

# A Study on the Role of UIG Triple Helix Intensity in the Level of Regional Entrepreneurship

Xiaobao Peng<sup>1</sup> Shanwei Liu<sup>2\*</sup>

1.School of Public Affairs, University of Science and Technology of China, 96 Jinzhai Street, Hefei 230026, China

2.School of Public Affairs, University of Science and Technology of China, 1129 Huizhou street, Hefei 230051, China

## Abstract

UIG triple helix is a relatively stable relationship among universities, industries, and governments formed in the relationship due to long-term formal and informal cooperation and communication. According to previous studies, in accordance with whether to achieve the tripartite cooperation among universities, industries and government, UIG triple helix can be divided into positive overlap and negative overlap, positive overlap refers to the three parties to achieve effective cooperation, and negative overlap refers to other forms of cooperation except the cooperation of positive overlap. The present study argues that the positive overlap is more conducive to the optimization of the regional entrepreneurial environment and the improvement of the regional entrepreneurial level than the negative overlap. In addition, this study argues that while positive overlap is more conducive to the promotion of the level regional entrepreneurship, it is undeniable that positive overlap also has some limitations, which have the disadvantages of high cost of coordination, poor flexibility and low efficiency. Therefore, trust governance can reduce the coordination costs brought by positive overlap, improve the efficiency of cooperation, and mediate the relationship between UIG triple helix intensity and regional entrepreneurial level. Through the collection of public data, the author test the model.

**Keywords:** UIG triple helix intensity, positive overlap, negative overlap, trust governance, the level of regional entrepreneurship

## 1. Introduction

With the continuous advancement of globalization, the development of the economy is increasingly showing the characteristics of regionalization, and entrepreneurial activities are an important force to promote regional economic development, while the UIG triple helix cooperation is one of the key factors to promote the level of regional entrepreneurship. UIG triple helix is a relatively stable relationship among universities, industries, and governments formed in the relationship due to long-term formal and informal cooperation and communication. The existing research on UIG triple helix mainly focuses on the study of its relationship with regional innovation(Hang ,2013; Li *et al.*,2011; Cui *et al.*,2015), but there are few literatures on the relationship between UIG triple helix and regional entrepreneurship (Park & Leydesdorff,2010; Kim *et al.*, 2012; Li *et al.*,2016). In the study of the relationship of UIG triple helix and regional entrepreneurship, the research of academia mainly focuses on the research of entrepreneurial universities (Etzkowitz & Zhou,2007; Liu *et al.*,2007; Etzkowitz,2009; Han, 2010) and entrepreneurship education (Tao *et al.*,2010; Yu *et al.*,2016), and few studies involve the study of the level of regional entrepreneurship. On the research of the relationship between UIG triple helix and regional entrepreneurship, scholars mainly discuss the impact of the whole or bilateral relations on regional entrepreneurship (Park 7 Leydesdorff,2010; Kim *et al.*, 2012; Li *et al.*,2016), and whether the UIG triple helix to achieve effective cooperation among the three parties lacks research. According to previous studies, in accordance with whether to achieve the tripartite cooperation among universities, industries and governments, UIG triple helix can be divided into positive overlap and negative overlap, positive overlap refers to the three parties to achieve effective cooperation, and negative overlap refers to other forms of cooperation except the cooperation of positive overlap. This study suggests that the positive overlap is more conducive to the optimization of the regional entrepreneurial environment and the improvement of the level of regional entrepreneurial than the negative overlap. In the era of knowledge economy, the characteristics of innovation and entrepreneurship are manifested as collaboration between organizations, entrepreneurship activities in the region cannot be separated from the tripartite cooperation of universities, industries and governments, and the cooperation among universities, industries and governments is the core force of regional development. Therefore, the effective cooperation among UIG triple helix subjects plays an important in the improvement of the level of regional entrepreneurship.

This study will focus on exploring the positive overlap is more conducive to promoting the promotion of the level of regional entrepreneurship than the negative overlap, which is mainly reflected in the relationship between UIG triple helix intensity and the level of regional entrepreneurship. In this study, we believe that the higher the UIG triple helix intensity, the more conducive to the promotion of regional entrepreneurial level. In

addition, positive overlap plays an important role in the promotion of the level of regional entrepreneurship, but compared to negative overlap, positive overlap will result in greater transaction costs, coordination costs, friction costs, and has poor flexibility. So, trust governance can reduce the high transaction costs brought about by positive overlap and enhance the flexibility of transactions. Therefore, this study holds that trust governance moderating the relationship between UIG triple helix intensity and the level of regional entrepreneurship, and UIG triple helix intensity is more positive associated with the level of regional entrepreneurship when there is a high level of trust governance.

