Contents lists available at YXpublications

International Journal of Applied Mathematics in Control Engineering

Journal homepage: http://www. ijamce.com

Analysis of the Influence Factors of Typhoon Disaster on Catastrophe Insurance Demand in China

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ARTICLE INFO

Article history:
Received 15 January 2021
Accepted 26 March 2021
Available online 28 March 2021

Keywords:
Catastrophe risk
Insurance demand
Panel data
The empirical research

ABSTRACT

This paper conducts an empirical study on typhoon insurance demand in China. Some property insurance premium income data of Hainan, Fujian, Guangdong, Zhejiang and Guangxi were selected as explained variables, and Eviews was used for panel data analysis. Through analysis, it is found that the direct economic losses caused by typhoon disasters are positively correlated with the premium income. The gross regional product, people's risk attitude and the government disaster relief system explain the premium income more strongly, while the social capital has a limited explanation for the premium income. Based on the results of empirical research, some suggestions are put forward, such as providing specific types of insurance, strengthening risk education and drawing lessons from foreign advanced experience.

1. Introduction

In recent years, in the global scope, a variety of natural disasters occur frequently, and China is one of the few countries in the world with the most types of natural disasters, the highest frequency, the largest intensity and the most serious catastrophe losses. According to the National Basic Situation on Natural Disasters released by the Ministry of Emergency Management, 260 million people were affected by natural disasters in China in 2018 and 2019, resulting in a direct economic loss of 591.55 billion yuan.

In the face of such severe risk of catastrophe loss, the traditional mechanism of disaster loss treatment and compensation in China is still based on the national financial relief as the main body and social donation and counterpart support as the auxiliary. Although the effect of this mechanism is quite remarkable, in the long run, it restrains the growth of China's economy to some extent. Therefore, it is necessary to establish a catastrophe risk management system in line with China's national conditions.

According to the practical experience of foreign countries, the post-disaster compensation of catastrophe insurance can quickly fill the gap of capital liquidity after the catastrophe event, improve the society's post-disaster recovery ability, and also promote the further development of disaster prevention and loss prevention work, thus occupies an unshakable position in the catastrophe risk management system. Therefore, in order to establish catastrophe risk management system, catastrophe insurance should be studied first.

Although there have been a large number of researches on catastrophe insurance in China, they focus on the establishment of catastrophe insurance system from the standpoint of catastrophe insurance suppliers, but do not pay enough attention to the demand side of catastrophe insurance. Foreign experience shows that the demand of catastrophe insurance plays an important role in the effect of catastrophe insurance system.

From the perspective of research methods, most of the domestic research is based on theoretical analysis, with few empirical analysis. Zhang Yue[1] summarized the research results of catastrophe insurance demand at home and abroad, and believed that the theoretical research and empirical research on catastrophe insurance demand were seriously derailed at present, and the model proposed in theoretical research could not be supported by empirical research.

In terms of the factors influencing the demand for catastrophe insurance, Li Haitang [2] believed that the demand for catastrophe insurance was affected by risk, income, price, psychology and the government's disaster relief compensation system. Pan Tanrui [3] also holds the same view; Zhang Yue [4] found that liquidity constraints would also affect the demand for catastrophe insurance. Tian Ling and Yao Peng [5] found that China's current post-disaster donation system has a certain degree of "crowding out effect" on the demand for catastrophe insurance.

As for the method used in empirical research, since there is no

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special insurance type in China at present, researchers tend to adopt the form of questionnaire survey. Zhu Wei and Chen Bingzheng [6] conducted a questionnaire survey on earthquake risk perception and earthquake insurance demand among residents in Beijing, Chengdu and Dalian.Tian Ling, Yao Peng and Wang Hanbing [7] conducted a sample questionnaire survey on 681 peasant households in Chuxiong Prefecture, and studied the impact of risk perception and government behavior on the demand for catastrophe insurance. However, the cost of questionnaire research is too high, because it usually requires money to improve the quality of the questionnaire, which restricts the sample size. In addition to the questionnaire survey, Tian Ling and Zhang Yue [8] used the panel analysis method to study the influencing factors of catastrophe insurance demand.

In this paper, the premium income data of some provinces in coastal areas seriously affected by typhoons are selected as the research object, and the panel data analysis method is adopted to conduct empirical analysis to verify the existing catastrophe insurance theory, and then provide reference for the establishment of catastrophe insurance system.

