

INSTITUTIONAL INVESTOR, ECONOMIC POLICY UNCERTAINTY, AND INNOVATION INVESTMENT: EVIDENCE FROM CHINA

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Abstract: As a participator in corporate investment decision-making, the institutional investor is directly related to the corporate innovation investment. However, the economic policy uncertainty is aggravated by problems, such as economic slump and trade friction. Thus, institutional investors are not optimistic about the prospects of innovation investment. To explore the influence of institutional investors on corporate innovation investment from the perspective of economic policy uncertainty, using the 2010–2018 panel data in China and the fixed effect model, the influences of institutional investors on innovation investment and the moderating effects of the economic policy uncertainty were analyzed. Results show that institutional investors facilitate corporate innovation investment. Moreover, the increasing economic policy uncertainties repress the promoting effect of institutional investors on innovation investment. Furthermore, the institutional investors boost the corporate innovation investment by improving the internal control and relieving the financing constraints. For private companies, new and high-tech companies, the promoting effect of institutional investors on the corporate innovation investment is inhibited by the economic policy uncertainty to a small extent. For the listed companies located in areas with a high level of investor protection and intellectual property protection, the economic policy uncertainty has a minimal influence on the institutional investors and corporate innovation investment. The conclusions obtained from this study provide empirical evidence for giving full play to the role played by institutional investors in corporate innovative development. The conclusions also reveal, from the macroscopic level, that the consistency and stability of governmental economic policies have important effects on corporate development.

Keywords: Economic policy uncertainty, institutional investor, innovation investment.

JEL Classification: D21, G34, M21.

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Introduction

Innovation-driven economic development is a global trend. Specifically, in the Sino-American trade war, the events, such as the suppression of Huawei 5G, knock the alarm bell of independent research and development (R&D) in all countries. Hence, the entire society is aware of the strategic significance of corporate innovation and key technologies

to the companies and the entire country. Compared with traditional investments, such as fixed assets investment, the innovation investment is featured by large capital demand, long recycling period, high risk, and others. The interruption of the capital supply chain will generate high adjustment costs and sunk costs (Ju et al., 2013; Gu et al., 2019). As important enterprise managers, institutional

investors have become an important force that cannot be ignored in the current capital market. The American financial market is the most developed market across the globe, and the institutional investors account for over 80% of the American stock market. Up to the end of 2018, the total market value held by nine types of professional institutional investments, such as foundation and insurance, occupied 12.6% of the total value of Shanghai and Shenzhen stock markets in China. Therefore, the corporate core competitiveness can be enhanced. Moreover, their long-term development can be maintained, considerably, by giving full play to the promoting effect of institutional investors on the corporate innovation investment.

With the continuous improvement of China's capital market, institutional investors have an ignorable influence in the corporate operation process by exerting the functions of improving the corporate information quality (Bushee & Goodman, 2007; Kong et al., 2019) and maintaining the market stability (An & Zhang, 2013; Callen & Fang, 2013). These functions, if well exerted, can elevate the corporate governance level (Yi et al., 2010; Bushee et al., 2014; Jahnke, 2019) and corporate value (Chemmanur et al., 2009). In addition, such functions can improve corporate performance (Ferreira & Matos, 2008; Li & Han, 2013; Wondirad, 2020), thus further facilitating the companies to proactively fulfill their social responsibilities (Amel-Zadeh & George, 2018; Nofsingera et al., 2019; Agudelo et al., 2019). Investor protection provides a guarantee for the institutional investors to improve the corporate internal governance (La Porta et al., 2000), allow full play to their operating management function, and greatly alleviate the financing constraints (Whited & Wu, 2006; Fan, 2018). However, faced with the pressure of economic downturn, the Chinese government has promoted a series of economic policies to support the economic transformation and upgrading and provides an impetus for sustainable economic development. Nevertheless, the frequent formulation and adjustment of financial and monetary policies will aggravate the uncertainty of economic policies. According to Baker's statistical data, China's economic policy uncertainty index has been rising since 2012, which is related to a series of supply-side structural reform policies promulgated by the Chinese government in recent years. In the context of ever-aggravated

economic policy uncertainty in China, few scholars have paid attention to the moderating effect of economic policy uncertainty on institutional investors and innovation investment. The institutional investors share common interests with the company as its stakeholders. Relative to individual investors, institutional investors have more rational investment concepts and more sensitive to the change of economic policies. The corporate decisions made by the institutional investors are influenced, at all times, by the high risk of innovation investment and uncertainty of the external economic environment, including corporate development.

Hence, the 2010–2018 data of A-share-listed companies in Shanghai and Shenzhen stock markets were selected. From the perspective of institutional investors, the economic policy uncertainty and institutional investors were combined with innovation investment to discuss the following questions: (1) Do institutional investors facilitate the corporate innovation investment? (2) How does the uncertainty of external macroeconomic policies influence institutional investors and innovation investment? (3) What is the action mechanism of institutional investors on the innovation investment?

