

Economic Policy Uncertainty and Regional Innovation and Entrepreneurship Performance: An Empirical Analysis Based on 288 Cities in China

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Abstract: Does economic policy uncertainty affect the pace and nature of urban innovation and entrepreneurial performance and if so, by how much? In order to answer this issue, this study analyses China city panel data from 2003 to 2020 and experimentally analyze their relationship. The key findings are as follows: Initially, the unpredictability of economic policy can considerably boost urban innovation and entrepreneurship. Second, the unpredictability of economic policy has a detrimental influence on western cities, a positive effect on innovation and entrepreneurship in central and eastern cities, and no statistically meaningful result yet in the northeast. Thirdly, the unpredictability of economic policy might encourage innovation and entrepreneurship in places with a marketization rate of at least 75%. Fourthly, the uncertainty of economic policy has a positive influence on cities with an urbanization rate above 48.9% and a negative effect on cities with an urbanization rate below this threshold. Fifthly, the unpredictability of economic policy might impact regional innovation and entrepreneurship through changing the degree of urban financial development. On this basis, a proper local development policy framework will be formulated by merging various urban development endowments, and the degree of local financial development, marketization, and urbanization will be continuously enhanced.

Keywords: economic policy uncertainty; innovative entrepreneurial performance; mediating effect

JEL Classification: O11; O14; E00

1. Introduction

With the aggressive promotion of the "mass entrepreneurship and innovation" development plan, innovation and entrepreneurship have become crucial for the country to stabilize employment and achieve high-quality economic growth. Innovation and entrepreneurship are a dynamic development process that has undergone resource-driven, financial-driven, and innovation-driven development (Zhang et al., 2016), is influenced by cultural, institutional, economic, and other factors (Wang et al., 2018), and exhibits the characteristics of high uncertainty. Entrepreneurial performance may accurately reflect all the ultimate effects of entrepreneurial action (Endalew et al., 2020), and it is one of the most important markers in both empirical and theoretical study for determining whether a new

business grows healthily and swiftly (Chen & Mao, 2020). Focusing on innovative entrepreneurial performance allows one to comprehend the actual operation of entrepreneurial activities, which is crucial for promoting the dual-venture strategy more actively.

Government behavior and policies are the external factors that have the most direct effect on the production and operation activities of businesses, and the effectiveness of policy instruments has always been an important tool for local governments to support industrial development and enterprise innovation. However, economic policy uncertainty refers to the reality that economic agents are unable to precisely forecast whether, when, and how the government will alter its current economic policy (Gulen & Ion, 2016). Numerous academic researches have been conducted on economic policy uncertainty. Some researchers have found that the increase in economic policy uncertainty exacerbates the fluctuation of key macroeconomic variables and financial asset variables, thereby impacting the economic cycle (Villaverde et al., 2015; Pastor & Veronesi, 2012; Born & Pfeifer, 2014). This, in turn, will have a negative impact on macro variables such as output and employment, thereby impeding economic recovery (Baker et al., 2016). In addition, there are studies that imply the uncertainty of economic policies may influence the investment activities of businesses by altering their operating expenses, so restricting their investment (Jin et al., 2014; Wang & Song, 2014; Li & Yang, 2015).

This study seeks to elucidate the theoretical process underlying the influence of economic policy uncertainty on innovation and entrepreneurship at the urban level and conducts research from an empirical analysis viewpoint. Compared to previous research, this work makes the following contributions: The paper begins by explicating the theoretical mechanism through which economic policy uncertainty influences innovation and entrepreneurship, i.e., financial development. Second, it broadens the innovation-related research field. Existing literature on innovation and entrepreneurship focuses primarily on enterprise perspectives. This research seeks to assess the influence of economic policy uncertainty on urban innovation and entrepreneurship. Third, previous studies have mostly explored the impact of economic policy uncertainty on the behavior and process of innovation and entrepreneurship. However, no research has yet examined the impact of economic policy uncertainty on innovation and entrepreneurship from the standpoint of outcomes and if the influence of outcomes varies among areas. As a result, this article focuses on the outcomes of innovation and entrepreneurship, namely the performance of innovation and entrepreneurship, and examines the impact of economic policy uncertainty on it.