2. Variable definition and data source

China's coastal areas were seriously affected by typhoons, among which Hainan, Fujian, Guangdong, Zhejiang and Guangxi were the most severely affected provinces. Therefore, we chose to collect data from these provinces for empirical analysis.

(1) Premium income

China's current home property insurance, enterprise property insurance and agricultural insurance insurance underwriting responsibilities include typhoon. So to hainan, fujian, guangdong, zhejiang and those affected by the typhoon in guangxi province enterprises general insurance, home insurance and agricultural insurance premium income as the sum of typhoon insurance demand be explained variable, coupled with our hypothesis: "when launching specific catastrophe insurance, buy the insurance policyholders tend to buy", is the ability to represent the typhoon insurance demand. Parts of these provinces property insurance premium income source for China's insurance yearbook from 2009 to 2018, the data shown in the following table (including because not be listed in China's insurance yearbook home insurance income, income and other premium income is mainly penates danger, so the premium income in the form of insurance enterprises income, agriculture insurance and other insurance revenue the sum of these three kinds of income) :

Table 1 Part of Property Insurance Premium Income Table (Unit: Million Yuan)

Year	Hainan province	Zhejiang province	Fujian province	Guangdong province	Guangxi Zhuang Autonomous Region
2008	282.51	2312.55	1079.67	3230.63	565.55
2009	271.92	2460.8	1229.66	3521.06	610.97
2010	537.35	2800.49	1474.7	3742.35	679.87
2011	447.44	3336.52	1673.23	4687.1	831.53
2012	500.43	3977.53	1860.39	5450.06	924.37
2013	773.67	4744.87	2016.53	5614.77	1150.66
2014	759.24	4843.71	2137.77	6582.02	1419.55
2015	792.81	4958.25	2252.62	6493.61	1578.49
2016	798.5	5160.49	2214.14	6581.23	1578.5
2017	1021.68	5396.91	2555.44	6965.15	2171.2

(2) Typhoon disasters

In the theory of catastrophe insurance demand, background risk is considered to be an important factor affecting catastrophe insurance demand. Therefore, the typhoon disaster situation in these provinces should be considered. The typhoon disaster situation is quantified by the direct economic loss data in the "Typhoon Disaster Loss Table" in the Statistical Yearbook of Chinese Civil Affairs. The data were collected from China Civil Affairs Statistical Yearbook from 2009 to 2018, as shown in the table below:

Table 2 Table of direct economic losses from typhoon (unit: 100 million yuan)

Year	Hainan province	Zhejiang province	Fujian province	Guangdong province	Guangxi Zhuang Autonomous Region
2008	5.5	18.5	21.1	159.1	60.7
2009	6.8	88.86	26.33	47.54	1.16
2010	2.8	1.3	39.7	116.2	6.4
2011	85.2	23.1	10.6	36.6	36.4
2012	12.6	275.5	17.1	44.3	27.3
2013	34.8	609	103.6	421.8	40.2
2014	176.9	10.8	16.5	255.3	170.1
2015	12.4	219.5	88.6	288	17.7
2016	76.7	113	433.7	59.4	3.8
2017	2.2	11.5	9.5	294.5	2.8

(3) Gross Regional Product

In catastrophe insurance demand theory, income is considered to be an important influence factors of catastrophe insurance demand, but in the theory, they usually study object is a family, so the family income is an important factor, however, we here be explained variables included income of company worth insurance, so it is not appropriate income as explanatory variables. Therefore, we choose gross regional product to replace income as the explanatory variable. The data source is National Bureau of Statistics - Statistical Data - Data Query, and the data are shown in the following table:

Table 3 Table of Gross Regional Product (Unit: 100 million yuan)

Year	Hainan province	Zhejiang province	Fujian province	Guangdong province	Guangxi Zhuang Autonomous Region
2008	1503.06	21462.69	10823.01	37138.85	7021
2009	1654.21	22998.24	12236.53	39923.24	7759.16
2010	2064.5	27747.65	14737.12	46544.63	9569.85