First, from the influence of institutional investors on the innovation investment, the effect of institutional investors on corporate innovation investment was revealed. Second, the moderating effect of economic policy uncertainty on institutional investors and innovation investment was analyzed, and the impact of economic policy uncertainty on institutional investors and innovative investment was explored. Third, the influence mechanism of institutional investors on corporate innovation investment was discussed. Finally, the influence of institutional investors on the corporate innovation investment was deeply probed by analyzing company differences. In comparison with those of the existing literature, the marginal contributions of this study were manifested by the following aspects: the external macro-environment is the foundation and precondition for enterprise decision-making, and the investment decisions of micro-enterprises will be influenced by the macroeconomic policies. The discussion about institutional investors stays at the micro-level in most of the present literature, whereas the micro-level has been involved

limitedly. This study exerted efforts to extend the research category of previous scholars and introduced the macroscopic economic policy uncertainty into the research on the relationship between institutional investors and innovation investment. The study also explored its modulating effect on institutional investors and innovation investment. Although extending the research literature regarding institutional investors, this research provides a macroscopic explanation basis for the existing literature from the level of micro-company.

The remainder of this study is arranged as follows: Section 1 sorts out the related literature involving the relationship between institutional investors and innovation investment and the regulatory role played by economic policy uncertainty. The study also proposes the research hypotheses. Then, Section 2 introduces the research data and design, defines the related variables, and constructs empirical models. Section 3 analyzes the empirical result and displays the effect, influence mechanism, and heterogeneous influence of institutional investors on the innovation investment. This section also expounds on the moderating effect of economic policy uncertainty and further implements the robustness test. Next, Section 4 further discusses the results and explains the possible reasons for the empirical results. Finally, Section 5 concludes the main research.

1 Literature Review and Research Hypotheses

1.1 Influence of Institutional Investors on Innovation Investment

Since 2001, China's financial regulatory agencies have proactively developed institutional investors. Therefore, the institutional investors, which are represented by securities investment funds, have achieved considerable progress. Moreover, they played significant roles in guiding the investments, stabilizing the market, and others. They have exerted increasingly significant influences and functions in China's capital market through more than 10 years of development. Their influence on the corporate innovation investment is mainly manifested by two aspects, namely, corporate governance and financing constraint.

The institutional investors influence the corporate innovation investment by exerting the effect of external corporate governance.

They participate in the corporate management, standardize the corporate operation, propose governance problems and suggestions (Hartzell & Starks, 2003; McCahery et al., 2016), and conduct field investigations on the invested companies whenever possible (Filatotchev et al., 2019). Moreover, they have significant influences on the aspects of the formulation of personnel change plans, long-term development strategies, and others. Meanwhile, innovation investment is an important guarantee for the company to win market share and is of great significance to the company's survival and development. The institutional investors evade the short-sighted behaviors of the management level, rationally analyze the market prospects, and strengthen the innovation investment by elevating its proportion through direct participation and proposal submission (Chen et al., 2007). Compared with retail investors, the institutional ones have stronger professional knowledge and more advanced governance concepts. They also understand and master the importance of innovation investment to long-term corporate value and externally impose pressure on corporate governance status by playing the role of "signal" (Li & Li, 2008; Schmalz, 2018). In addition, institutional investors supervise the management layer more effectively, reduce their self-interest behaviors (Lu et al., 2012), and further boost the implementation of innovation investment decisions. The institutional investors, which press close to the corporate management layer, are also usually considered the traders with information superiority in the market (Bushee & Goodman, 2007). Thus, acquiring "soft information" is easier for them, thereby reducing the information asymmetry. Connelly et al. (2010) pointed out that if the proportion of shares held by the institutional investors is high, then the advantage in acquiring the information is highly evident, and the governance degree disclosed in the corporate information is also high. They further noted that the governance effect would be more apparent, and the positive governance effect weakens the agency problem generated by the goal inconsistency between the management layer and shareholders. As the direct stakeholders (Borochin & Yang, 2017; Liang, 2018), the institutional investors proactively promote the corporate implementation of innovation investment decisions and guarantee and ensure

the investment benefits of the companies to increase their own benefits. The innovation investment requires long-term corporate support in the aspects, such as information, talent, and technology. The institutional investors collect the investment information (Dierksmeier & Seele, 2020), recruit investment professionals, participate in the independent innovation decision-making of the invested companies (Gillan & Starks, 2003), and ensure the value-added effect of the investment projects. With the increasing shareholding ratio of institutional investors, the scope of their corporate governance will be broader, and the depth of governance will be greater. Therefore, they will have more positive motivations to participate in corporate governance to facilitate corporate innovation activities and support corporate innovation investment.