## 2.Theory and Hypothesis

### 2.1 The Classification and Intensity of UIG Triple Helix

The cooperation among UIG triple helix subjects mainly includes industry-university cooperation, industry-government cooperation, university-government cooperation, university-industry-government cooperation and so on. Park & Leydesdorff (2010) divided UIG triple helix into negative overlap and positive overlap according to the above types. In their study, negative overlap refers to bilateral relations of cooperation including industry-university cooperation, industry-government cooperation, university-government cooperation and other bilateral relations, while positive overlap emphasizes the cooperation of university-industry-government. In this study, for ease of understanding, positive overlap refers to the three parties to achieve effective cooperation, and negative overlap refers to other forms of cooperation except the cooperation of positive overlap.

In accordance with whether to achieve the tripartite cooperation among universities, industries and governments, UIG triple helix can be divided into positive overlap and negative overlap. So, UIG triple helix intensity refers to the number of positive overlap accounts for the number of positive overlap and negative overlap. If the ratio is greater, indicating that UIG triple helix intensity is greater, if the ratio is smaller, indicating that the intensity is smaller. Therefore, the UIG triple helix intensity reflects the intensity of the positive overlap within the region.

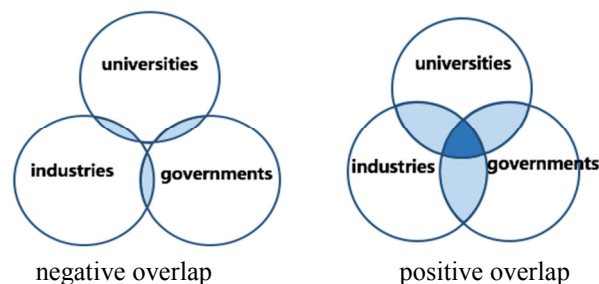


Figure 1. The negative overlap and positive overlap of UIG triple helix

### 2.2 UIG Triple Helix Intensity and The Level of Regional Entrepreneurship

The universities have two main functions, the first is the personnel training, the other is the scientific research, they are the most important output sites of technology, talent and other resources, and they play a vital role in the development of innovation and entrepreneurship. The function of the industries is to integrate all kinds of technical resources including scientific research achievements to achieve the transformation of innovation, so start-ups tend to sit in colleges and universities in order to quickly obtain innovative resources. The governments act on entrepreneurial activities through macro-control, policy guidance and other means. Li *et al.* (2016) have shown that UIG triple helix has a positive effect on regional entrepreneurship. Kim *et al.* (2012) argues that government and universities' R & D investment has an indirect effect on regional entrepreneurial activities. However, these studies did not distinguish between positive overlap and negative overlap of UIG triple helix. From the perspective of policy, positive overlap is more important than negative overlap in ascending a country or a region's competitive advantage (Etzkowitz & Leydesdorff, 2000; Mirowski & Sent, 2008), so, this study suggests that positive overlap is more conducive to the promotion of the level regional entrepreneurship.

Compared to negative overlap, positive overlap is more able to promote the improvement of the level of regional entrepreneurship, that is, UIG triple helix intensity is conducive to the improvement of the level of regional entrepreneurship, the reasons lie in the following aspects:

First, positive overlap is more conducive to the generation of synergies. Because universities, industries and governments have their own unique, heterogeneous resources, when they cooperate on a project, they complement each other and generate spillover benefits, thus forming a complementary relationship of resources and resulting in synergies (Leydesdorff & Meyer, 2006; Ye *et al.*, 2014). And this high degree of synergy cannot be achieved by negative overlap. In the regional entrepreneurial level, the technology, the production and the policy are highly complementary and combined, it can improve the survival rate of new start-ups. so, the higher the UIG triple helix intensity is, the more conducive to the promotion of regional entrepreneurial level is.

Second, the positive overlap can improve the breadth of knowledge sharing. Whether they are industries, universities, or government, learning and innovation are an essential motivation and guarantee for the survival and development of an organization. Cross-organizational cooperation is an important way to learn and innovate (Powell, 1996), the parties to the cooperation can learn from each other and get new information from each other. The subjects of UIG triple helix contribute their own information, and re-create information. And this re-creation often showed through the entrepreneurial activities

Third, positive overlap can produce relation-specific assets, such as tacit understanding and common interests. In the process of tripartite cooperation, the effective integration of the tripartite resources and the collision of ideas are easy to produce new business ideas. If the cooperation time is relatively long, mutual understanding can form among the three parties, it may reduce business decision-making time so that to grab the initiative in the market, which is conducive to entrepreneurship.