2011	2522.66	32363.38	17560.18	53908.59	11720.87
2012	2855.54	34739.13	19701.78	57924.76	13035.1
2013	3177.56	37756.58	21868.49	63357.92	14449.9
2014	3500.72	40173.03	24055.76	68777.25	15672.89
2015	3702.76	42886.49	25979.82	73876.37	16803.12
2016	4053.2	47251.36	28519.15	80666.72	18317.64
2017	4462.54	51768.26	32182.09	89705.23	18523.26

(4) the risk attitude of the applicant

In catastrophe insurance demand theory, policyholders' risk attitude is considered to be an important factor affecting catastrophe insurance demand, and policyholders with risk aversion are more inclined to purchase catastrophe insurance. Therefore, the risk attitude of people in these provinces needs to be considered. However, because the risk attitude is qualitative rather than quantitative, the education level of employees is chosen to be quantified. Here we assume that more educated people are more rational, that is, people with higher education are more likely to hold a risk aversion attitude. We choose "China statistical yearbook and employment in the" employment education scale 'university college diploma in number, the number of university undergraduate course diploma and postgraduate diploma in accounting for the proportion of the number of employees as a measure of the insured risk attitude data, the data source for 2009 to 2018, the China statistical yearbook and employment, the data shown in the table below:

Table 4 Proportion of Junior College, Undergraduate and Postgraduate in Employment (Unit: Percent)

Year	Hainan province	Zhejiang province	Fujian province	Guangdong province	Guangxi Zhuang Autonomous Region
2008	6.13	8.9	7.42	8.81	3.76
2009	6.14	10.38	12.03	7.72	4.45
2010	9.13	11.49	9.98	10.81	7.38
2011	11.44	15.96	15.72	12.48	7.99
2012	13.31	17.7	16.36	12.15	8.88
2013	14.19	19.16	17.04	14.21	8.33
2014	15.24	21.52	18.01	15.38	10.46
2015	13.9	24.7	17.9	17.3	13.5
2016	14.4	25.2	18.7	18.6	13.2
2017	14.7	26.5	18.8	18.6	12.9

(5) Social capital

In catastrophe insurance demand theory, family social capital is considered a factors affecting catastrophe insurance demand, because of family social capital, the greater the reconstruction after the catastrophe is faster, so may weaken the demand for catastrophe insurance to buy, but on the other hand, the size of the family, the greater the its after experienced a catastrophe is, the more loss, so this could prompt it to buy catastrophe insurance.So we consider these provinces of social capital, we choose to use in the Chinese journal of population and employment statistics yearbook "regional number, population, sex ratio and the average household size table" in the average household scale to measure the social capital of family, the data source for 2009 to 2018, Chinese journal of population and employment statistics yearbook, the data shown in the table below:

Table 5 Average household size table (unit: person per household)

Year	Hainan province	Zhejiang province	Fujian province	Guangdong province	Guangxi Zhuang Autonomous Region
2008	3.75	2.81	3.05	3.41	3.55
2009	3.75	2.8	2.96	3.3	3.57
2010	3.46	2.62	2.98	3.11	3.34
2011	3.54	2.59	2.78	3.33	3.15
2012	3.64	2.68	2.82	3.26	3.32
2013	3.52	2.54	2.72	3.15	3.31
2014	3.59	2.54	2.69	3.19	3.23
2015	3.65	2.69	3.1	3.23	3.51
2016	3.78	2.68	3.05	3.1	3.55
2017	3.58	2.62	3.03	3.05	3.51

(6) Government disaster relief system

In the theory of catastrophe insurance demand, government disaster relief system is considered to be an important factor affecting the demand for catastrophe insurance, because when people in disaster-stricken areas take it for granted that government disaster relief is provided, they are no longer likely to purchase catastrophe insurance, and government disaster relief will have a great inhibiting effect on the demand for catastrophe insurance. Therefore, we need to take it into consideration. We choose the government's natural disaster relief expenditure data from China Civil Affairs Statistical Yearbook from 2009 to 2018 as the explanatory variable. The data are shown in the following table:

Table 6 Government expenditure on natural disaster relief (unit: 100 million yuan)

Year	Hainan province	Zhejiang province	Fujian province	Guangdong province	Guangxi Zhuang Autonomous Region
2008	0.591	0.376	0.444	1.104	5.3974
2009	0.96649	1.28282	0.9806	2.19562	4.79025
2010	2.55693	1.12019	4.4655	4.59946	6.55214
2011	1.9228	1.72699	3.38129	2.84882	6.29976
2012	0.36	0.98	1.0983	1.51	3.5883
2013	0.57541	3.31987	2.67879	6.87835	4.87926
2014	2.838	0.404	0.5384	2.862	4.0779