The institutional investors act on the corporate innovation investment by influencing the financing constraints faced by the company. High risk, high failure rate, unpredictability, and great time consumption are the outstanding features of innovation investment, and the long-term maintenance can be ensured only with substantial capital (Xie & Fang, 2011). Hence, innovation investment is more easily influenced by financing constraints. For the fund suppliers, the institutional investors have objective cognition of the corporate value. As rational investors relative to individual investors, the institutional investors mostly regard the corporate value as a basis for investment decision-making while not being influenced by the information beyond the value. They are capable of understanding and mastering the information, such as the importance of corporate innovation investment to long-term corporate value. Thus, the short-sighted decisions faced by the corporate management layer are reduced, and they are more prone to the benefits brought by the innovation investment (Fan, 2018). The institutional investors can promote the corporate innovation investment and remit their financing constraints. The listed companies in China have a highly centralized ownership structure, which gives rise to the serious "insider control" problem. As the corporate agency problem becomes more severe, the share premium required by the investors will be higher, and the financing constraints will become more serious. The institutional investors can relieve

the agency problem, reduce the opportunistic behaviors of corporate insiders, such as fund embezzlement, and remit the corporate financing constraints (Aggarwal et al., 2011). The innovation process has a high degree of information asymmetry, and the innovation outputs are generally intangible, with a value difficult to evaluate. Hence, obtaining the bank credits with innovation outputs as the mortgages is hard, the financing cost of innovation activities is high (Barber & Odean, 2008; Brown & Petersen, 2011), and the financing constraints can significantly repress the corporate R&D input (Boone & White, 2015). The institutional investors transmit the positive signal of the invested company and shape a good image for it through their investment behaviors. They are able to approach the corporate management layer and acquire "soft information", which cannot be acquired by ordinary investors. Moreover, institutional investors transmit information related to corporate innovation activities to the outside world through information disclosure. This process can reduce the information asymmetry of corporate innovation activities, help the company to attract the attention of external fund suppliers, and increase the investment possibility. Therefore, institutional investors remit corporate financing constraints and facilitate their innovation activities to a certain extent.

To sum up, as an effective external governance mechanism, the institutional investors can bring down the principal-agent problem and relieve the information asymmetry. They can also alleviate corporate financing constraints by improving corporate internal governance. On this basis, the following hypotheses are proposed:

H1: Institutional investors drive corporate innovation investment.

H1a: Institutional investors improve the corporate innovation investment through their external corporate governance effect.

H1b: Institutional investors facilitate the corporate innovation investment by relieving the financing constraints.

1.2 Moderating Effect of Economic Policy Uncertainty

The economic policy uncertainty is generated when the economic subjects fail to accurately

predict whether, when, and how the government will change the current economic policies (Gulen & Ion, 2015). Such uncertainty also occurs when the formulation, enforcement, and implementation effect of economic policies are unclear (Baker et al., 2016; Rao et al., 2017). In the present economic downturn, various problems are outstanding, such as weak market demand, underinvestment, and excess production capacity. Hence, the government frequently adjusts the economic policies to stimulate economic development to adapt to the new normalcy of China's economic development. This adjustment will certainly increase the uncertainty of economic policies (Rao et al., 2017) and further influence the corporate innovation investment decision-making. The frequent adjustment of economic policies from the perspective of the principal-agent problem has greatly aggravated the information asymmetry. Considering self-interest motivation, the management supervisors are more prudent in decision-making to evade the risks, which aggravates the decision-making difficulty, and reduce the investment level (Panousi & Papanikolaou, 2012). Therefore, when the uncertainties of economic policies are increased, the principal-agent and information asymmetry problems in the corporate R&D process will be aggravated. Moreover, innovation investment requires sustainable input and concern. Furthermore, given the long period and large fund demand, the institutional investors will cancel the innovation investments with high uncertainties out of consideration of their own interests. Thus, forming unified opinions and planning inside the company are difficult because of the increasing uncertainties of economic policies, thereby discouraging the enthusiasm of institutional investors for innovation activities and reducing the innovation investment.

Second, the frequent formulation of macroeconomic policies based on the judgment of corporate risk will greatly drive the fluctuations of the stock price. In addition, the business environment faced by the company will become more complicated, and thus, the external risks will be increased (Pástor & Veronesi, 2013; Hoque et al., 2019). Under unstable or uncertain external macro-environment, the company will face an increasingly severe survival environment. Hence, the company will adjust the investment and operation strategies,

expecting to offset the ever-increasing external risks by reducing its internal risks to avoid the superposition of internal and external risks. The institutional investors play important roles in the corporate operation and management and positively drive the decision-making, which disperses and offsets the corporate risks. They participate in corporate investment decision-making through investigation, voting, and others. The institutional investors also evade the corporate risks under negative external situations, curtail the innovation investments (Bhattacharya et al., 2017; Lu et al., 2019c), and thus inhibit the corporate innovation investment.

In the end, from the theory of real option, if the corporate investment is regarded as a call option, then the uncertainty will increase the risk premium and option value under irreversible investment. The company will also postpone the current investment until the economic policy uncertainty tends to be steady (Bloom et al., 2007; Pan et al., 2020). Starting from the theory of real option, the institutional investors will neglect the importance of innovation investment and postpone the current innovation investment decision-making during the corporate operation process due to the economic policy uncertainty. With the economic policy uncertainty, the institutional investors will attach importance to the increase of the current value, so the innovation investments are reduced. Given this, the following hypothesis is put forward:

H2: As the economic policy uncertainty increases, the promoting effect of institutional investors on the innovation investment decreases.