2. Research Assumptions

2.1. The Direct Impact of Uncertain Economic Policies on Regional Innovation and Entrepreneurship Performance

With the deepening of research on innovation and entrepreneurship, it is discovered that innovation and entrepreneurship are inextricably linked. Entrepreneurs rely on innovation to realize economic value, sustain their businesses, and foster company growth. It is the origin

of entrepreneurship. However, entrepreneurs achieve organizational innovation by integrating diverse social resources and directing the generation of knowledge. Consequently, the literature evaluation reveals that entrepreneurship and innovation mutually reinforce one another. Innovation drives economic growth. Innovation is the means by which businesses achieve market dominance and surplus profits. When enterprises are confronted with market competition and risks, they tend to accelerate innovation to increase market power under certain conditions (Aghion, 2005), whereas the unpredictability of economic policies heightens market risks, which may prompt enterprises to increase investment in innovation in order to retain or regain market power. Moreover, Knight (1921) noted that entrepreneurs are investors and decision-makers of their own invention activities, and that uncertainty is the primary source of corporate profits. If future developments can be forecast, corporate revenues will vanish, hence the existence of uncertainty may encourage business owners to spend more in innovation. Based on the analysis presented above, the following hypotheses are drawn:

Hypothesis 1. Economic policy uncertainty has a direct effect on the improvement of regional innovation and entrepreneurship performance.

2.2. The Indirect Effect of Economic Policy Uncertainty on Regional Innovation and Entrepreneurship Performance

When economic policy uncertainty increases, market players face greater financing constraints than in normal economic times (Ma & Hao, 2022). The uncertainty of economic policy intensifies the financing constraint of market participants through three channels: First, the increase of uncertainty of economic policy will affect the financing of market participants through the bond market. When economic policy uncertainty increases due to principal-agent and moral hazard, creditors will not only reduce borrowing but also increase risk premium (Francis et al., 2014), which makes it more difficult for market players to issue bonds. Second, the increase in economic policy uncertainty will affect the financing of market participants through the stock market. The increase in uncertainty of economic policy results in the increase of volatility of stock price, the decrease of information content of stock price and the increase of cost of financing by issuing stock (Pham, 2019). Third, the increase in economic policy uncertainty leads to a decrease in the expected cash flows of market participants and an increase in financing constraints. However, the degree of financial development can effectively reduce the financing costs and thus ease the financing constraints faced by market players (Rajan & Zingales, 1998). On the one hand, the degree of financial development can promote investment and improve the efficiency of capital use; On the other hand, a high degree of financial development can create economies of scale by creating financial instruments and expanding financial resources, reduce transaction costs and investment risks, broaden financing channels, and increase the supply of market capital to ease market financing constraints. At the same time, enterprises have a large number of financing needs in all aspects of the process of innovation and entrepreneurship, and a sound financial system can effectively meet these needs through the rational allocation of funds, while financial markets can provide financial support for enterprises to engage in innovative

activities with high risk and high return characteristics (Saint-Paul, 1992). Therefore, the higher a country's financial development level is, the larger its financial institutions and financial markets are, the more it can provide more capital and liquidity, provide more convenient financial services for market participants, optimize the allocation of resources, provide financial services for market participants at low cost, ease financing constraints, and thus promote innovation and entrepreneurship development.

Hypothesis 2. Economic policy uncertainty can enhance regional innovation and entrepreneurship through the level of financial development.

3. Research Design

3.1. Model Settings

Basic model settings. Based on the above theoretical analysis, the following model is established:

$$innoentr_{it} = \alpha_0 + \alpha_1 EPU_{it} + \alpha_2 X_{it} + x_t + x_i + \varepsilon_{it} \quad (1)$$

The explained variable $innoentr_{it}$ in model (1) represents the regional innovation and entrepreneurship of city i in the period of t . The core explanatory variable EPU_{it} represents the economic policy uncertainty index of city i in the t period. X_{it} is the collection of other control variables that affect regional innovation and entrepreneurship. x_t is a time virtual variable that reflects the time effect. x_i is a regional virtual variable that reflects the regional effect and ε_{it} is a random perturbation term. As the most important model fitting coefficient in this study, the positive and negative values and size of α_1 represent the direction and degree of the influence of economic policy uncertainty on regional innovation and entrepreneurship.