2015	0.5653	2.0241	2.8144	2.019	3.7232
2016	0.56133	3.61514	6.0913	3.74135	4.86493
2017	0.131	0.884	0.2182	0.447	2.7986

3. Regression equation and regression results

We first take the logarithm of the variables of the absolute quantity, convert the absolute quantity into the relative quantity, eliminate the influence of the unit, reduce its fluctuation range, and make the data more stable.

Use Eviews10 software. Firstly, the stationarity of panel data was checked, and unit root test was carried out for each variable. (null hypothesis: unit root process; alternative hypothesis: stationary).

(1) The premium income

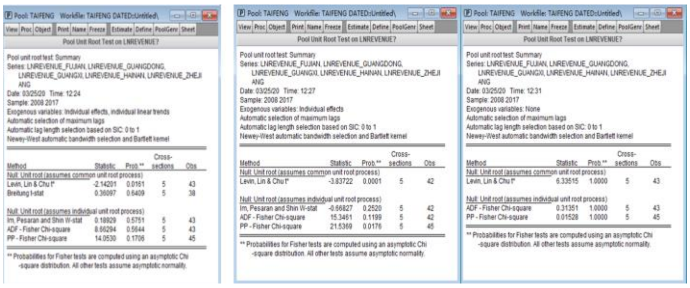


Fig. 1 Horizontal unit root test of sequential lnrevenue

The test results show that the null hypothesis cannot be rejected and the sequential lnrevenue is a unit root process containing individual intercept term and trend term.

Then do unit root test after the first-order difference:

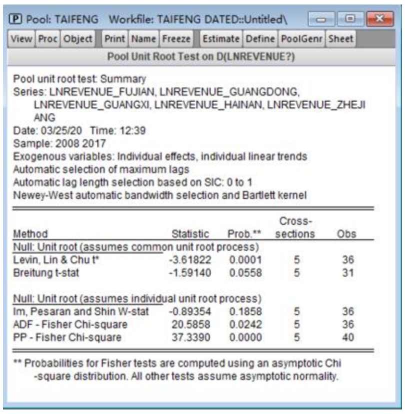


Fig. 2 One difference unit root test of sequential lnrevenue

The test results show that the null hypothesis is rejected, and the sequence D (lnrevenue) obtained after the first difference is a horizontal stationary sequence containing individual intercept term and trend term, so the sequence lnrevenue is a first-order integrated sequence (I(1) sequence).

2. Direct economic losses from typhoon

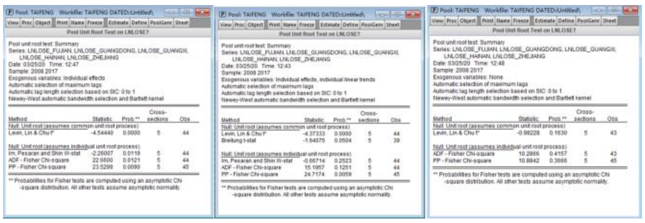


Fig. 3 Horizontal unit root test of sequence lnlose

The test results show that the null hypothesis is rejected, and the sequence lnlose is a horizontal stationary sequence with no trend in individual intercept, that is, a single integer (I(0) sequence) of zero order.

3. Government Disaster Relief Expenditure (lnexpand)

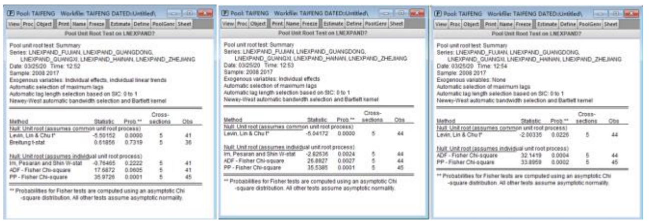


Fig. 4 Horizontal unit root test of sequence lnexpand

The test results show that the null hypothesis is rejected, and the sequence lnexpand is a horizontal stationary sequence with no trend in individual intercepts, that is, a single integer (I(0) sequence) of zero order.