2. Methodology

2.1 Data Sources and Sample Selection

In view of the data disclosure regarding the R&D input of listed companies, the A-share-listed companies in Shanghai and Shenzhen stock markets in 2010–2018 were selected as the research samples, which were screened and processed as follows: (1) The financial companies were excluded; (2) The ST and ST*-type-listed companies were excluded; (3) Companies with financial data missing were excluded; (4) The company-year samples undergoing insolvency were excluded; (5) The winsorization was implemented for all continuous variables in the model to reduce the

influence of extreme outliers. A total of 9,072 company-year observed values of 1,008 listed companies were finally obtained. The economic policy uncertainty data were collected from the China economic policy uncertainty index compiled by Baker et al. (2018) through the keyword search in South China Morning Post. The other data, such as annual shareholding information of institutional investors, basic information of listed companies, transaction data, and financial data, are all derived from the Wind database.

2.2 Modeling

To verify the previously proposed hypotheses, the 2008–2018 data of listed companies in China were utilized to construct the following models:

$$RD_{i,t} = \beta_0 + \beta_1 Institution_{i,t} + \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (1)$$

$$RD_{i,t} = \beta_0 + \beta_1 Institution_{i,t} + \beta_2 EPU_{i,t} + \beta_3 Institution_{i,t} \times EPU_{i,t} + \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (2)$$

Model (1) is used to investigate the influence of institutional investors on the innovation investment, whereas model (2) aims to explore the influence of economic policy uncertainty on institutional investors and innovation investment. Model (2) focuses on the interaction coefficient between economic policy uncertainty and institutional investors.

$$Con_{i,t} = \delta_0 + \delta_1 Institution_{i,t} + \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (3)$$

$$RD_{i,t} = \varphi_0 + \varphi_1 Institution_{i,t} + \varphi_2 Con_{i,t} + \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (4)$$

$$SA_{i,t} = \alpha_0 + \alpha_1 Institution_{i,t} + \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (5)$$

$$RD_{i,t} = \gamma_0 + \gamma_1 Institution_{i,t} + \gamma_2 SA_{i,t} + \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (6)$$

Models (1), (3), and (4) are used to verify the mediating effect of corporate governance (Con), whereas models (1), (5), and (6) are combined to verify the mediating effect of financing constraints (SA).

2.3 Variables

Explained Variable

Innovation investment: The current indexes used to measure the innovation input include the following: the proportion of R&D expenditure in total assets, main business income, and total market value of the company. As the stock markets in China are not complete, the total market values of companies are of great uncertainty and variability. Moreover, the proportion of total assets, main business income, and others are greatly influenced by external factors, such as market situation. Then, the logarithm of company R&D input is taken as the proxy variable, which is used to measure the innovation investment (RD) with reference to Kong et al. (2019).

Explanatory Variable

Institutional investors: The institutional investors participate in corporate management mainly by holding their shares. Following Liang (2018), the shareholding ratio of institutional investors is used as the proxy variable of institutional investors, namely, the proportion of shares held by institutional investors in the number of a company's circulating shares at the end of the year (Institution). In the meantime, several institutions are involved in the company's shareholding. The degree to which the company is supervised by the institutions and the degree of its information disclosure may also be elevated. Therefore, according to Gao et al. (2020), the robustness test was conducted by taking the number of institutional investors holding shares of the company each year as a proxy variable.

Moderator Variable

Economic policy uncertainty: The economic policy uncertainty was measured using the economic policy uncertainty index (EPU) released jointly by Stanford University and University of Chicago. Based on the test analysis by taking South China Morning Post, founded in 1903, with the maximum circulation in Hong Kong, as the sample, Baker et al. (2016) identified the monthly published reports containing keywords, such as "China", "economy", "uncertainty", and "policy" in this newspaper. They calculated the proportion of these reports in the total number of reports in this month to determine the monthly data of China's economic policy uncertainty. Then, the

arithmetic mean value of the monthly economic policy uncertainty index was solved to acquire the annual data of economic policy uncertainty. In consideration of problems similar to the regression coefficient, the arithmetic mean value was divided by 100 (Rao et al., 2017).

Mediator Variables

The corporate governance (Con) and financing constraint (SA) were selected as the mediator variables, which were measured in the following ways: (1) the corporate governance (Con) was standardly measured using the internal control index of listed companies released by Xu et al. (2019) in DIB internal control and risk management database. (2) The financing constraint (SA) was measured after the SA index was established with reference to Hadlock and Pierce (2010) through the following model:

$$SA = -0.737 \times Size + 0.043 \times Size^2 - 0.04 \times Age, \quad (7)$$

where Size is the natural logarithm of total circulating market value, and Age is the time length of the transaction after listing. As the SA value increase, the financing constraint of listed companies will also increase.