Intermediary effect model. As described in the preceding section on theory, economic policy uncertainty influences regional innovation and entrepreneurship indirectly through financial development level. In this study, the aforementioned theoretical analysis is evaluated using the model for testing the mediating effect:

$$med_{it} = \kappa_0 + \kappa_1 EPU_{it} + \kappa_2 X_{it} + o_{it} \quad (2)$$

$$innoentr_{it} = \gamma_0 + \gamma_1 EPU_{it} + \gamma_2 med_{it} + \gamma_3 X_{it} + \pi_{it} \quad (3)$$

Among them: med_{it} represents an intermediate variable.

3.2. Variable Design

Explained variable. In this paper, the innovation and entrepreneurship index are the explanatory variable. The China Regional Innovation and Entrepreneurship Index (IRIEC) compiled by the Enterprise Big Data Research Center at Peking University is chosen. The index combines big data thinking and technology, based on the three core elements of entrepreneur, capital, and technology, and uses the entire amount of enterprise information from 1990 to 2020 from the national industrial and commercial enterprise registration database to construct from five dimensions: the number of new enterprises, the attraction of foreign investment, the attraction of venture capital, the number of patent licenses, and the

number of trademark registrations. The China Regional Innovation and Entrepreneurship Index is multidimensional, objective, and real-time. It can objectively reflect the vitality and performance of innovation and entrepreneurship in various regions.

Explanatory variables. As the explanatory variable, Baker's et al. (2016) economic policy uncertainty index(epu) is utilized. The index was developed by Stanford University and the University of Chicago based on news coverage of the world's main economies. The China Economic Policy Uncertainty Index, for example, is created utilizing text retrieval and filtering techniques, with the South China Morning Post serving as a news item retrieval platform. In this work, the annual arithmetic mean is used to translate the monthly economic policy uncertainty into the yearly economic policy uncertainty.

Other variables. The main control variables selected in this paper are: the level of economic development (lngdp), level of government intervention in science and technology (fistec), industrial structure (stru) and human capital (hum).

The level of economic development (lngdp), which is an important driving force for the innovation and entrepreneurship. This paper uses the logarithmic GDP to measure. Level of government intervention in science and technology (fistec), as measured by the ratio of government expenditures on science and technology to gross domestic product, can directly stimulate innovation and entrepreneurial initiatives at the societal and corporate levels.

Industrial structure (stru). Currently, the majority of entrepreneurs begin their ventures in the service sector, or tertiary industry. Comparatively to the primary industry agriculture and the secondary industry, the service industry has a lower cost need and a greater variety of forms. China is currently experiencing an industrial shift, and the tertiary sector offers greater chances. Taking into account the saturation degree of the primary industry and the secondary industry as well as the state's support policy for the tertiary industry, this paper makes the industrial structure the control variable and uses the ratio of the added value of the tertiary industry to the secondary industry as the control variable index of the industrial structure.

The conclusion on the relationship between human capital and entrepreneurial rate is likewise complex. According to Schultz, human capital is embodied in human beings, generated through investments in human beings, and reflects the knowledge, skills, credentials, experience, and proficiency of individuals. It primarily invests in medical insurance, on-the-job training, formal education, adult learning programmes, and employment migration. Therefore, those with a greater amount of human capital will have greater expertise and experience. On the one hand, this makes it simpler for these individuals to obtain jobs and greater wages in the labor market, and they are more likely to be hired by others as opposed to starting their own businesses (Fritsch & Storey,2014). On the other side, it makes it simpler for such individuals to identify and exploit market openings in order to launch a firm. Even if people with greater human capital are not necessarily more likely to start a business, it may be simpler for them to succeed if they do. Fritsch (2006) used cross-sectional data from Germany to demonstrate that the quality of the labor force has a substantial influence on the development of new businesses. The empirical findings of

Audretsch and Fritsch (1994) indicate that the share of unskilled labor, which represents human capital, has a considerable negative effect on the entrepreneurial rate, regardless of whether the rate is calculated using the ecological technique or the labor market method. Based on the potential influence of human capital on the entrepreneurial rate, this article incorporates this variable into the model and measures human capital by the proportion of research and development personnel in the overall employed population.

