An Empirical Analysis of the Factors Influencing the Development of Insurance Industry in China

Ting Li and Menggang Li

Abstract
This article analyzes the relationship between inflation, increase of investment in fixed assets, monetary policy, financial openness, national savings, macro-economic climate index, deposit rate, and the development of insurance industry in China. We set the incremental indicators as the variables and constructed an analysis integrating a multiple linear regression, stepwise regression, and robustness analysis, and used historical monthly data sample during the period of January 2004 to December 2017 for empirical analysis. The result indicates that (a) the national savings and macro-economic climate index are the major factors that influence the development of insurance industry in China by now; (b) to improve the development of insurance industry, both the economic growth and people’s income should continue to advance; and (c) financial openness should be paid more attention to, which is insufficient, and there is lack of competitive vitality in the whole insurance market.

Keywords
insurance, development of insurance industry, national savings, macro-economic climate index, financial openness

Introduction
Insurance constitutes an integral part of finance, thus the healthy development and safety of insurance industry are of great significance to the social and economic development in a country, which even involve the safety and stability of the whole community to a certain degree. In China, premium reached 3.66 trillion Yuan in 2017, making the premium size of China the second largest in the world. However, in terms of insurance depth, density of China is weak, which represents that the development depth and breadth of insurance industry of China is weak. In 2016, the insurance density of China was US$377 per person, while the average insurance density of the world was US$621 per person, which is almost twice as high as China. Meanwhile, the insurance depth of China was 4.1%, while the average insurance depth of the world was 6.1% (Hu, 2018). It is obvious that there is a big gap between China and the average level of the world. Therefore, it is necessary to study and analyze the factors that affect the development of the insurance industry to promote further development of the insurance industry in China.

In addition, in terms of financial openness of China, the insurance industry is the earliest and most open. By the end of 2017, the original premium income of foreign insurance companies was 214.06 billion Yuan, and the market share was 5.85%. In detail, (a) 22 foreign property insurance companies (85 property insurance companies in China) had original premium income of 20.639 billion Yuan, accounting for 1.96% of the market share; (b) 28 foreign life insurance companies (85 life insurance companies in China) had original premium income of 19.366 billion Yuan, accounting for 7.43% of the market share; and (c) in Beijing, Shanghai, Shenzhen, and Guangdong, where the foreign insurance companies are relatively concentrated, the market shares of foreign insurance companies were 14.65%, 15.22%, 8.91%, and 10.46%, respectively (Feng et al., 2018). By contrast, foreign insurance companies have higher market share in regions with more openness. Overall, foreign insurance companies currently account for small share and limited influence on the insurance industry of China. However, there are great differences in the regions with more openness, which indicates the problem of regional development imbalance. Therefore, we should set the financial openness as a factor which can influence the development of Chinese insurance industry. Moreover, at the Boao Forum in the spring of 2018, Chinese President Xi Jinping has expressly proposed to accelerate the opening up (openness) of insurance industry.

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and cancel the restriction on the proportion of foreign shareholding. The expansion of opening up will bring new opportunities and challenges to insurance industry in China. To seize the new opportunities and cope with the challenges, it is necessary to analyze the major factors influencing the development of insurance industry in China, especially add the factor of financial openness.

A fair large of literatures have analyzed the factors influencing the development of insurance in China. The scholars analyzed from different perspectives, including the macro, medium, micro, and economic perspectives by applying various methods. Arena (2008), Lee et al. (2016), Rudra et al. (2016, 2017), and Anghelache et al. (2019) have conducted research on the relationship between insurance development and economic growth and used data from different countries of the world. Hong et al. (2014), Tang (2015), Gao (2018), and Wang (2019) have analyzed the relationship between insurance development and economic growth in China. They have found that the economic growth significantly promoted the development of insurance, since the economic growth reflects the insurance demand and the financial situation of people represents the purchasing power of insurance. Zhou (2014), Yuan (2015), and Yang and Zhu (2019) have researched the impact of monetary policy on the development of insurance industry in China. They have found that different types of monetary policy can affect the development of insurance industry differently. Hu and Chen (2012), Wang (2019), and Paunica et al. (2019) have studied how the inflation influence the development of insurance industry, resulting that the inflation would cause price rise expectations and make long-term insurance demand reduction. Tian (2017), Fu and Wang (2017), and Wang (2019) focused on the empirical analysis of the development of insurance industry in China. Their studies indicate that the national savings and increase of investment in fixed assets are important factors influencing the development of insurance industry in China. Meanwhile, Zhou and Guo (2012) and Tian (2017) have found that there is a significant negative correlation between the real interest rate and the per capita insurance expenditure in China. Moreover, different scholars have found different factors that can influence the development of insurance industry from different perspectives, such as the education (Dong, 2017; Wu & Zhao, 2011), rational industrial structure (Dong, 2017; Zheng & Zhang, 2017), market competition (Wu & Zhao, 2011), institutional environment (Lee & Chang, 2015; Lee et al., 2016), age structure (Dong, 2017) and urbanization level (Zheng & Zhe, 2017).

