.05	6.94	6.47	(1.07)
Education	0.047****	0.047****	0.028***	0.026**	0.045****
	10.45	10.38	2.67	2.48	10.11
Lnsalary	0.039****	0.040****	0.036****	0.038****	0.037****
	11.50	11.74	4.63	4.79	11.11
Politicaltie	0.063****	0.059****	0.244****	0.232****	0.045****
	8.26	7.64	13.66	12.88	5.80
LnNE	0.004	0.006**	0.036****	0.051****	0.002
	(1.36)	2.15	5.73	8.22	(0.89)
Lnperprofit	0.087****	0.078****	0.25****	0.219****	0.064****
	24.12	21.36	29.72	25.83	17.5
Businesstype	0.022****	0.022****	0.125****	0.124****	0.015****
	5.48	5.45	13.22	13.08	3.63
Province	0.000	0.000	0.008****	0.007****	0.000
	(0.13)	(0.22)	6.86	6.34	(-0.63)
Industry	-0.015****	-0.016****	-0.026****	-0.03****	-0.015****
	-17.29	-18.02	-12.36	-14.24	-16.05
Market	0.002	0.005**	0.03****	0.036****	0.002
	(1.18)	2.14	6.22	7.30	(1.12)
Constant	-0.099****	-0.132****	-0.331****	-0.428****	-0.107****

	-3.58	-4.71	-5.13	-6.55	-3.84
R^2	0.076	0.085	0.095	0.117	0.104
F	179.64****	165.20****	228.24****	236.66****	177.80****

Note:**** $p<0.001$,*** $p<0.01$, ** $p<0.05$

Figure 1: The inverted U-shaped relationship between enterprise charitable donations and enterprise

innovation investment.
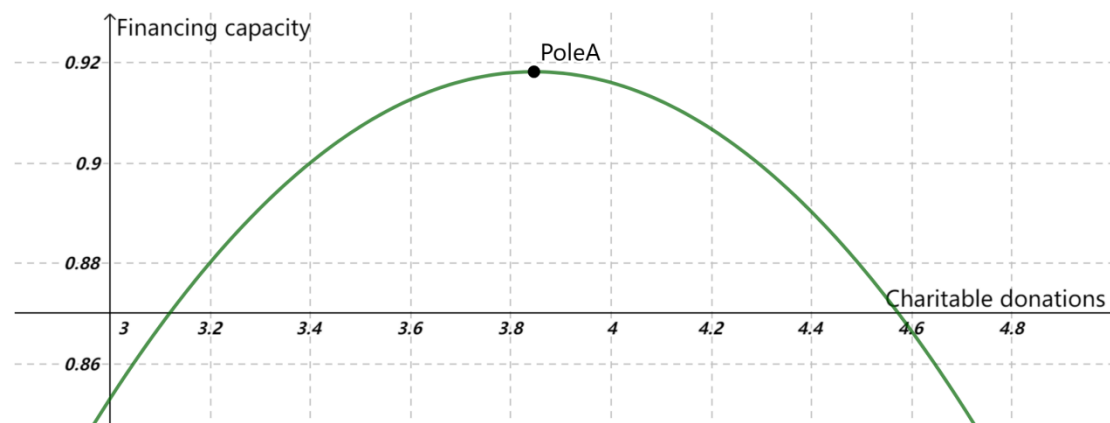
Figure 2: The inverted U-shaped relationship between enterprise charitable donations and enterprise

financing capacity

3.3. Robustness Tests

This study employs a robustness testing approach, replacing the measurements of explained

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variables. Specifically, the innovation input in the form of the ratio of total enterprise innovation input to total enterprise profit is utilized for this purpose. The robustness analysis results are presented in Table 4. The results from both Model 6 and Model 7 consistently reveal the presence of an inverted U-shaped relationship between charitable donations and the innovation input-profit ratio. These regression results demonstrate the robustness of this relationship.

Table 4
Robustness test.

