

Economic policy uncertainty and corporate investment efficiency: Evidence from China - Based on panel data

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Abstract. This paper studies the impact of economic policy uncertainty on corporate investment efficiency. The study finds that economic policy uncertainty has a significantly positive impact on corporate investment efficiency. In addition, the positive relationship is still robust after conducting a series of robustness checks. Further analyses show that the impact of economic policy uncertainty on corporate investment efficiency is more pronounced in firms that do not employ Big 4 auditors, are non-state-owned, and have fewer analysts. By exploring the economic channel, this study shows that economic policy uncertainty is related to higher information disclosure quality. Firms with higher information disclosure quality tend to improve their corporate investment efficiency when economic policy uncertainty increases. Findings show that the increase in economic policy uncertainty in China's capital market can improve corporate information disclosure quality and further improve corporate investment efficiency.

Keywords: economic policy uncertainty; corporate investment efficiency; information disclosure quality; China.

1. Introduction

Economic policy uncertainty means that the economic subject cannot predict exactly whether, when, and how the government changes the current economic policy [1]. In other words, it reflects the economic fluctuations caused by the unpredictability of fiscal, political, regulatory, and monetary policies [2]. Economic policy uncertainty may make firms adjust their investment efficiency to compete with better multinational firms, forming an opportunity for accelerated economic development. In addition, after introducing the policy, there are many possibilities for its implementation intensity and effect, so firms are faced with economic policy uncertainty while making decisions [3]. In recent years, due to the continuous increase in EPU and China's situation in a transition period, the investment efficiency is more concerned by the government and firm managers. And corporate investment efficiency is one of the factors affected by economic policy uncertainty. This paper links the macro level economic policy with corporate investment decision-making at the micro level to study the impact of economic policy uncertainty on corporate investment efficiency.

There is still controversy on the impact of economic policy uncertainty (hereafter, EPU) on corporate investment efficiency. On the one hand, EPU reduces the corporate investment efficiency by reducing the confidence of entrepreneurs and increasing the information asymmetry. On the other hand, some literature points out that higher EPU forces firms to improve their financing and investing method, reduce their systemic risk, and improve internal control and human capital structure, so it positively impacts corporate investment efficiency.

We choose China's capital market for two main reasons. First, China is transitioning from a centrally planned economy to a market economy and has focused on achieving sustainable economic development since 2012 [4]. With the effectiveness of economic policies adopted not being accurately

predicted, China has continuously introduced, tested, and changed policies to find the most beneficial one and achieve the goals. In addition, Trump's policies have exacerbated the contradiction between the US and China in trade policies, making the EPU of China fluctuate greatly in recent years.

Second, China's economic development has entered a shifting period, during which the mode of economic development is shifting from extensive growth of scale and speed to intensive growth of quality and efficiency, and the driving force of economic development is shifting from factor to innovation-driven growth. The report of the 19th National Congress of the Communist Party of China points out that the primary task of future economic development is to improve the efficiency of resource allocation [5]. Therefore, the healthy development of China's economy and society is closely related to improving corporate investment efficiency and avoiding over-investment and under-investment [6].

Based on the above reasons, China is a good setting to studying the impact of fluctuation of economic policy uncertainty on corporate investment efficiency. That provides a new research perspective that starts with the economic conditions of China rather than Western developed countries and enriching the discussion about the relationship between economic policy uncertainty and corporate investment efficiency.

Unlike many previous literatures which conclude that the increase in EPU reduces the corporate investment efficiency (e.g., Lei [7]; Rao, Yue and Jiang [8]; Wang, Chen and Huang [9]), our study finds that economic policy uncertainty is positively correlated with corporate investment efficiency, and this relationship is robust to a series of robustness checks, including using alternative test variable and fixed effects model. From further analyses, it is concluded that EPU has a more obvious impact on corporate investment efficiency in firms that Big 4 auditors do not audit, are non-state-owned, and have fewer analysts. Besides, we also find that this impact is related to corporate information disclosure quality through testing the intermediate mechanism.

This study mainly makes contributions in three aspects. First, this study provides a new critical finding. Our research not only supports the notion that economic policy uncertainty influences corporate investment efficiency but draws a conclusion that economic policy uncertainty increases corporate investment efficiency. In this regard, we believe that this study provides a reliable argument point for relevant research, such as Lei [7]; Rao, Yue and Jiang [8]; Wang, Chen and Huang [9].

Second, this study contributes to a better understanding of the impact of economic policy uncertainty on different firms with some unique Chinese attributes. Our finding shows that this impact is more pronounced in firms with weak internal and external governance based on our collected data.

Third, this study explores a new economic mechanism of the impact of EPU on corporate investment efficiency and finds the correlation between economic policy uncertainty, corporate information disclosure quality, and corporate investment efficiency. Previous studies have examined intermediate mechanisms like manager's confidence [10], trade credit [11], accounting conservatism [12], etc. Thus, our study enriches the literature and provides evidence for related research on information disclosure quality.