4. Gross Regional Product (lngdp)

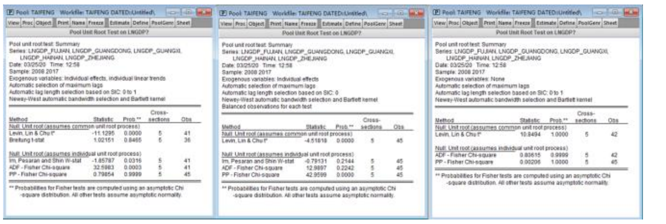


Fig. 5 Horizontal unit root test of sequential lngdp

The test results show that the null hypothesis is rejected, and the sequence LNGDP is a horizontal stationary series with individual intercept and trend, that is, a single integer (I(0) sequence) of zero order.

5. Average Household Size (lnsize)

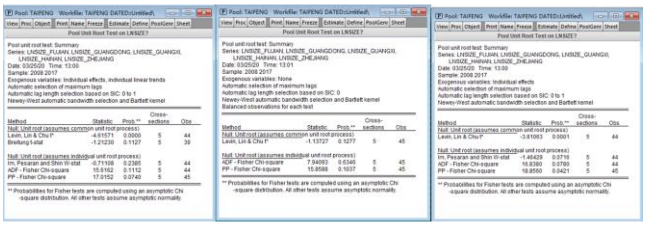


Fig. 6 Horizontal unit root test of sequence lnsize

The test results show that the null hypothesis is rejected, and the sequence LNSIZE is a horizontal stationary sequence with no trend in individual intercept, that is, a single integer (I(0) sequence) of zero order.

6. Risk Attitude

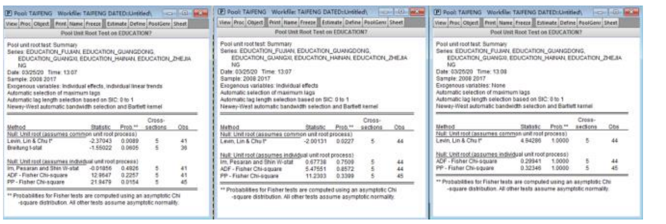


Fig. 7 Horizontal unit root test of sequential education

The test results show that the null hypothesis cannot be rejected, and the sequence education is a unit root process containing individual intercepts and trends.

Then do unit root test after the first-order difference:

Pool: TAIFENG Workfile: TAIFENG DATED::Untitled\

View Proc Object Print Name Freeze Estimate Define PoolGenr Sheet

Pool Unit Root Test on D(EDUCATION?)

Pool unit root test: Summary
Series: EDUCATION_FUJIAN, EDUCATION_GUANGDONG, EDUCATION_GUANGXI, EDUCATION_HAINAN, EDUCATION_ZHEJIANG
Date: 03/25/20 Time: 16:54
Sample: 2008 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.52543	0.0000	5	36
Breitung t-stat	-1.10952	0.1336	5	31
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.38181	0.0835	5	36
ADF - Fisher Chi-square	26.8932	0.0027	5	36
PP - Fisher Chi-square	58.7259	0.0000	5	40

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Fig. 8 Difference unit root test for sequence education

The test results show that the null hypothesis is rejected, and the D (Education) obtained by the sequence Education after a first difference is a horizontal stationary sequence containing individual intercept and trend, so the sequence Education is a first-order integrated sequence (I(1) sequence).

The results of the stationarity test show that 4 variables are zero-order integers and 2 variables are first-order integers. The number of variables corresponding to the maximum single integer order is greater than or equal to 2, so panel co-integration test can be carried out.

The following is the panel co-integration test (null hypothesis: there is no co-integration relationship; Alternative hypothesis: existence of co-integration relationship) :

Pool: TAIFENG Workfile: TAIFENG DATED::Untitled\

View Proc Object Print Name Freeze Estimate Define PoolGenr Sheet

Kao Residual Cointegration Test
Series: LNREVENUE? LNLOSE? LNGDP? LNEXPAND? LNSIZE? EDUCATION?
Date: 03/25/20 Time: 17:29
Sample: 2008 2017
Included observations: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.890756	0.0019
Residual variance	0.015974	
HAC variance	0.010507	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID01?)
Method: Panel Least Squares
Date: 03/25/20 Time: 17:29
Sample (adjusted): 2009 2017
Included observations: 9 after adjustments
Cross-sections included: 5
Total pool (balanced) observations: 45

Fig. 9 Panel co-integration test

The test results show that there is a co-integration relationship when the null hypothesis is rejected. This indicates that these six variables have a long-term equilibrium relationship, so the classical regression model method can be used to establish a regression model.