Financial development level (*findev*) is an intermediary variable. As the banking industry is the dominant financial system in China, and the innovation and entrepreneurship performance studied in this paper is generally that microeconomic entities predominantly use bank loans as the main external financing source of enterprises, this paper refers to Wang Chao et al. (2018) and uses the ratio of local and foreign currency credit balance to GDP to measure the degree of financial development.

Marketization level (*market*), measured by the municipal marketization index in Fan Gang's report on the marketization index in China.

Urbanization level (*urban*): it is measured by the ratio of the permanent population of cities to the total population at the end of the year.

3.3. Data Description

Taking into account the availability and accuracy of the data, this study picks 288 prefecture-level cities from 2003 to 2020 as its research object. Except for marketization index, the majority of the data come from the Statistical Yearbook of China, the statistical yearbooks of prefecture-level cities, industrial enterprise databases, etc., and the linear interpolation method and near-annual average method are used to fill in some missing values. Explanatory variables and control variables lag behind the explained variables for one period, with the exception of year and area dummy variables. Table 1 displays descriptive statistics of variables used.

Table 1. Variables' descriptive statistics

VARIABLE	MEAN	STD. DEV.	MIN	MAX
INNOENTR	51.8905	27.9785	1.0239	100.0000
EPU	123.5069	30.8928	75.9957	165.7432
HUM	0.8999	0.5736	0.0750	9.6220
STRU	0.9408	0.5158	0.0800	5.3500
LNGDP	16.0961	1.1052	12.6690	19.7740
FISTEC	0.1953	0.0459	0.0200	0.4970
FINDEV	1.1623	0.4596	0.1168	3.5917
URBAN	50.1416	16.6593	7.8000	100.0560
MARKET	9.8827	3.1366	1.9586	19.6944

3.4. Data Sources

This article uses data related to the transformation and upgrading of the digital economy and industrial structure in 30 provinces in China from 2013 to 2018. The data comes from the official websites of the National Bureau of Statistics and the provincial statistical bureaus, China Statistical Yearbook, China Tertiary Industry Statistical Yearbook, China Information Yearbook, China Information Industry Yearbook, China Academy of Information and

Communications Technology, and industry and informatization-related research reports and published data, Statistical yearbooks of various provinces over the years, and China's digital economy development reports over the years. Due to data availability issues, Hong Kong, Macau, Taiwan and Tibet are not included.

4. Empirical Analysis

4.1. Benchmark Regression

The influence of economic policy uncertainty on innovation and entrepreneurship performance is examined by progressively adding individual effect and time effect to the panel regression model (1). When annual dummy variables are inserted for time-effect regression, the joint statistic F is very significant, suggesting that the model (1) has both individual and time effects; hence, the panel model with two-way fixed effects is chosen to continue the analysis. In order to strengthen the model's rigour and trustworthiness, the control variables that affect innovation and entrepreneurial performance are gradually incorporated for regression (Table 1). In addition, based on the P-value of the Hausman test, the original hypothesis that the model is a random effect model is strongly rejected, hence the two-way fixed effect model is selected for this study. The fixed effect model in column (5) indicates that the fitting coefficient of economic policy uncertainty is 0.369 when time, individual effect and other influencing variables are controlled, indicating that the regional innovation and entrepreneurship performance will increase by an average of 0.369 units for each unit of economic policy uncertainty. This indicates that, from the perspective of