Fourth, positive overlap is more conducive to promoting scientific and technological transformation, thereby enhancing the level of entrepreneurship. In the transformation of scientific and technological achievements, it requires the effective cooperation of universities, industries and governments. At present, some major national projects are carried out through the cooperation of university-industry-government, this combination can give full play to the advantages of the three.

Fifth, positive overlap can produce restraint mechanism, reduce the possibility of opportunism, and create a fair competitive environment, so as to promote the level of regional entrepreneurship. Because once one party of the positive overlap destroys the rules, cooperation projects will be terminated and its reputation will suffer a great loss. Therefore, the subjects of positive overlap are less likely to take opportunism behavior than negative overlap, so it is more likely that positive overlap produces restraint mechanism.

Overall, the more the number of positive overlap in a region, that is, the more trilateral relations in a region, the greater the UIG triple helix intensity is, the more conducive to the promotion of the level regional entrepreneurship. In this regard, we make the following assumptions:

*Hypothesis 1: UIG triple helix intensity will be positively related to the level of regional entrepreneurship.*

### *2.3 Trust Governance and The Level of regional entrepreneurship*

In recent years, trust governance has been paid more and more attention by academics. Transaction Cost Economics argues that organizations use governance mechanisms to reduce transaction costs (Williamson, 1985), At the same time, Westphal & Zajac (2001) argue that trust governance is used in a lot of cooperation. Some scholars believe that trust is the confidence of one party in the expectations of other parties' actions and goodwill (Ring & Van de Ven, 1992; Zucker, 1986; Mayer *et al.*, 1995). Some scholars believe that, compared with the formal contract governance, trust governance mechanism is a more effective and low-cost (Hill, 1990).

Positive overlap due to its knowledge sharing, coordination and other aspects of the advantages, can better promote the promotion of the level of regional entrepreneurship, but coordination costs and transaction costs of it are greater than negative overlap, and tripartite cooperation often leads to inefficiency; in addition, while positive overlap can reduce the likelihood of opportunistic behavior, but there is no way of cooperation can completely eliminate the opportunistic behavior, so does positive overlap. Finally, in the face of changing external environment, the contract cannot involve in all the contingencies, so uncertainty is great, trust governance at this time can play a very good constraint. Therefore, this study holds that trust governance moderates the relationship between UIG triple helix intensity and the level of regional entrepreneurship.

First, from the perspective of transaction costs, the parties can better coordinate the cooperation (Gulati & Nickerson, 2008) with trust governance so that to reduce transaction costs (Zaheer, 1998). From the perspective of transaction costs, the cost of contracting for all contingencies is very expensive, it will spend a lot of time, manpower, material and financial resources and so on. In the Chinese context, on the one hand, the governments have the function of promoting economic development, and in the case of economic development into the new normal situation, supply side reform needs to explore some new ideas, so it is important to develop economy by innovation and entrepreneurship. On the other hand, in some projects, industries and universities are unable to afford, they need to seek effective cooperation with governments to play their respective advantages. Therefore, the government often cooperates with universities and industries to explore major projects and create new businesses. However, the development process of major projects is often extremely complex, comprehensive and detailed agreement of the three rights and obligations is very difficult, it needs to spend more time, human resources and so on. At this time, spending too much time and manpower may lead to entrepreneurial opportunities missed. Therefore, if there is a high degree of trust governance among the three parties, that is, they have high confidence in the expectations of others' goodwill and behavior, then they can seize the opportunities in the first time, so as to promote the improvement of the level of entrepreneurship.

Second, from the perspective of environmental uncertainty, trust governance can reduce the friction costs and coordination costs brought by uncertainty. The reason is that any environment contains a certain degree of uncertainty, from a legal point of view, the provisions of all the accidents of the contract is very difficult. In

the projects of the cooperation of university-industry-government, project size is very large, project term is long, and uncertainty is also great, trust governance can reduce the cost of friction and coordination caused by unforeseen circumstances, and promote the depth of tripartite cooperation, so as to promote the improving of the level of regional entrepreneurship.