Control variables: According to Liang (2018), company size (Size: Logarithm of year-end number of company employees); liability-asset ratio (LEV: Total liabilities/total assets); profitability (namely, return on equity, ROE: Net profit/gross revenue); growth ability (Growth: Growth rate of business revenue/100); duration of listing (AGE: Logarithm taken from number of years of listing +2); share ratio of the largest shareholder (FH: Number of shares hold by the largest shareholder/total number of shares); cash holding (Cash: Net operational cash flow/gross revenue); number of independent directors (IND: Year-end number of company's independent directors); number of directors (DIRECTOR: Year-end number of company's directors); duality (DUAL: If a person takes the posts of president and general manager simultaneously, the variable value is 1, or otherwise it is 0); international four major audit firms (SIDA: If the audit firm is among the international four major audit firms, the variable value is 1, or otherwise it is 0) were selected as the control variables. Then, year (Year) and industry (Industry) were controlled.

3. Result Analysis

3.1 Basic Regression Analysis

First, the regression analysis is conducted using model (1), and the fixed effects of year and industry are controlled using the fixed effect regression model. The standard error of regression was corrected through the company clustering effect. Tab. 1 shows the standard regression results regarding the influence of institutional investors on corporate innovation investment. In column (1), the time and industry effects are not controlled, but they are controlled in column (3). The obtained regression results indicate that the shareholding ratio of institutional investors is significantly positive at the 1% level. This result also certifies that institutional investors have a promoting effect on corporate innovation investment. In other words, with the increasing shareholding ratio of the institutional investors, the company expenditure in innovation investment is also increased.

From the previous part, the institutional investors facilitate innovation investment. If $H2$ holds true, then the interaction coefficient should be significantly negative. The time and industry effects are not controlled in column (2) of Tab. 1 but controlled in column (4). According to the regression results, the interaction term between the shareholding ratio of institutional investors and the economic policy uncertainty index is significantly negative at the 1% level. This finding means that the economic policy uncertainty represses the promoting effect of institutional investors on the innovation investment. Moreover, the supporting degree of institutional investors on the innovation investment is reduced. When the economic policy uncertainty is elevated, the promoting effect of institutional investors on the innovation investment will be weakened, so $H2$ is verified.

3.2 Influence Mechanism Analysis

The classical three-step mediating effects test method was used to verify the mediating effects of financing constraint (SA) and corporate governance (Con). With reference to Wen et al. (2006), the test was carried out according to the following steps: regression of model (1) and verification of models (3) and (4) on the precondition that is significant.

Tab. 1: Institutional investors and innovation investment

Variable	(1)	(2)	(3)	(4)
Institution	0.075*** (0.054)	0.224*** (0.068)	0.174*** (0.049)	0.280*** (0.065)
Institution×EPU		-0.047** (0.019)		-0.046*** (0.018)
EPU		0.142*** (0.010)		0.223*** (0.012)
Size	0.812*** (0.035)	0.787*** (0.035)	0.744*** (0.031)	0.745*** (0.031)
GROWTH	0.001 (0.004)	-0.001 (0.004)	0.030* (0.017)	0.029* (0.017)
ROE	0.000 (0.000)	0.000 (0.000)	0.006*** (0.001)	0.006*** (0.001)
LEV	-0.002*** (0.001)	-0.002** (0.001)	0.001 (0.001)	0.001 (0.001)
FH	-0.071*** (0.018)	-0.045*** (0.016)	-0.013 (0.023)	-0.009 (0.023)
IND	0.028 (0.029)	0.031 (0.028)	0.044 (0.028)	0.044 (0.028)
DIRECTOR	-0.013 (0.011)	-0.009 (0.011)	0.001 (0.010)	0.001 (0.010)
CASH	0.001** (0.000)	0.001* (0.000)	-0.001 (0.001)	-0.001 (0.001)
AGE	-0.003 (0.002)	-0.012*** (0.003)	-0.422*** (0.064)	-0.423*** (0.064)
DUAL	0.067*** (0.024)	0.051** (0.024)	0.026 (0.021)	0.026 (0.021)
SIDA	0.287*** (0.067)	0.296*** (0.068)	0.296*** (0.056)	0.297*** (0.056)
Constant	5.085*** (0.117)	4.830*** (0.118)	4.392*** (0.188)	4.142*** (0.189)
Year	No	No	Yes	Yes
Industry	No	No	Yes	Yes
Observations	9,072	9,072	9,072	9,072
R-squared	0.375	0.418	0.513	0.513

Source: own

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively; t-values reported in parentheses.

If and are significant, then the institutional investors influence the innovation investment partially by reducing the financing constraints. If is significant (insignificant), then the agency problem exerts a partial (complete) mediating effect. On the contrary, if at least one between and is insignificant, then whether the mediating

effect is significant should be judged through the Sobel test. The principles of models (5) and (6) are identical with those of models (3) and (4).

The test process is the same as the previous part. The coefficient of Institution in column (3) of Tab. 2 is significantly negative, indicating that the institutional investors relieve the financing

Tab. 2: Regression results of influence mechanism of institutional investors

Variable	Con (1)	RD (2)	SA (3)	RD (4)
Institution	0.023*** (0.004)	0.090* (0.050)	-0.019* (0.011)	0.101** (0.051)
SA				-0.309** (0.128)
Con		0.736*** (0.128)		
Controls variables	Yes	Yes	Yes	Yes
Constant	0.570*** (0.012)	4.360*** (0.199)	2.622*** (0.034)	5.591*** (0.371)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	6,181	6,181	6,181	6,181
R-squared	0.210	0.557	0.855	0.555

Source: own

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively; t-values reported in parentheses.

constraints. Moreover, the coefficient of SA in column (4) is significantly positive. This result means that institutional investors influence the corporate innovation investment by influencing the financing constraints. The coefficient of Institution in column (4) is significantly positive. This result indicates that, according to the test procedures of Wen et al. (2006), reducing the financing constraints is a partial mediator between institutional investors and corporate innovation investment. Hence, *H1b* is verified.