The rest of the structure of this study is arranged as follows: section 2 presents our hypothesis; section 3 describes the research design, including sample selection, model specification, and variables interpretation; section 4 conducts the empirical analyses; section 5 provides robustness checks, including fixed effects model and alternative test variable; section 6 carries out further analyses; section 7 discusses the intermediate mechanism; and section 8 concludes this paper.

2. Theoretical background and hypotheses development

Our study is motivated by two opposing strands of research on the relationship between economic policy uncertainty and corporate investment efficiency. Their main academic views are discussed below, which lead to our two different hypotheses.

One view supports that the economic policy uncertainty increases the corporate investment efficiency to a great extent. Uncertainty produces both volatility and opportunity. Kulatilaka and

Perotti [13] provide a strategic rationale for growth options under uncertainty and document that higher uncertainty means more opportunity rather than simply larger risk. Moreover, according to Hou, Tang, Wang, and Xiong, and Wang, Chen, and Huang, the EPU negatively affects inefficient corporate investment. And firms that have a higher return on invested capital are not state-owned and use more internal finance to reduce the negative effect of policy uncertainty [14, 15].

There are many perspectives to explain the positive relationship between economic policy uncertainty and corporate investment efficiency. First, Liu, He, Liang, Yang, and Xia [16] explain the relationship between economic policy uncertainty and investment efficiency from the perspective of financing. Their study shows that firms tend to improve their financing and investment policies to capture the growth opportunity with the strengthening of financing constraints. Growth opportunities can offset the inhibitory effect of economic policy uncertainty on investment. As a result, EPU increases investment, especially in the traditional energy firms [16]. Second, the economic policy uncertainty also forces firms to control their risk-taking level. Chen, He, and Wang [17] find that block-chain technology can potentially enable companies to reduce their systemic risks and enhance their investment efficiency with an increase in uncertainty. In addition, Liao, Ji, and Wang [18] show that firms tend to cope with higher EPU by improving internal control, which is beneficial to investment efficiency and sustainability development. Third, Chu and Fang [19] also propose that EPU induces firms to allocate more employees with high human capital, which eventually helps firms achieve higher total factor productivity. As a result, investment efficiency is positively correlated with economic policy uncertainty. Last, Wang, Zhao, and Yin [20] and Dutta and Nezlobin [21] document that EPU positively correlates with the promptness and sufficiency of voluntary disclosure, and the information disclosure quality positively affects corporate investment efficiency. Then we assume that the information disclosure quality plays an important role in the relationship between EPU and corporate investment efficiency.

Based on the above analysis, we contend that higher EPU forces firms to improve their financing and investing method, reduce their systemic risk, and improve their internal control, human capital structure, and information disclosure quality. As a result, firms can seize the growth opportunity under uncertainty. Therefore, we propose the following hypotheses:

H1a. Economic policy uncertainty has a positive impact on corporate investment efficiency.

However, many scholars support the opposing view. Giavazzi and Pagano [22] point out that there is a close relationship between entrepreneurial confidence and economic policy from the perspective of entrepreneurial confidence. The economic policy uncertainty would increase the risk of investment, which changes the firm's risk perception. To a certain extent, it limits the firm's investment and further reduces investment efficiency. From the perspective of information asymmetry, Venky, Jordan, and Laura [23] find that the economic policy uncertainty would affect the corporate information environment, leading to information credibility issues and information transmission delays. In addition, Myers and Majluf [24] indicate that information asymmetry leads to adverse selection of information problems and increases the moral hazard of managers, which leads to the reduction of corporate investment efficiency. Fuensanata and Juan [25] further verify that information asymmetry is the main reason for inefficient corporate investment.

Based on the above analysis, EPU can reduce corporate investment efficiency through entrepreneur confidence and information asymmetry. We propose the following hypotheses:

H1b. Economic policy uncertainty has a negative impact on corporate investment efficiency.

3. Research design

3.1 Sample

We use all Chinese A-share corporates listed in Shanghai and Shenzhen stock exchanges from 2007 to 2017 as samples. Our sample data mainly comes from Economic Policy Uncertainty Index developed by Baker, Bloom, and Davis [3] based on the South China Morning Post, and Economic Policy Uncertainty and Trade Policy Uncertainty indexes developed by Davis, Liu, and Sheng [26]

based on mainland newspapers: the Renmin Daily and the Guangming Daily. In addition, we exclude financial firms (e.g., banks, insurance companies, and investment trusts and according to Xu et al., we drop the firms with fewer than 30 trading weeks of stock return data in a fiscal year [27]. The data used in this study are obtained from China Stock Market and Accounting Research Database (CSMAR).

3.2 Models

The basic empirical employed is:

$$\text{Biddle2 (Biddle 4)} = \beta_0 + \beta_1 \text{Landepu} + \sum_k \beta_k \text{Control}_{k,i,t} + \varepsilon_t \quad (1)$$

This model controls the double fixed effects of year and industry. In this model, β_1 represents regression coefficients; ε is a random disturbance term; *Size*, *Age*, *Lev*, *BM*, *Frs*, *Roa*, and *Growth* are set as control variables. The dependent variables *Biddle2* and *Biddle4* measure corporate investment efficiency and are estimated using the first 2 and 4 yards of *gics* which is the residual value calculated by regressing investment and the growth rate of turnover [28]. While *Landepu* represents China's economic policy uncertainty index based on two leading mainland newspapers: the Renmin Daily and the Guangming Daily [26]. If β_1 is negative (positive), the uncertainty decreases (increases) corporate investment efficiency.