Variables	Innovation input-profit ratio	
	M6	*M7*
Donation	0.141****	0.299****
	6.36	4.81
Donation^2	—	-0.066***
	—	-2.81
Financing capacity	—	0.038****
	—	4.32
Donation*Financing capacity	—	-0.010
	—	(-0.77)
Sex	0.024	0.017
	(0.91)	(0.64)
Education	-0.019	-0.020*
	(-1.61)	-1.71
Lnsalary	-0.012	-0.014
	(-1.24)	(-1.49)
Politicaltie	0.002	-0.009
	(0.11)	(-0.46)
LnNE	0.059****	0.057***
	8.05	7.84
Lnperprofit	0.018*	0.006
	1.70	(0.59)
Businesstype	0.004	0.000

	(0.40)	(0.29)
Province	-0.004***	-0.004***
	-2.65	-2.83
Industry	0.003	0.004
	(1.16)	(1.63)
Market	-0.039****	-0.040****
	-6.94	-7.12
Constant	0.484****	0.493****
	6.41	6.52
F	15.32****	14.12****

Note: **** p<0.001, *** p<0.01, ** p<0.05, * p<0.1

4.4. Heterogeneity Analysis

The surveyed enterprises in China hail from diverse regions, each characterized by unique external development conditions, potentially yielding varying implications for charitable contributions and innovation investment. To elucidate this relationship, we categorize the enterprises into Eastern, Central, and Western regions, aligning with the National Bureau of Statistics of China's classification (denoted as M8, M9, and M10). The ensuing results are summarized in Table 5. It is imperative to highlight that no statistically significant correlation was observed between charitable donations and innovation investment in the Western and Central regions (p > 0.1). Conversely, in the Eastern region, a robust inverted U-shaped relationship was observed (p < 0.001). This divergence could be attributed to the comparatively underdeveloped economic infrastructure in the Western and Central regions, manifesting as limited internal and external resources for enterprises. In contrast, the Eastern region, characterized by a more expansive market and stronger economic foundations, offers enterprises enhanced access to external development resources and opportunities. In light of the regression results, it becomes evident that

substantial regional differences exist in the influence of enterprise charitable donations on innovation investment.

Table 5

Regional enterprise heterogeneity analysis.

Variables	Innovation investment		
	M8 west	*M9 Middle*	*M10 East*
Donation	0.053	0.049	0.167****
	(1.31)	(1.10)	6.22
Donation^2	-0.006	-0.016	-0.055****
	(-0.42)	(-1.04)	-5.11
Sex	0.005	0.016	0.03**
	(0.30)	(0.88)	2.55
Education	0.022**	0.005	0.028****
	2.44	(0.53)	5.29
Lnsalary	0.022****	0.032****	0.017****
	3.24	4.79	4.30
Politicaltie	0.100****	0.105****	0.073****
	6.46	7.01	7.99
LnNE	0.062****	0.058****	0.072****
	11.46	11.40	22.48
Lnperprofit	0.014*	0.028****	0.04****
	1.85	4.07	9.25
Businesstype	-0.025***	-0.003	0.012**
	-2.94	(-0.40)	2.49
Province	0.002*	0.01****	0.002**
	1.68	6.42	1.99
Industry	-0.021****	-0.02****	-0.028****
	-12.35	-12.01	-24.71
Market	-0.004	-0.033****	-0.016****
	(-0.98)	-5.08	-4.74
Constant	0.13**	0.22****	0.141****

	2.23	4.03	3.79
R^2	0.130	0.142	0.162
F	56.25[****]	65.45[****]	197.51[****]

Note: **** $p<0.001$, *** $p<0.01$, ** $p<0.05$

5.Research conclusion and enlightenment

After analyzing 26,458 data samples obtained from a 14-year survey of Chinese private enterprises, this study reveals a notable inverted U-shaped relationship between charitable donations and investment in innovation. Specifically, the findings suggest that increasing charitable donations have a positive impact on enterprise innovation investment up to a certain threshold. However, beyond this limit, further increases in charitable donations are associated with a decrease in innovation investment. Furthermore, this research delves into the underlying mechanism primarily from a financing perspective. It identifies a similar inverted U-shaped relationship between charitable donations and the financing capacity of enterprise, and reveals that financing capacity serves as a mediator in the U-shaped relationship between charitable donations and innovation investment. This research helps to guide managers to reasonably control the level of charitable donations in the face of limited resources and in combination with the actual situation of enterprise, so as to gain advanced financing capacity and effectively promote enterprise innovation.

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