3.3 Endogeneity Analysis

The following robustness test was implemented to further verify the reliability of regression results and make the conclusions more robust.

In consideration of the possible reversal cause-effect problem between institutional investors and corporate innovation investment, namely, the institutional investors will probably hold more shares in the companies with satisfying innovation investment, the instrumental variable method was used in this study to solve the sample endogeneity problem. The number of institutional investors holding shares in the invested company was used for the regression of instrumental variables with reference to Gao et al. (2020). From the regression results in Tab. 3, the number of institutional investors in the invested

company (Number) in column 1 is significantly positive at the 1% level. Moreover, the interaction coefficient between Number and EPU in column 2 is significantly negative at the 1% level, so the research conclusion still holds true.

3.4 Robustness Test

Different from the simple arithmetic mean method for the monthly data of economic policy uncertainty, the annual EPU was calculated using the geometric mean method. With reference to the processing method adopted by Pástor and Veronesi (2013), the geometric mean of the 12-month data in each year was taken to obtain the annual EPU data, which was then used as the EPU index of this year, specifically shown in Formula (8):

$$EPUS^{year} = \sqrt[12]{EPU_{1,month} EPU_{2,month} \dots EPU_{12,month}} \quad (8)$$

where $EPUS^{year}$ is the annual economic policy uncertainty index, $EPU_{1,month}$, $EPU_{2,month}$, ..., $EPU_{12,month}$ represent the economic policy uncertainty indexes in 12 months within one year, respectively, and column (1) of Tab. 4 shows the regression results. The influence of economic policy uncertainty on the institutional investors and innovation investment still appears significant, and the main research conclusion holds unchanged.

Tab. 3: Regression results of instrumental variables

Variable	(1)	(2)
Number	0.002*** (0.000)	0.004*** (0.000)
Number×EPU		-0.001*** (0.000)
EPU		0.208*** (0.009)
Controls variables	Yes	Yes
Constant	4.757*** (0.187)	4.566*** (0.186)
Year	Yes	Yes
Industry	Yes	Yes
Observations	9,072	9,072
R-squared	0.536	0.541

Source: own

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively; t-values reported in parentheses.

The main problem faced in the research on economic policy uncertainty is the missing variable problem. The influences of economic policy uncertainty as discovered in this research may include the influences of factors, such as macroeconomic uncertainty. In the previous regression analysis, the corporate internal factors are controlled, without the consideration of the influence of macroeconomic uncertainty, which may exist. In view of the influence of macroeconomic uncertainty, the macroeconomic leading indicator (MLI), consumer confidence index (CCI), and entrepreneur confidence index (ECI) were added into the regression analysis, similar to McCahery et al. (2016) to measure macroeconomic uncertainty. Column (2) of Tab. 4 presents the results consistent with the principal regression, thereby verifying the robustness of the research conclusions.

3.5 Heterogeneity Analysis

Under the special market system environment in China, the nature of property rights will have a great influence on management behaviors. According to the nature of property rights of listed companies, the full samples were divided into state-owned and private company groups, followed by the test group using model (1). The regression results in columns (1) and (2)

of Tab. 5 show that the interaction coefficient between institutional investors and economic policy uncertainty is significantly negative in the state-owned companies but insignificantly positive in the private companies. This result demonstrates that the institutional investors in the state-owned companies weaken their innovation investment due to the economic policy uncertainty, which further reduces their promoting effect on the innovation investment. However, among private companies, the influence of economic policy uncertainty on the innovation investment of institutional investors is insignificant. Based on the above results, the economic policy uncertainty exerts evidently different effects on the relationship between institutional investors and corporate innovation investment under different natures of property rights. Furthermore, the economic policy uncertainty restricts the effect exerted by the institutional investors in the state-owned companies.

The densities of technological factors and R&D intensity are varied in companies occupied in different industries. With reference to Hu and Png (2013), the company samples were subdivided into new and high-tech companies and non-new and high-tech companies to analyze whether the institutional investors exerted different influences on the innovation

Tab. 4: Robustness test

Variable	(1)	(2)
Institution	0.280*** (0.065)	0.280*** (0.065)
Institution×EPUS	-0.051*** (0.020)	
EPUS	0.260*** (0.014)	
Institution×EPU		-0.046*** (0.018)
EPU		0.117*** (0.009)
CCI		1.177*** (0.087)
MLI		-4.867*** (0.242)
ECI		-0.778*** (0.062)
Controls variables	Yes	Yes
Constant	4.118*** (0.189)	8.685*** (0.311)
Year	Yes	Yes
Industry	Yes	Yes
Observations	9,072	9,072
R-squared	0.513	0.513

Source: own

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively; t-values reported in parentheses.

investment under aggravated economic policy uncertainty. From the regression results in columns (3) and (4) of Tab. 5, the interaction coefficient between institutional investors and economic policy uncertainty is insignificant among the new and high-tech companies but significantly negative among the non-new and high-tech companies. This result indicates that the economic policy uncertainty will aggravate the negative effect of institutional investors on the innovation investment in the non-new and high-tech companies but not on the relationship between institutional investors and innovation investment in new and high-tech companies.