3.3 Variables

3.3.1. Dependent variable: corporate investment efficiency

Following Bloom, Bond and Van [29], Bonaime, Gulen and Ion [30], Tan [31], and Petersen and Rajan [32], we know that corporate investment efficiency is an important indicator to measure whether the development of a firm is good or not. We use the absolute value of residual estimated by Biddle's model [28] as the investment efficiency.

$$\text{INV}_{i,t} = a_0 + a_1 \times \text{Growth}_{i,t} + a_2 \times \text{Lev}_{i,t-1} + a_3 \times \text{Cash}_{i,t-1} + a_4 \times \text{Age}_{i,t-1} + a_5 \times \text{Size}_{i,t-1} + a_6 \times \text{Return}_{i,t-1} + a_7 \times \text{INV}_{i,t-1} + \sum \text{Industry} + \sum \text{Year} + \varepsilon_{i,t} \quad (2)$$

3.3.2. Test variable: economic policy uncertainty

People usually use the economic policy uncertainty index to measure the level of economic policy uncertainty [3]. EPU index for China is calculated by the number of newspapers and periodicals that contain terms, 'Economic', 'Policy' and 'Uncertainty', in the current month divided by the total number of all newspapers and periodicals in the same month [26]. The index mainly measures EPU from three aspects: one is news reports on government policies related to the economy, the second is the federal tax act, and the last aspect is the economic authorities' financial policy and monetary policy. The index reflects the frequency of uncertainty-related words in 10 major US newspapers. And add strict restrictions in words, subdivided into specific medical uncertainty index and national security uncertainty index [3].

3.3.3. Control variables

Following Li, Zeng and Ma [33], Wang, Liu and Gao [34], Chen and Liu [35], we control for the following variables which affect corporate investment efficiency. *Size* is the firm size measured by the nature logarithm of the market value of equity. *Age* is the listing age, equal to the natural logarithm of the year of observation minus the year of listing plus one. *Lev* represents the corporate financial leverage calculated by the book value of the total debt divided by the book value of the total assets. *BM*, the book-to-market ratio, calculated by the book value of equity divided by the market value of equity. *Frs* represents the proportion of the first largest shareholder. *Roa*, the return on assets, calculated by net profit divided by the book value of the total assets. *Growth*, the growth rate of

operating revenue, calculated by the increase in operating revenue divided by the total operating revenue in year t-1.

4. Empirical analyses

4.1 Descriptive statistics

Table 1 reports descriptive statistics on corporate investment efficiency, EPU, and control variables for the sample containing 20,000 firm-year observations from 2007 to 2017. Before the empirical analysis, to avoid the influence of extreme value, all continuous variables are winsorized at the 1% level in each tail. According to the data in Table 1, we can find that the corporate investment efficiency is relatively low and varies greatly.

Table 1. Descriptive statistics

Variable	Obs.	Mean	Std.dev.	Min.	25th	50th	75th	Max.
<i>Biddle4</i>	20,000	-0.208	0.093	-0.426	-0.413	-0.055	-0.024	-0.021
<i>Biddle2</i>	20,000	-0.198	0.089	-0.411	-0.397	-0.058	-0.023	-0.020
<i>Landepu</i>	20,000	138.174	62.043	50.443	104.556	122.168	129.314	277.813
<i>Size</i>	20,000	22.092	1.304	19.478	21.173	21.920	22.842	26.047
<i>Age</i>	20,000	2.773	0.362	1.609	2.565	2.833	3.045	3.434
<i>Lev</i>	20,000	0.469	0.205	0.062	0.311	0.472	0.624	0.941
<i>BM</i>	20,000	0.623	0.244	0.116	0.435	0.626	0.814	1.121
<i>Frs</i>	20,000	0.363	0.153	0.088	0.240	0.347	0.473	0.759
<i>Roa</i>	20,000	0.039	0.054	-0.183	0.014	0.035	0.064	0.201
<i>Growth</i>	20,000	0.193	0.481	-0.568	-0.015	0.113	0.273	3.305

4.2 Correlation analysis

In Table 2, we calculated Pearson correlation coefficients between variables. As shown in Table 2, there is a significant positive relationship between economic policy uncertainty and corporate investment efficiency. When the economic policy uncertainty increases, the corporate efficiency investment could be improved.