Table 2. Benchmark regression results

VARIABLE	OLS	OLS	FE	FE	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)
EPU	0.141*** (0.0049)	0.0577*** (0.0054)	0.150*** (0.0019)	0.0375*** (0.0025)	0.369*** (0.0165)	0.0378*** (0.0014)
HUM		1.292*** (0.0557)		2.124*** (0.0488)	0.0259 (0.108)	2.112*** (0.0208)
STRU		-1.507*** (0.516)		-2.258*** (0.470)	-1.751*** (0.479)	-2.221*** (0.131)
LNGDP		4.040*** (0.456)		-0.967*** (0.343)	-0.819** (0.324)	-0.907*** (0.103)
FISTEC		35.68*** (3.144)		9.050*** (2.243)	7.856*** (1.972)	9.256*** (1.097)
TIME EFFECT	NO	NO	NO	NO	YES	NO
INDIVIDUAL EFFECT	NO	NO	YES	YES	YES	NO
HAUSMAN					4514.67***	
_CONS	145.6*** (0.624)	133.5*** (0.968)	144.6*** (0.230)	138.2*** (0.643)	122.1*** (0.886)	137.6*** (0.570)
N	4608	4608	4608	4608	4608	4608
R ²	0.167	0.331	0.569	0.906	0.949	0.2528

Note: *, **, *** indicate significance at the statistical level of 1%, 5%, and 10%, respectively; (2) the robust standard errors are in parentheses.

innovation and entrepreneurship outcomes, economic policy uncertainty has promoted innovation and entrepreneurship at the local level. The fact that businesses confront greater possibilities and challenges due to the unpredictability of economic policy is one probable explanation. Businesses rely on innovation to attain market dominance and higher profitability. Innovation tends to help both young and established businesses strengthen their market positions, which boosts regional entrepreneurship and innovation performance.

4.2. Endogeneity and Robustness Test

As economic policy at the national level is part of macro-policy, it is impossible for economic subjects to affect all macro-policies; hence, there is hardly any reverse causal relationship between urban innovation activities and economic policy uncertainty. In addition, all explanatory factors and control variables have a one-period lag in this paper's empirical analysis, which substantially eliminates the possibility of reverse causation. Moreover, the empirical research thoroughly controls the fixed effects of years and geographies, effectively avoiding endogenous difficulties caused by missing data. Referring to Fang et al. (2015), this paper adds the lag term of the explained variables to the regression equation to eliminate the possible influence of the correlation between the explained variables before and after (column 3), and finds that the significance of the explained variables remains unchanged. Moreover, by altering the sample's time interval from 2010 to 2020 (column 1) and substituting the explained variable with the per capita innovation and entrepreneurship index (column 2), the empirical findings indicate that the uncertainty of economic policy continues to have a significant effect on innovation and entrepreneurship performance.

Table 3. Endogenous and robustness test results

VARIABLE	(1)	(2)	(3)
EPU	0.0485** (0.0065)	0.0472** (0.0241)	0.0279*** (0.0098)
HUM	0.134 (0.233)	0.284 (0.552)	0.0596 (0.388)
STRU	-2.997** (1.327)	-3.661*** (1.339)	-2.915*** (1.011)
LNGDP	0.918 (0.718)	1.375** (0.668)	1.006* (0.534)
FISTEC	-3.081 (9.014)	-6.552 (9.177)	-15.53** (6.904)
L.INNOENTR			0.307*** (0.0272)
_CONS	57.66*** (3.079)	63.42*** (4.957)	48.14 (129.6)
TIME EFFECT	YES	YES	YES
INDIVIDUAL EFFECT	YES	YES	YES
N	2880	4608	4608
R ²	0.007	0.013	0.112

Note: *, **, *** indicate significance at the statistical level of 1%, 5%, and 10%, respectively; (2) the robust standard errors are in parentheses.

4.3. Heterogeneity Analysis

Heterogeneity analysis-based on region. Due to varying resource endowments across locations, the impact of economic policy uncertainty varies in many ways. As shown in Table 3, the uncertainty of economic policy has a substantial positive impact on the central and eastern regions, a major negative impact on the western cities, and a statistically insignificant impact on the northeast. Currently, against the backdrop of the industrial transfer from the eastern region to the central region and the strategy of the rise of the central region, the economic policy has a significant impact on the innovation and entrepreneurship activities in the central region. Consequently, the innovation and entrepreneurship performance in the central region is positively impacted by the uncertainty of the economic policy. The eastern region has a high level of economic development, a higher threshold for entrepreneurship, and requires more investment for innovation activities; therefore, it is less affected by the uncertainty of economic policies, whereas the innovation and entrepreneurship activities in the western region are negatively affected by the uncertainty of economic policies, which may be related to the relatively insufficient environment for innovation and entrepreneurship.