Good investor protection means that the government will provide companies with advantageous policies, including talent introduction, tax preference, and fiscal subsidies (Andrlova et al., 2020). Such policies

will mitigate the constraints, such as talent, tax, technology, and capital, faced by the corporate R&D input, improve the feasibility of the R&D input, and reduce the R&D input risks. The investor protection index was introduced in this research, and the samples were divided into companies with strong and weak investor protection based on the median of the regional investor protection index. The regression results in columns (1) and (2) of Tab. 8 show that the interaction coefficient of innovation investment between institutional investors and economic policy uncertainty is insignificant in the area with high investor protection. However, such coefficient is significantly negative in the area with low investor protection. This result indicates that in the area with strong investor protection, the economic policy uncertainty will not result in a significant influence of institutional investors

Tab. 5: Influences of nature of property right, and industrial characteristic

Variable	SOE	Non-SOE	High and new	No high and new
	(1)	(2)	(3)	(4)
Institution	0.632*** (0.130)	0.075 (0.070)	0.167*** (0.055)	0.370*** (0.097)
Institution×EPU	-0.163*** (0.039)	0.011 (0.021)	-0.020 (0.015)	-0.067** (0.029)
EPU	0.287*** (0.023)	0.196*** (0.015)	0.108*** (0.011)	0.240*** (0.016)
Controls variables	Yes	Yes	Yes	Yes
Constant	3.809*** (0.361)	4.410*** (0.208)	4.627*** (0.114)	3.213*** (0.201)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	3,617	5,455	4,536	4,536
R-squared	0.524	0.514	0.726	0.553

Source: own

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively; t-values reported in parentheses.

on innovation investment but will significantly depress the relationship between institutional investors and innovation investment in the area with weak investor protection.

According to Doing Business Report 2020 released by the World Bank, China's ranking was elevated to 31st place (by 15 places) in 2018. Under the innovation-driven

Tab. 6: Influences of investor and IPR protection

Variable	High protect	Low protect	High IPR	Low IPR
	(1)	(2)	(3)	(4)
Institution	0.262*** (0.075)	0.290*** (0.080)	0.232*** (0.071)	0.337*** (0.083)
Institution×EPU	-0.032 (0.022)	-0.065** (0.027)	-0.032 (0.021)	-0.066** (0.027)
EPU	0.200*** (0.014)	0.246*** (0.016)	0.217*** (0.013)	0.220*** (0.018)
Controls variables	Yes	Yes	Yes	Yes
Constant	4.216*** (0.193)	4.086*** (0.203)	4.131*** (0.214)	4.177*** (0.190)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	5,004	4,021	4,931	4,141
R-squared	0.528	0.510	0.544	0.483

Source: own

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively; t-values are reported in parentheses.

development strategy, the intellectual property right (IPR) protection should be strengthened to create a good business environment (Kondić & Knok, 2020). With powerful IPR protection, the probability for a company's innovative product and benefit to be corroded and extruded will be reduced, and the motivation for R&D input will be enhanced (Aghion et al., 2013). After China's accession to the WTO, the country has continuously improved Patent Law and strengthened the juridical enforcement of IPR protection. With reference to Shen and Huang (2019), the regional IPR protection intensity was measured from the perspective of the regional number of settled IPR-related cases. From the regression results in columns (3) and (4) of Tab. 6, the interaction coefficient of innovation investment between institutional investors and economic policy uncertainty is insignificant in the area with a high IPR protection level. However, this coefficient is significantly negative in the area with a low IPR protection level. This result manifests that in the area with strong IPR protection, the influence of economic policy uncertainty on the institutional investors and innovation investment is weakened. However, the economic policy uncertainty evidently impedes the promoting effect of institutional investors on the innovation investment in the area with weak IPR protection.

4. Discussion

Through the regression results in Tab. 1, the institutional investors remarkably improve the corporate innovation investment, and this conclusion, which is identical to that of the existing literature (particularly Fan, 2018), verifies *H1*. The possible reason for this conclusion is that institutional investors play important roles in reducing corporate information asymmetry and relieving the principal-agent problem. With a high shareholding ratio, institutional investors can have close contact with the company management layer and acquire additional information than ordinary investors. This advantage boosts the message transmission to the external investors and reduces the information asymmetry. As proactive investors holding a great number of corporate stocks, the institutional investors fail to exit their own accord while not bearing any loss. They are motivated to take actions to supervise the companies, which will also conduct additional innovation activities. Therefore, their shareholding ratio is positively correlated

with innovation investment. The increasing shareholding ratio of institutional investors will effectively discourage the company management layer from opportunistic behaviors, such as fund embezzlement (Lin et al., 2011; Lu et al., 2019b). Moreover, this increase in the shareholding ratio will lower the short-sighted decision-making pressure faced by the company management layer and increase the company resources applicable to the innovation investment.