On the basis of the existing research, we should take into account the recent unique environment in China, especially with the acceleration of the liberalization of the Chinese insurance industry. Guo and Dong (2018) and Feng et al. (2018) have pointed out the importance of financial openness influencing the development of insurance industry in China. Therefore, we set the expansion of financial opening up in China as one of the factors influencing the insurance industry which was rarely considered before. We construct a special analysis integrating a multiple linear regression, stepwise regression, and robustness analysis to analyze the factors influencing the development of insurance industry in China.

**Previous Studies and Hypotheses**

**Development**

**Variables**

Based on previous studies and data availability, we select premium income as the leading indicator to evaluate the development of insurance industry in China, and the major factors influencing the development of insurance industry consist of the inflation, increase of investment in fixed assets, monetary policy, financial openness, national savings, macro-economic climate index, and deposit rate.

**Premium income.** Gu and Wang (2008) indicate that the safety of Chinese insurance industry requires that the effective supply of insurance industry should match the level of social and economic development. The effective demand of Chinese insurance industry should at least not be lower than that of developed countries in the same period. The insufficient effective demand of insurance industry (also the actual insufficient effective supply) means the effective supply cannot meet the needs of current social and economic development. If the effective supply (demand) is not reached, it denotes that the insurance industry is in an unsafe situation; the greater the gap, the higher the degree of unsafe. The total premium can reflect the scale of the development of the insurance industry; the higher the amount, the higher the effective supply of the insurance industry, and the higher the safety degree of the insurance industry. Therefore, in this article, we set premium income (PI) as an important leading indicator to evaluate the development of insurance industry in a country.

**Inflation.** The Fisher effect has pointed out that the inflation expectation showed a positive correlation with the interest rate. It means that the interest rate will increase upon the rise of the inflation expectation. Generally, insurance uses a fixed predetermined interest rate to calculate the premium. When the nominal interest rate increases rapidly with inflation and far higher than the insurance predetermined interest rate, the premium appears more expensive. Thus, the demand for new insurance orders reduces, and the withdrawal of cash by existing policy holders increases. Moreover, inflation will cause people to form future price rise expectations, prompting them to expand spot consumption and reduce the demand for long-term insurance, which is not conducive to the development of the insurance industry (Wang, 2019). Therefore, we can consider the inflation as an important factor affecting the development of insurance industry. In this article, we use...
the year-on-year growth rate of consumer price index (CPI) of the current month \( R_{CPI} \) to measure the inflation.

**Increase of investment in fixed assets.** The total investment in fixed assets of a country reflects the main amount of fixed asset reproduction. The growth of fixed asset investment will stimulate the growth of property insurance, thus affecting the growth of the insurance industry (Tian, 2017). In 2006, the investment in fixed assets was 934.72 billion Yuan for the whole year in China. By 2017, this figure had increased to 631.68 billion Yuan (Wang, 2019). Actually, we can assume that two thirds of the assets are invested in the construction in progress and buy insurance products at a rate of 1%, which will generate a large premium income. It can be said that the growth of fixed asset investment plays an important role in the development of insurance industry. Therefore, the increase of investment in fixed assets \( IIFA \) can be one of the important factors affecting the development of insurance industry.

**Financial openness.** Since the opening of Chinese insurance industry to the outside world, foreign-funded insurance institutions have played a positive role in promoting the standardization of Chinese insurance industry. The impact on the insurance market has gradually increased, although there are relatively slow development of foreign insurance institutions and relatively small share. Guo and Dong (2018) have pointed out that the policy of further opening up can help foreign insurance institutions to open up the Chinese market and play a positive role in promoting the insurance industry. It can improve the product research and management, promote the competition in the insurance industry, and, thus, improve market efficiency and protect the interests of consumers. Although the influence of further financial opening policy on the competition pattern of Chinese insurance industry is limited in the short term, it is an important factor affecting the development of Chinese insurance industry in the long run.