Next, check the model Settings.

Maximum likelihood ratio test (LR test) was performed on the regression results (null hypothesis: mixed model; Alternative hypothesis: fixed effect model or random effect model) :

Equation: EQ02 Workfile: TAIFENG BALANCED PANE...

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Redundant Fixed Effects Tests
Equation: EQ02
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	1.288261	(9,35)	0.2779
Period Chi-square	14.306565	9	0.1118

Period fixed effects test equation:
Dependent Variable: LNREVENUE
Method: Panel Least Squares
Date: 03/25/20 Time: 19:38
Sample: 2008 2017
Periods included: 10
Cross-sections included: 5
Total panel (balanced) observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.396471	0.636356	-0.623033	0.5365
LNSIZE	0.323299	0.330153	0.979242	0.3328
LNLOSE	0.028288	0.020479	1.381317	0.1742
LNGDP	0.729417	0.036675	19.88885	0.0000
LNEXPAND	-0.091732	0.031204	-2.939780	0.0052
EDUCATION	0.028418	0.007096	4.004906	0.0002

Fig. 10 Maximum likelihood ratio test

The test results show that the null hypothesis cannot be rejected and the mixed regression panel data model is more suitable.

Then the panel co-integration test was carried out, and the statistical value of the co-integration test was -2.891, and the corresponding probability was 0.002. The null hypothesis was rejected, and there was a co-integration relationship. This shows that the six variables have a long-term equilibrium relationship, so the classical regression model method can be used to establish the regression model.

Next, check the model Settings. The maximum likelihood ratio test was conducted on the regression results, and the test results showed that the statistical value was 1.288, and the corresponding probability was 0.278. Therefore, the null hypothesis could not be rejected, and it was appropriate to establish a mixed regression panel data model.

The mixed regression panel data model takes the following form:

$$Ln(revenue\_it) = \alpha + \beta_1 * Ln(lose\_it) + \beta_2 * Ln(expand\_it) + \beta_3 * Ln(\lg dp\_it) + \beta_4 * Ln(size\_it) + \beta_5 * Ln(education\_it) + \varepsilon\_it$$

Where, I = Fujian, Guangdong, Guangxi, Hainan, Zhejiang, t = 2008,2009,......, 2017.

Model regression results:

Equation: EQ02 Workfile: TAIFENG BALANCED PANE...

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: LNREVENUE
Method: Panel Least Squares
Date: 03/25/20 Time: 19:42
Sample: 2008 2017
Periods included: 10
Cross-sections included: 5
Total panel (balanced) observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.396471	0.636356	-0.623033	0.5365
LNSIZE	0.323299	0.330153	0.979242	0.3328
LNLOSE	0.028288	0.020479	1.381317	0.1742
LNGDP	0.729417	0.036675	19.88885	0.0000
LNEXPAND	-0.091732	0.031204	-2.939780	0.0052
EDUCATION	0.028418	0.007096	4.004906	0.0002

R-squared	0.957804	Mean dependent var	7.514624
Adjusted R-squared	0.953009	S.D. dependent var	0.890969
S.E. of regression	0.193138	Akaike info criterion	-0.338657
Sum squared resid	1.641300	Schwarz criterion	-0.109214
Log likelihood	14.46643	Hannan-Quinn criter.	-0.251284
F-statistic	199.7525	Durbin-Watson stat	0.866439
Prob(F-statistic)	0.000000		

Fig.11 Model regression results

Next, model test was carried out to make residual diagnosis:

Section independence test (null hypothesis: there is no contemporaneous section correlation; Alternative hypothesis: there is a cross-section correlation at the same time) :

Equation: EQ02 Workfile: TAIFENG BALANCED PANE...

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: EQ02
Periods included: 10
Cross-sections included: 5
Total panel observations: 50
Note: non-zero cross-section means detected in data
Cross-section means were removed during computation of correlations

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	33.93293	10	0.0002
Pesaran scaled LM	5.351566		0.0000
Pesaran CD	0.533136		0.5939

Fig. 12 Section independence test

The test results show that the null hypothesis is rejected and there is a cross-sectional correlation at the same time.