Table 2. Pearson correlation coefficients

	<i>Biddle4</i>	<i>Biddle2</i>	<i>Landepu</i>	<i>Size</i>	<i>Age</i>	<i>Lev</i>	<i>BM</i>	<i>Frs</i>	<i>Roa</i>	<i>Growth</i>
<i>Biddle4</i>	1									
<i>Biddle2</i>	0.940***	1								
<i>Landepu</i>	0.043***	0.049***	1							
<i>Size</i>	-0.061***	-0.051***	0.151***	1						
<i>Age</i>	-0.089***	-0.086***	0.303***	0.156***	1					
<i>Lev</i>	-0.100***	-0.099***	-0.085***	0.396***	0.116***	1				
<i>BM</i>	-0.056***	-0.054***	0.229***	0.571***	0.036***	0.334***	1			
<i>Frs</i>	0.004***	0.019***	-0.032***	0.237***	-0.160***	0.037***	0.167***	1		
<i>Roa</i>	0.140***	0.150***	0.026***	-0.018**	-0.089***	-0.386***	-0.185***	0.113***	1	
<i>Growth</i>	0.037***	0.057***	-0.007***	-0.001***	-0.026***	0.054***	-0.006***	0.029***	0.187***	1

This table reports Pearson correlation coefficients of the variables used in our study. *Biddle4* and *Biddle2* are proxies for corporate investment efficiency. *Landepu* is proxy for EPU. Firm characteristics variables include firm size (*Size*), listing age (*Age*), firm financial leverage (*Lev*), book-to-market ratio (*BM*), the proportion of the first largest shareholder (*Frs*), return to assets (*Roa*), and the growth rate of operating revenue (*Growth*).

4.3 Multivariate results

Table 3 displays the regression results of our Eq. (2) using *Landepu* as the measurement of EPU and *Biddle4* and *Biddle2* to measure corporate investment efficiency. The coefficients of the *Landepu* are 0.711 and 0.759, significant at the 1% level, which indicates that the *Landepu* increases the investment efficiency and supports the hypotheses, *H1a*. Therefore, *Landepu* has a significant positive effect on corporate investment efficiency.

The coefficients of some control variables, *Lev*, *Roa*, and *Growth*, are positive, indicating that firms with higher leverage, higher profitability, and higher growth rate are associated with higher investment efficiency. In addition, the coefficients of *BM* and *Frs* are both negative, which suggests that high book-to-market ratios and the proportion of the largest shareholders reduce corporate investment efficiency.

Table 3 Relationship between EPU and corporate investment efficiency

Dependent variable =	<i>Biddle4</i>	<i>Biddle2</i>
	(1)	(2)
<i>Landepu</i>	2.664*** (6.36)	0.759*** (4.32)
<i>Size</i>	-0.026*** (-10.48)	-0.003*** (-2.82)
<i>Age</i>	-0.043*** (-3.46)	-0.024*** (-7.08)
<i>Lev</i>	-0.039*** (-4.33)	0.003 (0.47)
<i>BM</i>	-0.032*** (-5.37)	-0.011** (-2.08)
<i>Frs</i>	0.030** (2.06)	0.000 (0.00)
<i>Roa</i>	0.122*** (6.03)	0.213*** (11.29)
<i>Growth</i>	0.002 (-1.20)	0.005*** (2.76)
Constant	0.678*** (12.14)	0.087*** (3.59)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	19812	19812
Adjusted R ²	0.063	0.087

5. Robustness checks

5.1 Fixed effects model

To eliminate the influence of changes in time and firm-specific characteristics, we adopt the methods of year fixed effect and firm fixed effect to re-estimate Eq. (1). Table 4 reports the firm fixed effects regression of the impact of economic policy uncertainty on corporate investment efficiency with *Biddle4* and *Biddle2* as the dependent variables. The results show that regardless of using the *Biddle4* or *Biddle2* measurement methods, the coefficients of *Landepu* are significantly positive at the 1% level, in line with our multivariate results.

Table 4. Robustness checks: Firm fixed effects

Dependent variable =	<i>Biddle4</i>	<i>Biddle2</i>
	(1)	(2)
<i>Landepu</i>	2.664*** (6.36)	0.759*** (4.32)
<i>Size</i>	-0.026*** (-10.48)	-0.003*** (-2.82)
<i>Age</i>	-0.043*** (-3.46)	-0.024*** (-7.08)
<i>Lev</i>	-0.039*** (-4.33)	0.003 (0.47)
<i>BM</i>	-0.032*** (-5.37)	-0.011** (-2.08)
<i>Frs</i>	0.030** (2.06)	0.000 (0.00)
<i>Roa</i>	0.122*** (6.03)	0.213*** (11.29)
<i>Growth</i>	0.002 (-1.20)	0.005*** (2.76)
Constant	0.678*** (12.14)	0.087*** (3.59)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	19812	19812
Adjusted R2	0.063	0.087

5.2 Alternative sample

5.2.1. Alternative sample: SCMP

We replace the original test variable, *Landepu*, with another indicator of EPU, *SCMP*, which is the economic policy uncertainty index for China based on a Hong Kong English newspaper South China Morning Post [3]. Then we adopt this new indicator of EPU to re-estimate Eq. (1), and the results from regression of the impact of economic policy uncertainty measured with *SCMP* on corporate investment efficiency are reported in Table 5.