Dong (2019) thinks that (a) the contents of financial openness can be basically reflected by the provisions and constraints of financial items through policies and regulations; (b) the regulations or constraints on capital account and financial services trade are the core contents of financial openness; and (c) the larger the total amount of capital and financial account inflow and outflow in the current year, the smaller the government's restrictions on financial openness, and the greater the corresponding financial openness. In this article, we adopt the total inflow and outflow of the capital and financial account in balance of international payments of China as the indicator of financial openness \( \text{Openness}_{fu} \), which mainly reflect the financial openness of a country.

**National savings.** National savings \( NS \) increase shows two opposing effects on insurance: (a) income effect and (b) substitution effect. The income effect can facilitate the development of insurance, since the rise of personal savings indicates the increase of personal wealth by four reasons. First, according to the consumption theory, when personal wealth increases, consumption grows, and the quantity of durables purchased by consumers grows. Thus, people will purchase insurance for their durables to prevent any loss. Second, when people's wealth has accumulated to a certain level, they will purchase insurance for their wealth. Third, according to the Maslow’s hierarchy of needs, people will consider the higher level demands (e.g., nursing of the aged, and medical care) after meeting the basic demands of life. It brings the demands on insurance. Fourth, with the increase of wealth, people will consider how to preserve or increase the value of idle funds, and purchase saving insurance products as a kind of investment. The substitution effect means that personal savings may substitute for the security function of insurance, and people save more may suggest that people purchase fewer insurance products. However, it is generally believed that the income effect of national savings is greater than the substitution effect.

**Macro-economic climate index.** The development of macro-economy can influence or determine the insurance demand. Insurance demand refers to the real purchasing power demand for various insurance products. To prevent risk and avoid losses, the policyholders are willing to pay the premium to avoid the major losses that may arise in the future. Tang (2015) has found that the main reasons that can affect the insurance demand are risk tolerance, idle funds, and insurance awareness. However, the development of macro-economy can determine the abovementioned reasons, mainly reflected as follows: (a) in the case of rapid economic development, the amount of existing wealth of policy holders will increase. It will bring more financial security concerns and resulting in an increase in the total amount of risk, so that the demand for insurance; (b) it will actually increase the average income level of residents and improve the real purchasing power of people to insurance; and (c) the development of macro-economy will raise the people's demand for various consumer goods, thus producing more demand for insurance.

Generally, the development of macro-economy is measured with gross domestic product (GDP) by scholars. However, the GDP is not published by monthly in China, we employ the macro-economic climate index \( EI_{macro} \) as a surrogate indicator alternatively. \( EI_{macro} \) is also called entrepreneur expectation index. It reflects entrepreneurs' confidence in macro-economic environment and forecasts the future trend of economic development. When \( 100 < EI_{macro} < 200 \), it suggests a favorable environment for macro-economy; when \( 0 < EI_{macro} < 100 \), it indicates a gloomy environment for macro-economy. Therefore, it is believed that a greater \( EI_{macro} \) means a better situation of social and macro-economic development.

**Deposit rate.** The deposit rate will affect the savings of residents, thus affecting the development of the insurance
industry. Zhou and Guo (2012) have concluded through an empirical research that there is a significant negative correlation between the real interest rate and the per capita insurance expenditure in China. When the rate is high, the people will choose the products of bank instead of the insurance. According to previous research, we choose the 1-year deposit rate \( r_{\text{deposit}} \) as the indicator.

**Data Source**

The historical data set consisting of 168 monthly data samples from the Wind database during the period of January 2004 to December 2017 is used for empirical analysis in this article. Before the test, we have carried on a stationarity test to the data to make sure it is stationary. For some data missing, we have done the following: (a) \( \text{IIFA} \) of each January is missing, thus \( \text{IIFA} \) of February is divided into two parts for January and February, respectively; (b) the total inflow and outflow of capital and financial account in balance of international payments of China \( \text{Openness}_{\text{fin}} \) is only quarterly, and we use the linear method to convert quarterly data into monthly data.