Heteroscedasticity test (null hypothesis: residuals are homoscedasticity; Alternative hypothesis: Heteroscedasticity exists in residuals) :

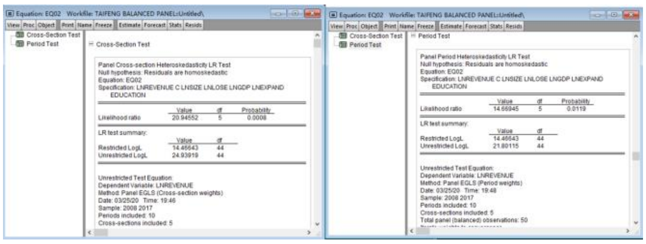
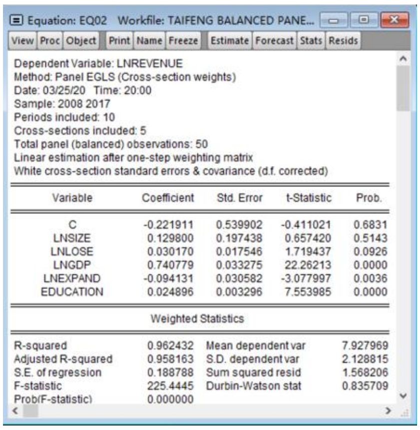


Fig. 13 Heteroscedasticity test

The test results show that the null hypothesis is rejected and the residuals are heteroscedasticity.

Based on the results of the above model test, the model is modified. The generalized least squares is set as cross-section weights, and the robust estimation of the covariance of the coefficients is set as White cross-section.

Final regression results of the model:



Equation: EQ02 Workfile: TAIFENG BALANCED PANE...

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: LNREVENUE
Method: Panel EGLS (Cross-section weights)
Date: 03/25/20 Time: 20:00
Sample: 2008 2017
Periods included: 10
Cross-sections included: 5
Total panel (balanced) observations: 50
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.221911	0.539902	-0.411021	0.6831
LNSIZE	0.129800	0.197438	0.657420	0.5143
LNLOSE	0.030170	0.017546	1.719437	0.0926
LNGDP	0.740779	0.033275	22.26213	0.0000
LNEXPAND	-0.094131	0.030582	-3.077997	0.0036
EDUCATION	0.024896	0.003296	7.553985	0.0000

Weighted Statistics

R-squared	0.962432	Mean dependent var	7.927969
Adjusted R-squared	0.958163	S.D. dependent var	2.128815
S.E. of regression	0.188788	Sum squared resid	1.568206
F-statistic	225.4445	Durbin-Watson stat	0.835709
Prob(F-statistic)	0.000000		

Fig. 14 Final regression results of the model

The preliminary regression results were obtained, followed by model test and residual diagnosis. The cross-sectional independence test results show that the null hypothesis is rejected, and the cross-sectional correlation exists. The results of heteroscedasticity test showed that the null hypothesis was rejected and the residuals had heteroscedasticity.

Based on the results of the above model test, the model is modified.

Final regression results of the model:

variable	coefficient	P value
C	-0.222	0.68
Lnsize	0.13	0.51
Lnlose	0.0301*	0.09
Lngdp	0.741**	0.00
Lnexpand	-0.094**	0.0036
Education	0.025**	0.00

Note: 1.* means significant at 10% confidence level; 2.** indicates significant at a 5% confidence level.

2. The F statistic and DW statistic of the model are 225 and 0.84 respectively.

The regression results of the model show that the correction R square is large, indicating that the model fitting degree is good. F test is significantly non-zero, indicating that the corresponding parameters of the five variables are not all zero, that is to say, the combination of the five explanatory variables has a significant impact on the premium income of the explained variable. The T test results showed that the explanatory variables lngdp, lnexpand and education coefficients were significant, the explanatory variable lnlose coefficient was significant, and the explanatory variable lnsize coefficient was not significant.