Under both situations using the *Biddle4* or *Biddle2* measurement methods, the coefficients of *SCMP*, 1.475 and 1.601, are both significantly positive at the 1% level. The result is in line with the last regression using *Landepu* as the test variable, which further proves a positive relationship between the economic policy uncertainty and investment efficiency.

Table 5. Robustness checks: SCMP as the alternative measure of EPU

<u>Dependent variable =</u>	<u>Biddle4</u>	<u>Biddle2</u>
	(1)	(2)
<i>SCMP</i>	1.475*** (6.06)	1.601*** (6.36)
<i>Size</i>	-0.025*** (-10.48)	-0.026*** (-10.48)
<i>Age</i>	-0.035*** (-2.95)	-0.043*** (-3.46)
<i>Lev</i>	-0.036*** (-4.22)	-0.039*** (-4.33)
<i>BM</i>	-0.040*** (-6.94)	-0.032*** (-5.37)
<i>Frs</i>	0.039*** (2.78)	0.030** (2.06)
<i>Roa</i>	0.127*** (6.48)	0.122*** (6.03)
<i>Growth</i>	0.001 (0.29)	-0.002 (-1.20)
Constant	0.620*** (11.79)	0.678*** (12.13)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	19812	19812
Adjusted R2	0.077	0.063

5.2.2. Alternative sample: TPU

Drawing on the definition of economic policy uncertainty by Davis, Liu, and Sheng, we use another indicator, *TPU*, which represents the Trade policy uncertainty index for China based on the Semi-Annual Reports on China's Foreign Trade from 2003 to 2018, to express economic policy uncertainty [26]. *TPU* is calculated by the number of articles containing terms, 'Economic', 'Trade Policy' and 'Uncertainty', in the current month divided by the total number of all articles in the same month [26].

Replacing the original indicator by this new economic policy uncertainty index to re-estimate the Eq. (1) and the results from regression of the impact of trade policy uncertainty on corporate investment efficiency are reported in Table 6. Under both situations using the *Biddle4* or *Biddle2* measurement methods, the coefficients of *TPU* are significantly positive at the 1% level, which is 1.111 and 1.206, respectively. This is consistent with our previous results, showing the robustness of our results.

Table 6. Robustness checks: TPU as the alternative measure of EPU

Dependent variable =	<i>Biddle4</i>	<i>Biddle2</i>
	(1)	(2)
<i>TPU</i>	1.111*** (6.06)	1.206*** (6.36)
<i>Size</i>	-0.025*** (-10.48)	-0.026*** (-10.48)
<i>Age</i>	-0.035*** (-2.95)	-0.043*** (-3.46)
<i>Lev</i>	-0.036*** (-4.22)	-0.039*** (-4.33)
<i>BM</i>	-0.040*** (-6.94)	-0.032*** (-5.37)
<i>Frs</i>	0.039*** (2.78)	0.030** (2.06)
<i>Roa</i>	0.127*** (6.48)	0.122*** (6.03)
<i>Growth</i>	0.001 (0.29)	-0.002 (-1.20)
Constant	0.630*** (11.73)	0.690*** (12.08)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	19812	19812
Adjusted R2	0.077	0.063

6. Further analyses

6.1 The moderating effects of governance mechanisms

Compared with well-managed firms, poorly governed firms are more susceptible to economic policies. To minimize the losses caused by changes in economic policies and protect their own profits, they must pay more attention to and be more careful about their investments. Therefore, we predict that the positive relationship is more pronounced for firms with weaker governance. We discuss the Big 4 auditors, ownership forms, and analyst team in the governance mechanism.

6.1.1. Big 4 auditors

The four major audit institutions have the advantage of providing scientific auditing procedures and comprehensive information disclosure. The annual audit reports they provide are of higher quality and can help managers to avoid risks effectively. Therefore, when economic policy uncertainty fluctuates, firms that employ the Big 4 auditors are less affected than those without Big 4 auditors [36].

Following Yuan et al. [37], we divide the sample into two subsets: the subset of firms that entrust the Big 4 auditors to prepare annual auditing reports, represented as Big4, and the other subset of those without Big 4 auditors, represented as Non-Big4. Then we use these two subsets to re-estimate the Eq. (1) separately. It can be seen from Table 7 that when using *Biddle4* to measure corporate investment efficiency, the estimated coefficient of *Landepu* for Big4 is 2.297, which is significant at the 10% level, and that for Non-Big4 is 2.885, which is more significant at 1% level. This indicates that *Landepu* has a greater impact on firms' investment efficiency that do not accept Big 4 auditors. Similarly, when *Biddle2* is used as a measurement indicator, the estimated coefficient of *Landepu* under Non-Big4, 2.693, is more pronounced, which also proves the above view.