To eliminate the heteroscedasticity and multi-collinearity of data, and prevent the violent fluctuation caused by data changes, we adopt the logarithm values of premium income \( \ln \text{PI} \), increase of investment in fixed assets \( \ln \text{IIFA} \), financial openness \( \ln \text{Openness}_{\text{fin}} \), national savings \( \ln \text{NS} \), and macro-economic climate index \( \ln \text{EI}_{\text{macro}} \). We also have done the \( F \)-test on them, and the test result is significant. Table 1 shows the descriptive statistics of relevant variables.

**Method**

We construct an analysis integrating a multiple linear regression, stepwise regression, and robustness analysis. The process can be expressed as three parts, as follows:

1. Construct an initial model and check the multi-collinearity; a multiple linear regression is applied to build the initial model as:

   \[
   y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + \epsilon, \quad (1)
   \]

   where \( y \) is the value of leading indicator to evaluate the development of insurance industry, \( x_{n}, n = 1, 2, \ldots \) are the values of the factors influencing the development of insurance industry, and \( \epsilon \) is a random error term which meets the general classical hypothesis of econometrics. Then, a regression analysis of all the factors is done to check the multi-collinearity and calculate the correlation coefficients between pairs of the variables.

2. Find an optimal combination of variables without collinearity: a stepwise regression is used. A stepwise regression is actually a feature extraction method that can find an optimal combination of variables that can explain most dependent variable variation. In this step, Formula 1 can be improved as:

   \[
   y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \epsilon, \quad (2)
   \]

   where \( y \) is the value of leading indicator to evaluate the development of insurance industry, \( x_{k}, k = 1, 2, \ldots, k < n \) are the values of factors selected by stepwise regression, and \( \epsilon \) is a random error term which meets the general classical hypothesis of econometrics.

3. Perform a robustness analysis: the common DF method proposed by Dickey–Fuller is applied for the variable stationarity test first. If the variables are stationary, a vector auto-regressive (VAR) model will be built; if the variables are non-stationary, a vector error correction model (VECM) will be constructed, and then a cointegration test and other model tests (model residual autocorrelation test and VECM system stability test) will be generated.

**Empirical Test and Results**

**Initial Model Construction and Regression Analysis**

A multiple linear regression is applied to construct the initial model to analyze the relationship between the year-on-year growth rate of CPI of the current month \( \text{RCPI} \), the increase of investment in fixed assets \( \text{IIFA} \), the financial openness \( \text{Openness}_{\text{fin}} \), the national savings \( \text{NS} \), the macro-economic climate index \( \text{EI}_{\text{macro}} \), the 1-year deposit rate \( r_{\text{deposit}} \), and the premium income \( \text{PI} \) which indicate the development of insurance industry in China. According to Formula 1, this specific initial model can be expressed as:

\[
\ln \text{PI} = \beta_0 + \beta_1 \text{RCPI} + \beta_2 \ln \text{IIFA} + \beta_3 \ln \text{Openness}_{\text{fin}} + \beta_4 \ln \text{NS} + \beta_5 \ln \text{EI}_{\text{macro}} + \beta_6 r_{\text{deposit}} + \epsilon. \quad (3)
\]

Table 2 shows the results of the regression analysis for all the factors that influence \( \ln \text{PI} \) and itself. The \( R^2 \) value of this model is .999, which is relatively high. The insignificant

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**Table 1. Descriptive Statistics of Relevant Variables.**

| Variable      | Obs. | M     | SD   | Minimum | Maximum |
|---------------|------|-------|------|---------|---------|
| \( \ln \text{PI} \) | 168  | 19.85 | 1.306| 15.16   | 21.50   |
| \( \text{RCPI} \) | 168  | 0.236 | 0.573| -1      | 2.600   |
| \( \ln \text{IIFA} \) | 168  | 9.800 | 0.924| 7.405   | 11.25   |
| \( \ln \text{Openness}_{\text{fin}} \) | 168  | 11.05 | 1.329| 5.006   | 12.29   |
| \( \ln \text{NS} \) | 168  | 12.57 | 0.556| 11.60   | 13.38   |
| \( \ln \text{EI}_{\text{macro}} \) | 168  | 4.524 | 0.187| 4.170   | 4.831   |
| \( r_{\text{deposit}} \) | 168  | 2.562 | 0.737| 1.500   | 4.140   |
coefficients $R_{CPI}$, $\ln IIFA$, and $\ln E_{macro}$ suggest the possibility of severe multi-collinearity. Thus, a multi-collinearity analysis should be performed and Table 3 shows the results. It shows the large correlation coefficients between several pairs of variables, and it can be believed that this model is exposed to severe multi-collinearity.