Table 4. Regional heterogeneity test results

VARIABLE	EAST	CENTRAL	WEST	NORTHEAST
	(1)	(2)	(3)	(4)
EPU	0.0307*** (0.0104)	0.396** (0.1912)	-0.224** (0.1046)	-0.0897 (0.321)
HUM	0.120 (0.141)	0.133 (0.183)	0.138 (0.175)	0.393 (0.263)
STRU	0.303 (0.582)	-2.620*** (0.826)	-1.283*** (0.383)	-1.955*** (0.597)
LNGDP	-0.950*** (0.359)	-0.0803 (0.290)	-0.605 (0.374)	-1.389** (0.650)
FISTEC	-0.276 (2.728)	12.78*** (3.605)	5.855 (3.801)	-5.670 (5.122)
_CONS	130.3*** (1.104)	116.0*** (1.538)	115.3*** (1.387)	130.3*** (2.435)
TIME EFFECT	YES	YES	YES	YES
INDIVIDUAL EFFECT	YES	YES	YES	YES
N	1457	1380	1249	522
R2	0.967	0.975	0.957	0.938

Note: *, **, *** indicate significance at the statistical level of 1%, 5%, and 10%, respectively; (2) the robust standard errors are in parentheses.

Heterogeneity analysis-based on marketization. Herrera-Echeverria et al. (2014) believe that economic liberalization provides a good external environment for entrepreneurs to engage in entrepreneurial activities and has a positive impact on entrepreneurial activities, whereas the degree of marketization is an essential indicator for measuring the level of market economy construction in a country or region. The less marketization there is in a country or region, the less flawless the system architecture of finance, legal system, economic freedom, product market, and factor market, and the greater the entrepreneurial risk. As shown in Table 4, if the degree of marketization is graded from high to low, the influence of economic policies on the degree of marketization below 75% is not statistically significant, but the value

demonstrates a clear decline. In addition, the lower the degree of marketization, the more the degree of influence, but the higher the degree of marketization, the greater the positive impact, that is, the greater the incentive degree of economic policy uncertainty for the city with a larger degree of marketization.

Table 5. Marketization heterogeneity test results

VARIABLE	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
EPU	-0.0122* (0.0071)	-0.0164* (0.0097)	-0.0086*** (0.0014)	0.0312* (0.0173)	0.0820** (0.0404)
HUM	0.0649** (0.0312)	-0.312 (0.237)	0.0759* (0.0441)	0.0550 (0.0516)	0.741*** (0.0300)
STRU	-5.635*** (1.366)	1.338 (6.440)	-1.173 (2.848)	-1.342 (1.554)	0.963 (2.467)
LNGDP	-1.311 (3.995)	3.980** (1.694)	0.178 (1.360)	0.510 (1.174)	-0.342 (2.330)
FISTEC	-32.93** (15.63)	-7.288 (10.92)	-1.006 (15.09)	-13.30** (5.94)	-13.34** (7.87)
_CONS	60.77*** (8.397)	56.82*** (6.376)	60.72*** (4.241)	56.88*** (3.409)	61.74*** (6.510)
TIME EFFECT	YES	YES	YES	YES	YES
INDIVIDUAL EFFECT	YES	YES	YES	YES	YES
N	327	513	946	968	563
R2	0.027	0.007	0.001	0.007	0.004

Note: *, **, *** indicate significance at the statistical level of 1%, 5%, and 10%, respectively; (2) the robust standard errors are in parentheses.

Heterogeneity analysis-based on urbanization. As an input-output process, innovation requires all types of resources, such as human resources, material resources, information resources (comprising technical and commercial information), etc., and must interact with or trade with resource owners or related stakeholders. So where are the resources? How can we better communicate or conduct business with resource stakeholders? Regarding the first question, from the standpoint of cities and villages, urbanization is the urbanization of population, which means that cities and towns always have more entrepreneurial resources, which are more concentrated in cities. Regarding the second question, from the perspective of geographical location, proximity to the relevant stakeholders of resources in the spatial geographical location is unquestionably a major advantage for establishing contact or conducting business with them, and urbanization of population is an important means of promoting proximity to the relevant stakeholders in the spatial geographical location. For instance, the empirical findings of Audretsch and Fritsch (1994) demonstrate that whether entrepreneurship is measured using the ecological technique or the labor market method, population change has a considerable positive effect on the entrepreneurship rate. When examining the effect of regional entrepreneurial opportunity structure and creative social environment on women, black, and Hispanic entrepreneurs, Hackler and Mayer (2008) also addressed the influence of population shift. As seen in Table 5, the impact of economic policy uncertainty on cities with varying levels of urbanization varies. It has a detrimental impact