Third, trust governance can improve the efficiency of tripartite cooperation and enhance the flexibility of cooperation. In a sense, the more partners, the lower the efficiency. Because the more the number of partners in the handling of the problem, the more time to coordinate and communicate, the lower the efficiency. If the parties have strong trust governance, there is lower possibility of opportunism, then the handling of entrepreneurial problems can simplify the process, so that to improve flexibility and efficiency.

In summary, trust governance can reduce transaction costs, coordinate costs and increase cooperation flexibility and efficiency, thereby improving entrepreneurship. In the case of strong trust governance, the combination of technology of universities, the commercialization of industries and the policies of governments can better promote the improving of the level of regional entrepreneurship. Based on this, we make the following assumptions:

*Hypothesis 2: UIG triple helix intensity will be more positively related to the level of regional entrepreneurship when there is high trust governance among universities, industries, and governments.*

### 3.Method

#### 3.1 Sample

The selection of samples is the data of 30 provinces in China in 2013, the reasons are: first, because the measurement of independent variables mainly uses the cooperation data among universities, industries, and governments in National Science and Technology Report Sharing Service System, but technology report only shows the project time, and after the project is completed, a report will be formed. And the project is generally studied for 2 years, or even longer. Generally speaking, the project was established in 2013 have been completed and submitted to the project report. If choose project after the year of 2014, the project may have not been completed, resulting in less project cooperation data, so that to be difficult to make a comprehensive judgment on cooperation among the three parties. Second, we regard 30 provincial units as our samples, because the data of Hong Kong, Macau, Taiwan and Tibet are difficult to obtain and are incomplete, the data for these places will not be included in the scope of our data selection. Except for the data sources of the independent variables, the data sources of the control variables and the dependent variables are derived from the Statistical Yearbook of each province, the data sources of the moderating variables are derived from China City Commercial Credit Environment Index Report.

#### 3.2 Measures

**Dependent variables.** The existing measurements of the level of regional entrepreneurship are mainly focused on several aspects: first, self-employment rate. Blanehflower (2004) used the number of self-employed persons divided by the total employed population to measure the level of regional entrepreneurship. Parker & Robson (2004) measured the level of entrepreneurship by dividing the number of self-employed persons by the total number of workforce. Second, the ratio of business owners. That is, the number of business owners accounted for the proportion of the number of working population (Audretsch & Thurik, 2001). Li *et al.* (2004) used the number of new private enterprises to measure the level of regional entrepreneurship. This study suggests that self-employment rate and the ratio of business owners cannot directly reflect the process of the improvement of the level of regional entrepreneurship. Therefore, in this study, we use the measurement of Li *et al.* (2012).

**Independent variables.** This research uses the project cooperation between universities, industries and governments to measure the UIG triple helix intensity within the region. In the Chinese context, the government has the function of promoting economic development. But governments are our administrative organs, not directly involved in the process of research, development, commercialization, and production. The government's projects are the implementation of government policies (Zhu Han, 2013), they often cooperate with industries and universities in the form of projects. Therefore, projects can measure the cooperation among the three parties. In the research, research institutes are classified as universities, hospitals are classified as industries.

**Moderating variables.** For the measurement of trust governance, Zaheer *et al.* (1998), Noordeweir *et al.* (1990), etc., measured it in the form of a questionnaire scale. Since this research is a study of trust governance at the regional level, those way does not fit. On average, the overall commercial credit within a region is good, by contrast, the degree of trust between the various entities within the region may be higher, the possibility of using trust governance is greatly enhanced. Therefore, this study uses the data from China City Commercial Credit Environment Index Report to measure the trust governance in the region.

**Control variables.** This study holds that residents' living standard, population size, education and training resources, R & D transfer capacity, financial support, government policies will affect the level of regional entrepreneurship, so, these variables are controlled. The residents' living standard is measured by per

capita GDP(Zhu Han, 2013); the population size is measured by the number of resident population in the area(Zhu Han, 2013); education and training resources are measured by the number of college students and the number of full-time teachers(Zhu Han, 2013); R & D transfer capability is measured with the authority of the patent(Zhu Han, 2013); financial support is measured by the balance of savings deposits of urban and rural residents as well as short-term loan balances(Zhu Han, 2013); government policies are measured by the total retail sales of social consumer goods and the total investment in fixed assets(Zhu Han, 2013).