**Stepwise Regression for Finding an Optimal Combination of Variables**

A stepwise regression is used as a feature extraction method to find an optimal combination of variables that can explain most dependent variable variation. Forward selection, backward elimination, and bidirectional elimination are the three methods used usually. (a) **Forward selection**: only one independent variable is in the model that explains the largest dependent variable variation first, and then another independent variable is added to see whether the dependent variable variation explained by the whole model increases significantly after adding it ($F$-test, $t$-test, etc.). This process iterates over until no independent variable meets the conditions of adding the model. (b) **Backward elimination**: in contrast to forward selection, all variables are put into the model, and then try to remove one of the independent variables to see whether there is a significant change in the variation of the explanatory variables in the whole model, and the variables that minimize the amount of interpretation will be eliminated. This process continues to iterate until no independent variables meet the condition of elimination. (c) **Bidirectional elimination**: it is equivalent to combining the forward selection and backward elimination. It is not blindly increasing variables, but after adding one, all variables in the whole model are tested and the variables with no significant effect are eliminated. Finally, an optimal combination of variables is obtained.

In this article, we apply the bidirectional elimination. First, we construct six simple linear regression models of $\ln PI$, respectively, to $R_{CPI}$, $\ln IIFA$, $\ln Openness_{fin}$, $\ln NS$, $\ln E_{macro}$, and $\ln deposit$. Table 4 shows the results. According to the $R^2$ value, the fitting effect between $\ln PI$ and $\ln Openness_{fin}$ is the best achieving .965, which means that the financial openness exerts the greatest influence on $\ln PI$. Based on the goodness-of-fit in these models, the sequence of the seven explanatory variables can be determined as:

$$R^2(\ln Openness_{fin}) > R^2(\ln NS) > R^2(\ln IIFA) > R^2(\ln E_{macro}) > R^2(R_{CPI}) > R^2(\ln deposit).$$

With the model of $\ln PI$ to $\ln Openness_{fin}$ as the optimum basic model, we introduce each explanatory variable to seek the optimum regression model and Table 5 shows the results. According to the results shown in Columns 1, 2, and 6 in Table 5, it is confirmed that the major variables can affect $\ln PI$, which consists of $\ln Openness_{fin}$, $\ln NS$, and $\ln deposit$. Therefore, we can improve Formula 2 as:

$$\ln PI = \beta_0 + \beta_1 \ln Openness_{fin} + \beta_2 \ln NS + \beta_3 \ln deposit + \epsilon.$$ 

Table 2. Regression Results of the Initial Model.

| Variable   | (1) $\ln PI$ | (1) $\ln PI$ |
|------------|--------------|--------------|
| $R_{CPI}$  | 0.00825      | -0.0452***   |
| $\ln IIFA$| 0.0133       | 1.764***     |
| $\ln Openness_{fin}$ | 0.643*** | Observations 168 |
| $\ln NS$  | 0.860***     | 0.860***     |
| $\ln E_{macro}$ | 0.0336 | $R^2$ .999     |

Table 3. Correlation Coefficient Matrix of Independent Variables.

| Variable   | $R_{CPI}$ | $\ln IIFA$ | $\ln Openness_{fin}$ | $\ln NS$ | $\ln E_{macro}$ | $\ln deposit$ |
|------------|-----------|-------------|----------------------|----------|----------------|--------------|
| $R_{CPI}$  | 1         | ---         | ---                  | ---      | ---             | ---          |
| $\ln IIFA$|          | -2.68       | 1                    | ---      | ---             | ---          |
| $\ln Openness_{fin}$ |          | ---        | -.063               | .834     | 1               | ---          |
| $\ln NS$  |          | ---        | -.094               | .879     | .887            | 1            |
| $\ln E_{macro}$ |          | ---        | -.181               | -.646    | -.579           | -.757        |
| $\ln deposit$ |          | ---        | .085                | -.13     | .0560           | -.218        | .449         |

Note. Robust standard errors in parentheses.