Table 7. Moderating effects of Big 4

Dependent variable =	<i>Biddle4</i>		<i>Biddle2</i>	
	(1) Big4	(2) Non-Big4	(3) Big4	(4) Non-Big4
<i>Landepu</i>	2.972* (1.83)	2.885*** (6.55)	2.870* (1.76)	2.693*** (6.36)
<i>Size</i>	-0.027 (-1.50)	-0.029*** (-11.64)	-0.030* (-1.76)	-0.026*** (-11.43)
<i>Age</i>	-0.057* (-1.71)	-0.044*** (-3.35)	-0.060* (-1.69)	-0.037*** (-2.93)
<i>Lev</i>	-0.037 (-0.85)	-0.039*** (-4.25)	-0.051 (-1.16)	-0.035*** (-4.09)
<i>BM</i>	-0.025 (-1.30)	-0.033*** (-5.19)	-0.027 (-1.44)	-0.041*** (-6.76)
<i>Frs</i>	0.049 (1.05)	0.032** (2.08)	0.073 (1.57)	0.039*** (2.66)
<i>Roa</i>	0.059 (0.69)	0.125*** (5.95)	0.039 (0.47)	0.130*** (6.43)
<i>Growth</i>	-0.003 (-0.44)	-0.002 (-1.43)	-0.007 (-1.18)	0.000 (0.23)
Constant	0.778* (1.89)	0.720*** (13.22)	0.848** (2.22)	0.654*** (12.76)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	1387	18425	1387	18425
Adjusted R ²	0.044	0.065	0.083	0.078

This table reports the results of moderating effects of governance mechanisms on the relationship between EPU and corporate investment efficiency by dividing the full sample into two groups based on the Big 4 auditors in the governance mechanism. Columns (1) and (2) contain the regression results using *Biddle4* as the dependent variable, and Columns (3) and (4) contain the regression results using *Biddle2* as the dependent variable. The t-values based on robust standard errors clustered by both firm and year are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

6.1.2. Ownership forms

Non-state-owned enterprises have higher flexibility with relatively simple structures and have strong adaptability. Besides, they are not protected by the external or the government. Hence, when economic policy uncertainty increases, these firms are more cautious and adjust their decisions in time to maximise the firms' benefits.

Following Yuan et al. [37], we divide the sample into two subsets: the subset of state-owned firms with the label of SOE and the other subset of the non-state-owned with Non-SOE. Then we use these two subsets to re-estimate the Eq. (1) separately. From Table 8: when using *Biddle4* to measure corporate investment efficiency, the estimated coefficient of *Landepu* for SOE is 2.630 and that for Non-SOE is 3.473, which are both significant at the 1% level, but the estimated coefficient of *Landepu* for Non-SOE is larger. This indicates that *Landepu* has a greater impact on the efficiency of corporate investment in non-state-owned firms. Similarly, the same result is produced when using the *Biddle2* measurement indicator: the estimated coefficient of *Landepu* for Non-SOE, 3.305, is larger than that for SOE, 2.382. It further proves that *Landepu* has a positive effect on corporate investment efficiency and works better on the investment efficiency of non-state-owned firms.

Table 8. Moderating effects of SOE

Dependent variable =	<i>Biddle4</i>		<i>Biddle2</i>	
	(1) SOE	(2) Non-SOE	(3) SOE	(4) Non-SOE
<i>Landepu</i>	2.630*** (4.46)	3.473*** (5.55)	2.382*** (4.04)	3.305*** (5.58)
<i>Size</i>	-0.038*** (-12.58)	-0.022*** (-6.01)	-0.035*** (-12.18)	-0.021*** (-6.03)
<i>Age</i>	-0.020 (-1.07)	-0.066*** (-3.91)	-0.016 (-0.86)	-0.055*** (-3.47)
<i>Lev</i>	-0.019* (-1.66)	-0.053*** (-3.96)	-0.017 (-1.59)	-0.048*** (-3.79)
<i>BM</i>	-0.037*** (-4.48)	-0.031*** (-3.38)	-0.043*** (-5.51)	-0.038*** (-4.31)
<i>Frs</i>	0.017 (0.93)	0.063*** (2.73)	0.024 (1.31)	0.071*** (3.23)
<i>Roa</i>	0.099*** (3.44)	0.125*** (4.92)	0.117*** (4.12)	0.115*** (4.31)
<i>Growth</i>	-0.003 (-1.44)	-0.002 (-0.85)	-0.001 (-0.69)	0.001 (0.38)
Constant	0.873*** (11.66)	0.614*** (7.69)	0.807*** (10.85)	0.564*** (7.52)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	10146	9666	10146	9666
Adjusted R2	0.091	0.051	0.110	0.058

This table reports the results of moderating effects of governance mechanisms on the relationship between EPU and corporate investment efficiency by dividing the full sample into two groups based on the ownership forms in the governance mechanism. Columns (1) and (2) contain the regression results using *Biddle4* as the dependent variable, and Columns (3) and (4) contain the regression results using *Biddle2* as the dependent variable. The t-values based on robust standard errors clustered by both firm and year are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

6.1.3. Analyst team

Analyst teams play a crucial role in economic activities. Compared with individual analysts, analyst teams generate more accurate reports to support the business activities. Moreover, team size and team member diversity are significantly associated with forecast accuracy [38]. Therefore, when economic policy uncertainty increases, firms followed by higher analyst teams perform more stable. However, firms followed by lower analyst teams are confronted with relatively more management pressure, which forces them to improve their corporate investment efficiency.