on cities with less than 48.9 percent urbanization and a favorable influence on those with more than 48.9 percent urbanization. This demonstrates that population urbanization naturally exerts both a pulling and a pushing influence on entrepreneurship, and that the lower the level of population urbanization, the lower the entrepreneurship rate. Population urbanization helps explain the disparities in regional entrepreneurship rates. The impact of population urbanization on the rate of entrepreneurship cannot thus be overlooked in light of China's current urbanization trend.

Table 6. Urbanization heterogeneity test results

VARIABLE	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
EPU	-0.0221* (0.0131)	-0.0212* (0.0124)	0.0125** (0.0058)	0.0136** (0.0061)	0.0118*** (0.00095)
HUM	0.459*** (0.0898)	1.250* (0.740)	0.118** (0.0589)	0.0836 (0.0290)	0.185 (0.0216)
STRU	-9.816*** (3.018)	-1.918 (4.146)	-1.014 (2.940)	-4.320** (1.876)	-2.089 (1.920)
LNGDP	-2.171 (5.880)	0.460 (4.766)	0.912 (1.316)	-0.618 (2.022)	1.994* (1.132)
FISTEC	0.416 (37.14)	-34.64* (20.00)	-13.10 (14.50)	-19.51 (15.69)	7.160 (6.382)
_CONS	51.25*** (12.24)	69.83*** (7.804)	54.72*** (6.156)	69.42*** (4.232)	69.87*** (1.483)
TIME EFFECT	YES	YES	YES	YES	YES
INDIVIDUAL EFFECT	YES	YES	YES	YES	YES
N	327	513	946	968	563
R2	0.027	0.007	0.001	0.007	0.004

Note: *, **, *** indicate significance at the statistical level of 1%, 5%, and 10%, respectively; (2) the robust standard errors are in parentheses.

4.4. Intermediary Effect

In accordance with the preceding theoretical study, the level of financial development is chosen as an intermediate variable to assess the effect of economic policy uncertainty on innovation and entrepreneurial performance. Table 6 provides the results. The level of financial development has served as an intermediary variable, according to Bootstrap. In particular, in columns (1) to (2), the fitting coefficients of economic policy uncertainty to financial development level and financial development level to innovation and entrepreneurship performance all pass the 1% significance level test, indicating that economic policy uncertainty does affect the innovation and entrepreneurship performance of cities via financial development level. In addition, every 1 unit increase in the impact degree of economic policy uncertainty can directly increase the level of innovation and entrepreneurship by 0.0384 units and the level of financial development by 0.0588 units, resulting in an indirect improvement of urban innovation and entrepreneurship performance of 0.0164 units ($0.0588 \times 0.279 \approx 0.0164$) and a total effect of 0.0548 units. About 29.93% of the total effect is accounted for by the indirect effect of financial development level on urban innovation and entrepreneurship performance.

Table 6. Mediating effect result

VARIABLE	FINDEV	INNOENTR
	(1)	(2)
EPU	0.0588***	0.0384***
	(0.00308)	(0.00959)
FINDEV		0.279***
		(0.0686)
HUM	0.0231***	0.0365
	(0.0016)	(0.107)
STRU	0.0825	-1.861***
	(0.0541)	(0.475)
LNGDP	2.432***	6.429***
	(0.577)	(1.875)
FISTEC	0.0329	-0.769**
	(0.0416)	(0.319)
_CONS	-3.118***	166.3***
	(0.353)	(0.820)
TIME EFFECT	YES	YES
INDIVIDUAL EFFECT	YES	YES
BOOTSTRAP	[0.0013 0.0060]	
N	4608	4608
R2	0.911	0.943

Note: *, **, *** indicate significance at the statistical level of 1%, 5%, and 10%, respectively; (2) the robust standard errors are in parentheses.