### 3.3 Analysis

In this study, we use SPSS 19.0 to analyze the data and test the relevant hypothesis. Before we test the hypothesis, we standardized the raw data, and standardization formula is as follows:

$$d_{ij} = \frac{X_{ij} - X_{jmin}}{X_{jmax} - X_{jmin}} \quad (1)$$

In the above formula, where  $d_{ij}$  represents standard value of the  $j$ th indicator in  $i$  province.  $X_{ij}$  refers to the original value of the  $j$ th indicator in  $i$  province,  $X_{jmax}$  represents the maximum value of the  $j$ th indicator in all provinces, and  $X_{jmin}$  represents the minimum value of the  $j$ th indicator in all sample provinces.

## 4. Results

Table 1 shows the mean values, standard deviations and correlations among all the measured variables in this study. From the correlation analysis results, the correlation coefficient between UIG triple helix intensity and regional entrepreneurial level is 0.841 ( $p < 0.01$ ), and there is a correlation between them.

Table 1. Means, Standard Deviations, and Correlations

T	Mean	S.D.	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>
Residents' living standard	0.319	0.267	1								
Population size	0.385	0.278	-0.315	1							
R & D transfer capacity	0.142	0.228	0.219	0.408*	1						
Financial support	0.201	0.196	0.259	0.139	0.501**	1					
Government policies	0.325	0.246	0.150	0.506**	0.571**	0.468**	1				
Education and training resources	0.417	0.26	-0.030	0.558**	0.534**	0.533**	0.517**	1			
UIG triple helix intensity	0.363	0.149	0.046	0.444*	0.469**	0.504**	0.651**	0.667**	1		
Trust governance	0.254	0.202	0.124	0.443*	0.659**	0.325	0.583**	0.371**	0.281	1	
The level of regional entrepreneurship	0.307	0.190	0.163	0.482**	0.710**	0.542**	0.776**	0.678**	0.841**	0.726**	1

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

To see how much additional variance are explained by independent variables after control variables, we test our hypotheses with hierarchical regression analysis, entering control variables in step 1, independent variables in step 2, and interactions in step 3 and tracing change in the multiple squared correlation coefficient ( $R^2$ ) from step to step.

Table 2 shows the result of hierarchical regression analyses estimating the effect of UIG triple helix intensity and trust governance on the level of regional entrepreneurship. Hypothesis 1 states that UIG triple helix intensity will be positively related to the level of regional entrepreneurship. As shown in Table 2, the coefficient for UIG triple helix intensity is positive and significant ( $p < 0.001$ ), indicating that UIG triple helix intensity contributes to the level of regional entrepreneurship. Hence, Hypothesis 1 is supported. Hypothesis 2 states that trust governance will moderate the relationship between UIG triple helix intensity and the level of regional entrepreneurship. To test this hypothesis, I multiplied UIG triple helix intensity and trust governance, and entered the multiplicative interaction item into the regression. As predicted, the coefficient of the interaction is positive and significant ( $p < 0.001$ ), indicating that the effect of UIG triple helix intensity on the level of regional entrepreneurship is dependent on trust governance. Hence, Hypothesis 2 is supported.

Table 2 Results of Hierarchical Regression Analysis

Variables	Y= The level of regional entrepreneurship			
	Modal 1	Modal 2	Modal 3	Modal 4
(constant)	0.065	-0.048	-0.155***	-0.048*
Residents' living standard	0.019	0.029	0.072**	0.011
Population size	-0.014	-0.013	0.022	-0.003
R & D transfer capacity	0.236*	0.252*	0.025	-0.043
Financial support	0.028	-0.30	-0.011	-0.003
Government policies	0.354*	0.195*	0.004	0.012
Education and training resources	0.209	0.057	0.026*	0.036
UIG triple helix intensity		0.645***	0.826***	0.621***
Trust governance			0.464***	0.115
UIG triple helix intensity * Trust governance				0.861***
F	12.248***	20.817***	116.387** *	262.824***
R2	0.762	0.869	0.978	0.992
ΔR2	-	0.107	0.109	0.014

\* p <0.05; \*\* p<0.01; \*\*\* p<0.001

To better explain the form of interactions reported in the above hierarchical regression analysis, I plotted the interaction effects in the graphs shown in Figure 3, using one standard deviation above and below the mean to capture high and low trust governance.