Following Yuan et al. [37], we divide the sample into two subsets: the subset of firms with higher analyst team, the number of analysts above the median of the same year and industry, which is set as High Analyst and the other subset of those with lower analyst team, set as Low Analyst. Then we use these two subsets to re-estimate the Eq. (1) separately. The results show in Table 9. The estimated coefficients of *Landepu* for Low Analyst are greater than that of High Analyst ($3.957 > 2.196$; $3.696 > 2.025$) both in using *Biddle4* and using *Biddle2* as measurement indicators, significant at the 1% level. This indicates that the increased economic policy uncertainty boosts the corporate investment efficiency. Economic policy uncertainty on investment efficiency is more pronounced in firms with lower analyst teams.

Table 9. Moderating effects of the Analyst team

Dependent variable =	<i>Biddle4</i>		<i>Biddle2</i>	
	(1)	(2)	(3)	(4)
	High Analyst	Low Analyst	High Analyst	Low Analyst
<i>Landepu</i>	2.196*** (4.40)	3.957*** (5.20)	2.025*** (4.19)	3.696*** (5.06)
<i>Size</i>	-0.022*** (-6.84)	-0.044*** (-9.70)	-0.020*** (-6.56)	-0.043*** (-9.91)
<i>Age</i>	-0.037** (-2.42)	-0.042** (-2.00)	-0.030** (-2.08)	-0.031 (-1.50)
<i>Lev</i>	-0.045*** (-3.90)	-0.010 (-0.63)	-0.041*** (-3.76)	-0.013 (-0.89)
<i>BM</i>	-0.035*** (-4.67)	-0.029** (-2.54)	-0.041*** (-5.64)	-0.036*** (-3.38)
<i>Frs</i>	0.020 (1.11)	0.073*** (2.85)	0.026 (1.45)	0.084*** (3.47)
<i>Roa</i>	0.111*** (4.56)	0.099** (2.57)	0.111*** (4.76)	0.109*** (3.00)
<i>Growth</i>	-0.004* (-1.68)	-0.001 (-0.39)	0.000 (0.09)	-0.001 (-0.41)
Constant	0.585*** (8.30)	1.020*** (10.24)	0.532*** (7.78)	0.970*** (10.10)
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Observations	12512	7300	12512	7300
Adjusted R2	0.055	0.085	0.067	0.106

This table reports the results of moderating effects of governance mechanisms on the relationship between EPU and corporate investment efficiency by dividing the full sample into two groups based on the analyst team in the governance mechanism. Columns (1) and (2) contain the regression results using *Biddle4* as the dependent variable, and Columns (3) and (4) contain the regression results using *Biddle2* as the dependent variable. The t-values based on robust standard errors clustered by both firm and year are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

7. Economic mechanisms: information disclosure quality

In line with previous studies, we conjecture that EPU will improve the firms' information disclosure quality, which may stimulate more efficient investment activities and act as the potential mechanism that supports the explanation of the relationship between EPU and corporate investment efficiency. Following Fairchild and McDaniel [39], Daniel, De Stavola, Cousens, and Vansteelandt [40], and Baron and Kenny [41], we conduct mediation analysis to examine the role of the public information quality on the relationship between EPU and corporate investment efficiency. The information disclosure quality is employed in this study as the mediator, normally reported as the rating of A, B, C, D. And we substitute these ratings with the numbers 4, 3, 2, 1 to quantify the quality of the corporate information disclosure.

According to Wang, Zhao, and Yin, EPU is positively associated with the timeliness and sufficiency of voluntary disclosure [20]. Moreover, Dutta and Nezlobin [21], Francis, Nanda, and Olsson [42], Lambert, Leuz, and Verrecchia [43] show that the information disclosure quality significantly affects corporate investment efficiency. Thus, the satisfactory corporate public information quality can

improve the firms' investment decisions and may act as an important economic channel supporting the relationship between EPU and corporate investment efficiency.

Specifically, we conduct the following analyses to examine the mediating effect of the public information quality on the relationship between EPU and corporate investment efficiency.

$$\begin{aligned}
 Biddle2 (Biddle4)_{i,t} &= \beta_0 + \beta_1 Landepu_{i,t-1} + \sum_k \beta_k Control_{k,i,t-1} + \varepsilon_{i,t} && \text{(Path A)} \\
 INFO_quality_{i,t} &= \beta_0 + \beta_1 Landepu_{i,t} + \sum_k \beta_k Control_{k,i,t} + \varepsilon_{i,t} && \text{(Path B)} \\
 Biddle2 (Biddle4)_{i,t} &= \beta_0 + \beta_1 Landepu_{i,t-1} + INFO_quality_{i,t-1} + \sum_k \beta_k Control_{k,i,t-1} + \varepsilon_{i,t} && \text{(Path C)}
 \end{aligned}$$

Where $Biddle2 (Biddle4)_{i,t}$ refer to the proxies for corporate investment efficiency of firm i in year t . $Landepu_{i,t}$ refers to EPU, measured by EPU index based on a scaled frequency count of articles about policy-related economic uncertainty in the People's Daily and Guangming Daily. $INFO_quality_{i,t}$, which refers to the corporate information disclosure quality of firm i in year t , is employed as the mediating variable. $Control_{k,i,t}$ refers to control variables of firm i in year t with individual β_k , including firm size ($Size$), listing age (Age), firm financial leverage (Lev), book-to-market ratio (BM), the proportion of the first largest shareholder (Frs), return to assets (Roa), and the growth rate of operating revenue ($Growth$).