5. Conclusions and Recommendations

5.1. Conclusion

This research empirically studies the influence and internal mechanism of economic policy uncertainty on urban innovation and entrepreneurship performance using urban panel data from 2003 to 2020. The key findings are as follows: Initially, economic policy uncertainty can considerably boost urban innovation and entrepreneurial performance. Second, the unpredictability of economic policy has a negative influence on western cities, while it encourages innovation and entrepreneurship in central and eastern cities. There are currently no statistically meaningful results in the northeast. Thirdly, the unpredictability of economic policy might encourage innovation and entrepreneurship in places with a marketization rate of at least 75%. Fourthly, the unpredictability of economic policy has a positive influence on cities with a population that is greater than 50 percent urbanised and a negative effect on cities with a population that is less than 50 percent urbanised. Fifthly, the unpredictability of economic policy might impact regional innovation and entrepreneurship through changing the degree of urban financial development.

This study found a positive correlation between economic policy uncertainty and innovation, which at first glance appears to be somewhat unexpected. However, when one considers the economic policies developed by the Chinese government during the country's rapid economic growth and the fact that innovation is driving China's economy into the "new normal," this conclusion is in line with reality. Uncertainty in economic policy is both a risk and an opportunity for businesses at the micro level. As a result, businesses take advantage

of the chance to expand R&D spending, consolidate or further reinforce their market dominance through technical innovation operations, and have access to greater profit and growth potential.

Although economic policy uncertainty has a selective impact on innovation activities from a macro perspective, overall, relevant departments are always working to create a favorable external economic environment to support businesses in better leveraging their innovative vigor. For instance, the appropriate ministries strengthen support for businesses with innovation potential through the use of government subsidies in order to enhance business operating environments and encourage businesses to engage in high-quality innovation activities. Another illustration is how the government continuously encourages the growth and improvement of the financial market, lowers the cost of financing the financial market, eases internal and external financial constraints on businesses, and fosters an environment that is conducive to enterprise innovation within the economic system.

5.2. Recommendations

Based on the above research conclusions, this study puts forward the following suggestions:

First of all, although the research results show that the uncertainty of economic policy positively affects the innovation input and output of enterprises, the rising uncertainty of economic policy will also bring negative effects. Therefore, when relevant departments frequently introduce or adjust economic policies to smooth economic fluctuations and enhance national innovation capability, they should weigh the impact of economic policy uncertainty on different economic activities. In addition, in order to minimize the negative impact of economic uncertainty, there must be a set of systems, such as market systems, full competition systems, property rights systems, contracts, especially equity contracts.

Secondly, the research results of this paper are instructive for the adjustment of innovation and entrepreneurship policies. At present, China's economy is in a "new normal" driven by innovation. Given that the uncertainty of economic policy has different impacts on innovation and entrepreneurship in different regions, different levels of marketization and urbanization of population, relevant departments should devote themselves to building a good external economic environment to help enterprises better exert their innovation vitality. For example, relevant departments should attach importance to the role of marketization and urbanization, and increase support for economic entities with innovation and entrepreneurship potential, so as to promote economic entities to carry out high-quality innovation activities. Furthermore, the uncertainty of economic policy can affect the level of financial development, thus affecting the development of urban innovation and entrepreneurship. Therefore, it is necessary to promote the development and perfection of financial market, reduce the financing cost of financial market, reduce the internal and external financial constraints of enterprises, and create a good economic institutional environment for enterprise innovation. When the uncertainty of economic policy changes, these measures, which are conducive to improving business conditions, will help to stimulate innovation.

Finally, relevant departments can make use of the selection effect brought by the rising uncertainty of economic policies and use effective economic policies and administrative means to optimize the industrial structure. Specifically, relevant departments can take external measures to influence the business conditions of enterprises, so that the development of economic environment is conducive to innovative enterprises. When the uncertainty of economic policy rises, with the cooperation of external measures, the response of those high-efficiency enterprises is to increase innovation, while those low-efficiency enterprises may choose to withdraw from the market because of rising costs. Eventually, the industry will be shuffled, and the overall innovation capability of the industry will be improved.

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