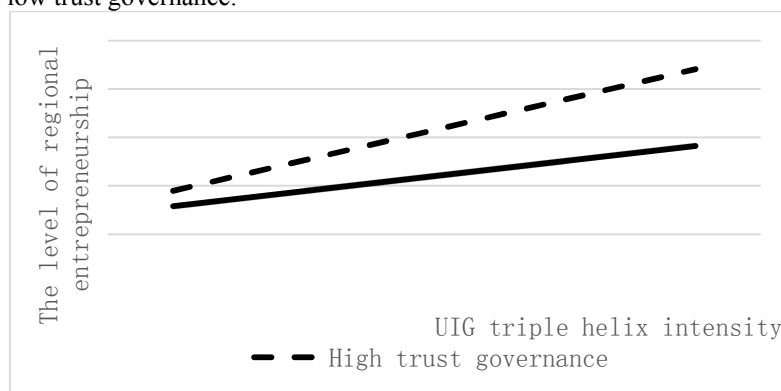


Figure 2. Interaction Results

## 5 Discussion and Conclusion

This study explores the effect of UIG triple helix intensity on the level of regional entrepreneurial. Through empirical research, this study draws the following conclusions:

First, compared with the bilateral relations between universities, enterprises and the government, the tripartite cooperation between universities, enterprises and the government is more conducive to the promotion of the level of regional entrepreneurship. It is found that the UIG triple helix has a positive effect on the regional entrepreneurial level. As the proportion of positive overlap in the region is getting higher and higher, the level of regional entrepreneurship is higher. Therefore, the positive overlap is more favorable than the negative overlap to promote the improvement of the level of regional entrepreneurship. Because the subjects of positive overlap can be complementary to each other, resulting in synergistic effect. Tripartite cooperation can give the timely

and accurate access to the necessary resources, reduce the risk of entrepreneurship, thereby enhancing the success rate of regional entrepreneurship and the level of regional entrepreneurship. In addition, the constraints mechanism between the three parties are greater than negative overlap, it can effectively reduce the opportunism, create a favorable competitive environment, and thus promote the improvement of the level of regional entrepreneurship.

Positive overlap due to its knowledge sharing, coordination and other aspects of the advantages, can better promote the promotion of the level of regional entrepreneurship, but coordination costs and transaction costs of it are greater than negative overlap, and tripartite cooperation often leads to inefficiency; in addition, while positive overlap can reduce the likelihood of opportunistic behavior, but there is no way of cooperation can completely eliminate the opportunistic behavior, so does positive overlap. Finally, in the face of changing external environment, the contract cannot involve in all the contingencies, so uncertainty is great, trust governance at this time can play a very good constraint. Therefore, this study holds that trust governance moderates the relationship between UIG triple helix intensity and the level of regional entrepreneurship.

Any cooperation contains a certain degree of risk, although in a sense positive overlap can effectively reduce the opportunism, but cannot completely put an end to this behavior. Because of the changing environment, the contract cannot specify all the contingencies, so the uncertainty is relatively large. However, trust governance can reduce transaction costs, coordinate costs and friction costs, improve the flexibility and efficiency of cooperation, moderates the relationship between UIG triple helix intensity and the level of regional entrepreneurship.

By studying the relationship between UIG triple helix intensity and the level of regional entrepreneurial, this study may include the following contributions:

First, the existing research on UIG triple helix mainly focuses on the study of its relationship with regional innovation, but there are few literatures on the relationship between UIG triple helix and regional entrepreneurship. This study suggests that the UIG triple helix plays an important role in the promotion of regional entrepreneurship. Hence, we cannot ignore the role of UIG triple helix in regional entrepreneurship.

Second, in accordance with whether to achieve the tripartite cooperation among universities, industries and government, UIG triple helix can be divided into positive overlap and negative overlap, this study suggests that the positive overlap is more conducive to the improvement of the level of regional entrepreneurship than the negative overlap, while previous studies have paid little attention to the possible differences in the two dimensions of the UIG triple helix.

Third, positive overlap plays an important role in the promotion of the level of regional entrepreneurship, but compared to negative overlap, positive overlap will result in greater transaction costs, coordination costs, friction costs, and has poor flexibility. So, trust governance can reduce the high transaction costs brought about by positive overlap and enhance the flexibility of transactions. Therefore, this study holds that trust governance moderating the relationship between UIG triple helix intensity and the level of regional entrepreneurship.

The findings of this study should be considered in light of its limitations, which also provide directions for future studies. First, limitations about sample selection. In this study, 31 provinces are selected as samples, and there are some shortcomings in the sample size. In the future research, in order to ensure that the sample and the data more representative, the selection of the sample can spread to the various cities across the country. Second, the limitations of cross-sectional data. Due to the constraints of time, energy and data availability, we cannot collect a few years of data for panel regression, and cross-sectional data may have heterogeneous variation problems for the results. In the future research, we can try to collect time series data to study the relationship between UIG triple helix and the level of regional entrepreneurship.

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