4. Result analysis

(1) Typhoon disasters

According to the regression results of the model, the coefficient of direct economic loss of typhoon disaster is relatively significant, which is positively correlated with the premium income. This indicates that the frequent occurrence of typhoon disasters will promote the demand for catastrophe insurance to some extent, which also verifies the theory of catastrophe insurance demand theory that background risks will positively influence the demand for catastrophe insurance.

(2) Gross Regional Product

From the regression results of the model, it can be seen that the coefficient of regional gross product is significant, which is positively correlated with premium income, and the regional gross product has a strong explanatory power to premium income. This shows that the economic level is indeed a very important factor affecting the demand for catastrophe insurance. The higher the economic level of people is, the higher the corresponding demand for catastrophe insurance will be, and the economic development is closely related to the demand for catastrophe insurance.

(3) the risk attitude of the applicant

From the regression results of the model, it can be seen that the coefficient of the education level of employees is significant, and the education level of employees is positively correlated with the premium income. This indicates that the risk aversion attitude will promote the demand for catastrophe insurance to some extent. In other words, if the policyholder's risk attitude is risk aversion, he is more likely to purchase catastrophe insurance.

(4) Social capital

According to the regression results of the model, the coefficient of the average household size is not significant, and the average household size has limited explanation for the premium income. The possible reason is that our choice is to take the sum of the income of home property insurance, enterprise property insurance and agricultural insurance as the explained variable premium income, in which enterprise property insurance accounts for a large proportion, but the connection between enterprise property insurance and household is not very big. At the same time, another possible reason is that the definition of social capital is relatively broad, and the average household size index we selected is not particularly representative, so it can not well reflect the social capital of a family.

(5) Government disaster relief system

According to the regression results of the model, the coefficient of the government's natural disaster relief expenditure is significant, and the government's natural disaster relief expenditure is negatively correlated with the premium income. This indicates that the government disaster relief system has a significant inhibitory effect on the demand for catastrophe insurance, which also verifies that the government disaster relief system has a so-called "crowding out effect" on the demand for catastrophe insurance in the theory of catastrophe insurance demand. Residents in disaster-stricken areas will no longer be willing to buy catastrophe insurance when they are used to waiting for government rescue and compensation.

5. Conclusions and Suggestions

Summarizing the conclusions drawn from the above empirical analysis, we can know that:

(1) The higher the economic level, the higher the demand for catastrophe insurance.

(2) Risk attitude is risk aversion, so there will be a willingness to purchase catastrophe insurance.

(3) The government disaster relief system has a great impact on the demand for catastrophe insurance. If the disaster relief system is mainly assisted by the national government, the demand for catastrophe insurance will be restrained.

Accordingly, we propose the following suggestions:

(1) Provide specific catastrophe insurance types. China has become the world's second largest economy, and China's economy is still developing rapidly, so the demand for catastrophe insurance is bound to be higher and higher, and the call for the establishment of catastrophe risk management system is also becoming stronger and stronger. Therefore, governments and each big insurance company should be cooperation as soon as possible, combined with the rate of insurance company actuarial advantages and national government propaganda and policy regulation, introduced specific catastrophe risks, in order to let the insurance is covered by insurance have more choices, not only choice, although there is a natural disaster insurance liability but common property insurance premiums are low.

(2) Improve the public's awareness of catastrophe risk prevention. The national government should strengthen the education related to catastrophe risk, improve the risk prevention awareness, risk diversification awareness and disaster self-rescue knowledge of the people in the disaster-stricken areas, popularize the role of catastrophe insurance to the public, or provide corresponding subsidies for those who buy catastrophe insurance, so as to change the risk attitude of the people in the disaster-stricken areas.

(3) Learn from the existing excellent catastrophe insurance system. The national government should make full use of the developed foreign natural disaster relief system, learn from foreign catastrophe risk management system, and combine with China's national conditions to change the current traditional inefficient natural disaster relief system in China, so as to reduce the financial burden, improve the efficiency of fund utilization and reduce the fluctuation of fiscal expenditure demand. The establishment of catastrophe risk management system is a more rational and long-term solution. China should give full play to the advantages of market economy and establish a catastrophe risk management system suitable for China.

Acknowledgements

Jing Wei would like to acknowledge financial support provided by National Natural Science Foundation of China (11702094),Natural Science Foundation of Hebei Province, E2017209178) and Fundamental Research Funds for the Central Universities, (3142018060, 3142013025, 3142016023).

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