Through the regression results in Tab. 2, after the crossover term between economic policy uncertainty and institutional investor is added, the symbol is apparently negative, which verifies *H2*. The economic policy uncertainty weakens the promoting effect of institutional investors on innovation investment, which is a new finding of this research. The possible reason for this conclusion is that the increasing uncertainties brought by the frequent adjustment of economic policies weaken the rational market expectations made by the institutional investors (Gulen & Ion, 2015), waver their investment resolutions, and inhibit their supporting degree for the corporate innovation investment. Moreover, the economic policy uncertainty can give rise to the fluctuation of corporate value, that is, the company may suffer from a serious decline of corporate value. Therefore, to evade the risks, the company should take conservative decisions to cope with the challenge brought by the policy fluctuations, thus reducing its innovation investment. Economic policy is an important government means of macro-regulation, and the ever-changing economic policies will aggravate the uncertainty, and consequently, the investors will belittle the investment prospects. As the innovation investment is a high-risk long-term investment project, innovation investment is highly sensitive to related policies. Thus, the economic policy uncertainty weakens the promoting effect of institutional investors on the innovation investment.

From the regression results in Tab. 3, the institutional investors relieve the corporate financing constraints by improving the corporate governance and further enhance the corporate innovation investment. The advantages of institutional investments in three aspects – size, personnel, and information – provide advantageous conditions for them to participate in the corporate governance, improve the internal control quality, effectively counterbalance

the opportunistic behaviors, such as fund embezzlement of the company management layer, and increase the company resources applicable to the innovation investment (Fan, 2018). With the “wind indicator effect”, the institutional investors send the positive signal of the company to the market. Then, they transmit the information that they master regarding the company’s innovation activities to the capital market through their investment behaviors in way of information disclosure. This process can mitigate the information asymmetry with respect to the company’s innovation activities in the capital market and help the company to attract potential external fund suppliers (Almazan et al., 2005; Guido et al., 2020). Therefore, institutional investors relieve the company’s financing constraints and facilitate its innovation investment by improving corporate governance.

From the regression results in Tabs. 5 and 6, the economic policy uncertainty exerts a minor inhibitory effect on the private companies, new and high-tech companies, and those with low market competition. For the investors and companies with high IPR protection level, the institutional investors and corporate innovation investment are influenced by the economic policy uncertainty to a minimum extent. This conclusion is consistent with that of the existing literature (Ferreira & Matos, 2008; Alan et al., 2019). Considering the diversified business objectives, the institutional investors have limited right of speech in the corporate governance of state-owned companies under the competitive manager market. The economic policy uncertainty aggravates market uncertainty. In addition, the management layer will lay more emphasis on other interests, such as political and social interests, except for economic performance when making decisions (Brown & Petersen, 2011; Lu et al., 2019a). Therefore, conservative business strategies will be adopted, which, to a great extent, reduce the promoting effect of institutional investors on the innovation investment. If the economic policy uncertainty is high, then the risk of being knocked out is also high. The perfect and complete investor protection and IPR protection provide a system guarantee for institutional investors to participate in corporate governance. Such protection will also create a good business environment and weaken the negative impacts of economic policy uncertainty on institutional investors. Through the grouping

test, the significant roles played by institutional investors in stabilizing the securities market and boosting economic development are verified.

Conclusions

The influence of institutional investors on the corporate innovation investment was explored from the perspective of economic policy uncertainty. The 2010–2018 panel data in China were used to investigate the influences of institutional investors and innovation investment. Then, the moderating effect of economic policy uncertainty on institutional investors and innovation investment was analyzed. The main conclusions are as follows: (1) Institutional investors boost the corporate innovation investment; (2) The aggravated economic policy uncertainty inhibits the promoting effect of institutional investors on the innovation investment; (3) Institutional investors improve the corporate governance and facilitate the corporate innovation investment by remitting the financing constraints; (4) The economic policy uncertainty inhibits, to a small extent, the promoting effect of institutional investors on the innovation investments of private companies, new and high-tech companies; (5) If a listed company is located in an area with a high level of investor and IPR protection, then the economic policy uncertainty has a minimal influence on the institutional investors and corporate innovation investment. The research conclusions can provide a macroscopic interpretation mechanism for developing institutional investors and reveal the importance of consistent and stable governmental economic policies to corporate development.

Enriching the related literature in the research field of innovation investment, this research provides a brand-new research idea from the perspective of institutional investors. Moreover, this study provides a useful supplementation for the innovation investment mechanism of listed companies. As an important macro factor, the economic policy uncertainty will probably become a new signal influencing the corporate innovation investment. However, limitations are not avoided in the research. For instance, the instrumental variable method cannot completely overcome the endogeneity problem. Moreover, the EPU measurement method will be disturbed by the external economic environment. Both of which, to a certain extent, give rise to some biased errors in the estimation results.

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