$*** p < .01$. 

According to the result shown in Column 6 of Table 5, the main factors affecting the premium income (insurance safety) are financial openness, national savings, and deposit rate. In detail, the coefficient of $\ln Openness_{fin}$ reached three stars and the coefficient is .646. It is means that for every 1% increase in financial openness, premium income will increase by 0.646%. In the economic sense, financial openness can help foreign insurance institutions to open up the Chinese market and play a positive role in promoting the insurance industry. It can also improve the product research and management, promote the competition in the insurance industry, and, thus, improve market efficiency and protect the interests of consumers. The coefficient of $\ln NS$ also reached three stars and the coefficient is .866. It is means that for every 1% increase in national savings, premium income will increase by 0.866%. Since the coefficient is positive, the income effect of savings on insurance demand is greater than the substitution effect. In the economic sense, the increase of national savings shows that the income of residents has increased. On this basis, both the real purchasing power of
residents and the demand for insurance have increased, which will promote the development of insurance business. Thus, the premium income of insurance industry will increase with the increase of national savings. In addition, the coefficient of deposit is also very significant, achieving \(-0.0418\). It means that for every 1% increase in deposit rate, insurance premium income will decrease by 0.0418%. It indicates that when the deposit rate increases, the people are inclined to put money in the bank, which is not conducive to the development of the insurance industry.

**Endogenous Analysis**

The endogeneity of the variables caused by bidirectional interactions is the most common endogeneity issue. In this article, there may be bidirectional interactions between the

### Table 4. Estimated Results of Simple Linear Regression of $\ln PI$ to Seven Variables.

| Variable         | 1   | 2   | 3   | 4   | 5   | 6   |
|------------------|-----|-----|-----|-----|-----|-----|
| $\ln RCPI$       | -0.172 | —   | —   | —   | —   | —   |
|                  | (0.178) | —   | —   | —   | —   | —   |
| $\ln IIFA$       | —   | 1.237*** | —   | —   | —   | —   |
|                  | (0.067) | —   | —   | —   | —   | —   |
| $\ln Openness_{fn}$ | —   | —   | 0.965*** | —   | —   | —   |
|                  | (0.030) | —   | —   | —   | —   | —   |
| $\ln NS$         | —   | —   | —   | 2.246*** | —   | —   |
|                  | (0.0795) | —   | —   | —   | —   | —   |
| $\ln EI_{macro}$ | —   | —   | —   | —   | 4.666*** | —   |
|                  | —   | —   | —   | —   | (0.370) | —   |
| $r_{deposit}$    | —   | —   | —   | —   | —   | -0.119*** |
|                  | —   | —   | —   | —   | —   | (0.119) |
| Constant         | 19.89*** | 7.727*** | 9.180*** | -8.385*** | 40.95*** | 20.15*** |
|                  | (0.110) | (0.696) | (0.341) | (1.024) | (1.625) | (0.378) |
| Observations     | 168 | 168 | 168 | 168 | 168 | 168 |
| $R^2$            | .006 | .767 | .965 | .915 | .448 | .005 |

Note. Robust standard errors in parentheses.

***$p < .01$.

### Table 5. Results of Stepwise Regression.

| Variable         | 1   | 2   | 3   | 4   | 5   | 6   |
|------------------|-----|-----|-----|-----|-----|-----|
| $\ln Openness_{fn}$ | 0.965*** | 0.618*** | 0.616*** | 0.622*** | 0.618*** | 0.646*** |
|                  | (0.0302) | (0.00685) | (0.00696) | (0.00654) | (0.00686) | (0.00541) |
| $\ln NS$         | —   | 0.936*** | 0.927*** | 0.911*** | 0.937*** | 0.866*** |
|                  | (0.0173) | (0.0189) | (0.0205) | (0.0174) | (0.0135) | —   |
| $\ln IIFA$       | —   | —   | 0.00780 | —   | —   | —   |
|                  | —   | —   | (0.00790) | —   | —   | —   |
| $\ln EI_{macro}$ | —   | —   | —   | -0.0640** | —   | —   |
|                  | —   | —   | —   | (0.0277) | —   | —   |
| $RCPI$           | —   | —   | —   | —   | 0.00287 | —   |
|                  | —   | —   | —   | —   | (0.00602) | —   |
| $r_{deposit}$    | —   | —   | —   | —   | —   | -0.0418*** |
|                  | —   | —   | —   | —   | —   | (0.00538) |
| Constant         | 9.180*** | 1.255*** | 1.300*** | 1.811*** | 1.249*** | 1.939*** |
|                  | (0.341) | (0.154) | (0.159) | (0.293) | (0.155) | (0.124) |
| Observations     | 168 | 168 | 168 | 168 | 168 | 168 |
| $R^2$            | .9650 | .9986 | .9986 | .9986 | .9986 | .9989 |

Note. Robust standard errors in parentheses.