Table 10.Channel test

	(Path B) <i>INFO_quality</i>	(Path C) <i>Biddle4</i>	(Path C) <i>Biddle2</i>
<i>Landepu</i>	12.955** (2.38)	4.295*** (5.22)	3.874*** (4.97)
<i>INFO_quality</i>		0.007*** (3.76)	0.007*** (4.17)
<i>Size</i>	0.042** (2.13)	-0.033*** (-8.34)	-0.030*** (-7.99)
<i>Age</i>	0.082 (0.76)	-0.047*** (-2.65)	-0.038** (-2.26)
<i>Lev</i>	-0.234*** (-2.91)	-0.046*** (-3.64)	-0.044*** (-3.65)
<i>BM</i>	0.066 (1.15)	-0.033*** (-3.59)	-0.039*** (-4.52)
<i>Frs</i>	0.485*** (4.26)	0.042* (1.74)	0.054** (2.31)
<i>Roa</i>	1.798*** (9.04)	0.146*** (5.14)	0.151*** (5.48)
<i>Growth</i>	-0.010 (-0.86)	-0.002 (-0.92)	0.000 (0.18)
Constant	1.429*** (3.23)	0.796*** (9.15)	0.710*** (8.61)
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
Observations	10838	10837	10837
Adjusted R2	0.058	0.070	0.082

This table reports the impact of information disclosure quality on the relationship between EPU and corporate investment efficiency. The sample contains 10,838 firm-year observations from 2007 to

2017. The t-values based on robust standard errors clustered by both firm and year are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

As shown in Table 10, the coefficient of *Landepu* in Path B is significantly positive at the 5% level, showing that the economic policy uncertainty improves sample firms' corporate information disclosure quality. The coefficient of *INFO_quality* is significantly positive at the 1% level in Path C, indicating that the higher the information quality, the higher the investment efficiency. And the coefficient of *Landepu* in Path C is significantly positive at the 1% level for both *Biddle4* and *Biddle2*, suggesting that corporate information disclosure quality is a significant channel through which economic policy uncertainty influences corporate investment efficiency. There are three possible reasons for these associations. First, the higher level of information quality assessment brings greater convenience in corporate investment activities, contributing to investment efficiency. For example, firms with higher reputations have lower financing and investment costs [42]. Moreover, superior information disclosure quality helps convey information about the firms' future capital stocks and their future operating cash flows, which are the main factors to be considered in corporate investment activities [21]. Second, the economic policy uncertainty results in careful operating management, which benefits corporate performance and reputation [44]. Therefore, firms are more willing to take full disclosure of information and have more efficient investment activities. Third, the increased EPU requires that the firms' investment decisions be elaborately to avoid turbulence and conflict in investment activities [44]. As a result, firms could have more qualified public information by prompting risk, enhancing their investment efficiency.

8. Conclusions

In recent years, economic policy uncertainty has continued to rise, and its impact has become an issue worthy of our attention. In addition, because China is in a transition period, corporate investment efficiency that affects the economic performance of a firm or even a country has also attracted widespread public attention. Therefore, we study the relationship between economic policy uncertainty and corporate investment efficiency to provide better advice and a theoretical basis for the government and firm managers to make investment decisions. And we use all Chinese A-share corporates listed in Shanghai and Shenzhen stock exchanges from 2007 to 2017 as samples.

This study presents its own viewpoints to support the conclusion that economic policy uncertainty enables improving corporate investment efficiency based on the analyses described above. Specifically, firms that do not employ Big 4 auditors, are non-state-owned and have fewer analysts have a more significant positive relationship between EPU and corporate investment efficiency. Moreover, the information disclosure quality has a positive relationship with both economic policy uncertainty and corporate investment efficiency. The EPU can force firms to improve the information disclosure quality, which would further increase their corporate investment efficiency.

According to the above conclusions, we put forward the following suggestions. The firm should be more cautious in evaluating investment to reduce losses caused by investment risk and capture growth opportunities when economic policy uncertainty fluctuates. In addition, regulatory authorities should intervene appropriately to increase the transparency of information related to economic policies, which helps firms to make beneficial investment decisions. The economic policy uncertainty within a reasonable range makes firm managers consider much comprehensively when making investment decisions and getting a better understanding of the economic situation, which provides an opportunity for the country's economic development. Therefore, it is necessary to give full play to the market's regulation mechanism and improve the investment mechanism of firms from a macro perspective. Then corporate investment efficiency will be at a higher level.

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