**$p < .05$. ***$p < .01$.**
Table 6. Regression Results of Instrument Variable.

| Variable          | 1      | 2      | 3      | 4      |
|-------------------|--------|--------|--------|--------|
| \( \ln Openness_{fin} \) | —      | 1.563*** | —      | 0.302*** |
| \( IMEX \)        | (0.916) | —      | (0.0752) | —      |
| \( \ln NS \)      | 0.393*** | 2.431  | 1.304*** | —      |
| \( r_{deposit} \) | (0.102) | (1.508) | (0.0204) | —      |
| Constant          | 8.401*** | 14.55*** | 3.937*** | 7.213*** |
| \( \ln PI \)      | (2.298) | (5.020) | (0.281) | (1.999) |

Note. Robust standard errors in parentheses.

| Variable          | Test of unit root t | p-value | Conclusion |
|-------------------|---------------------|---------|------------|
| \( \ln PI \)     | -3.378              | .0117   | Stationary |
| \( \ln Openness_{fin} \) | -14.296            | .0000   | Stationary |
| \( \ln NS \)     | -1.380              | .5921   | Non-stationary |
| \( r_{deposit} \) | -0.847              | .8049   | Non-stationary |
| \( d_{ln PI} \)   | -22.357             | .0000   | Stationary |
| \( d_{ln Openness_{fin}} \) | -14.296            | .0000   | Stationary |
| \( d_{ln NS} \)   | -12.336             | .0000   | Stationary |
| \( d_{ln r_{deposit}} \) | -8.472             | .0000   | Stationary |

Table 7. Unit Root Stationarity Test Results.

safety degree of the insurance industry and financial openness. On one hand, the higher the safety degree of insurance industry, the more and deeper the expansion of financial openness. On the other hand, the more and deeper expansion of financial openness can always make a higher safety degree of insurance industry. Therefore, we have made an endogenous analysis and introduced the import and export (Wind database: IMEX, data from Win.d database) as an instrumental variable of financial openness. In general, the use of instrumental variables should satisfy both the exogenous and the endogenous conditions. With regard to endogeneity, a larger IMEX can indicate more communication and closer relationship between China and foreign countries, and the higher degree of openness. Based on the result shown in Column 3 of Table 6, the coefficient of IMEX is significantly positive, which means a positive correlation between \( \ln Openness_{fin} \) and \( IMEX \), thus the endogeneity is satisfied. As to exogenous condition, we used the method introduced by He et al. (2019) by adding endogenous and instrumental variables to the regression. If the coefficient of the instrumental variable is not significant, it means there will be no direct effect, thus the exogenous condition of the instrumental variable is satisfied. According to the results shown in Table 6, (a) in Column 1, IMEX is significant without adding endogenous variables and (b) in Column 2, \( \ln Openness_{fin} \) is significant and IMEX is not significant with controlling for endogenous variables, thus indicating that the instrumental variable is exogenous.

The results shown in Columns 3 and 4 of Table 6 are the regression results of the two-stage least squares for the instrumental variable. In Column 3, the first-stage regression result shows that the coefficient of IMEX is significantly positive and the \( F \)-statistic 3985.136 is larger than the empirical threshold of 10%, thus the instrumental variable is significantly and positively correlated with endogenous variables. The result of weak instrumental variable test shows that the Cragg-Donald Wald \( F \)-statistic is larger than the Stock-Yogo weak ID \( F \)-test critical value under tolerance of 10% distortion. The result of the identification test shows that the Anderson canonical correlation coefficient, LM, rejects the null hypothesis (the instrumental variable is unidentified) at the significance level of 1%. Therefore, the instrumental variable satisfied both the exogenous and the endogenous conditions. In Column 4, the second-stage regression result shows that the coefficients of \( \ln Openness_{fin} \) and \( \ln NS \) are significantly positive at the significance level of 1%, and the coefficient of \( r_{deposit} \) is significantly negative, which is consistent with the previous contents of this article.

Robustness Analysis

To verify the reliability and non-randomness of the previous results, a cointegration test for \( \ln PI \), \( \ln Openness_{fin} \), \( \ln NS \), and \( r_{deposit} \) should be performed. Therefore, we can confirm whether there is a long-run equilibrium relationship among these four variables and analyze the reliability of this empirical test.

Variable stationarity test. The DF method proposed by Dickey and Fuller is applied to carry out the unit root stationarity test. If the variables are stationary, a VAR model will be built; if the variables are non-stationary, a VECM model will be constructed. Table 7 shows the results, where \( \ln PI \) and \( \ln Openness_{fin} \) are stationary and \( \ln NS \) and \( r_{deposit} \) are non-stationary. However, after the first-order difference, variables \( d_{ln NS} \) and \( d_{ln r_{deposit}} \) are stationary, while the significance of the variable \( d_{ln PI} \) is evidently improved and \( d_{ln Openness_{fin}} \) is stationary. Therefore, we can consider these four variables all show first-order stationarity. Then, a VECM model should be constructed, and a cointegration test and model test should be performed.
Before the cointegration test, we shall determine the cointegration rank of the system as well as the lag order of VAR representations corresponding to the system. The lag order is determined based on the lag length criteria in the lag structure. In this article, the Akaike information criterion (AIC) minimum standard is applied to find the optimum lag order, and it can be expressed as:

\[
AIC(p) = \ln \det \left( \sum p \right) + \frac{2n^2 p}{T},
\]

where \(n\) is the vector dimension, \(p\) is the lag order, \(T\) is the number of samples, \(\det\) denotes the determinant of the matrix, and \(\sum p\) is the estimation of the residual white noise variance–covariance matrix when the lag order is \(p\). Based on the results of the cointegration, the rank of the system is 1 and the lag order is 13, and a cointegration test is performed. Table 8 shows the results of the cointegration equation that represent the long-run equilibrium relationship of \(\ln PI\), \(\ln Openness_{fin}\), \(\ln NS\), and \(r_{deposit}\). The model can be expressed as:

\[
\ln PI = 6.433 + 0.886 \ln Openness_{fin} \\
+ 1.228 \ln NS - 0.0581 r_{deposit}. \tag{7}
\]

Table 8. Cointegration Test Results.

| Equation          | The number of parameters | \(\chi^2\) | \(p > \chi^2\) | --- | --- | --- | --- | --- |
|-------------------|--------------------------|------------|----------------|-----|-----|-----|-----|-----|
| Cointegrating equations | ce1 | 3 | 415.2 | .0000 | --- | --- | --- | --- |
| Identification: beta is exactly identified | | | | | | | | |
| Johansen’s normalization restriction imposed | | | | | | | | |

Table 9. Comparison Between MLEs and OLS Estimations.

| Coefficient of variables | MLEs | OLS estimation |
|--------------------------|------|----------------|
| lnOpenness\(_{fin}\) coefficient | 0.886*** | 0.654*** |
| lnNS coefficient | 1.228*** | 0.866*** |
| r\(_{deposit}\) coefficient | -0.0581 | -0.0418*** |

Note. MLE = maximum likelihood estimation; OLS = ordinary least squares. *** \(p < .01\).

Cointegration test. Before the cointegration test, we shall determine the cointegration rank of the system as well as the lag order of VAR representations corresponding to the system. The lag order is determined based on the lag length criteria in the lag structure. In this article, the Akaike information criterion (AIC) minimum standard is applied to find the optimum lag order, and it can be expressed as:

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\[
\ln PI = 6.433 + 0.886 \ln Openness_{fin} \\
+ 1.228 \ln NS - 0.0581 r_{deposit}. \tag{7}
\]

Table 9 shows the result of comparative analysis between the maximum likelihood estimations (MLEs) and the ordinary least squares (OLS) estimations. Since the OLS estimations are significant and similar to Johansen’s MLEs, the empirical results are reliable. It indicates that the financial openness and the national savings are the factors affecting the insurance industry in China. However, the long-term relation between the deposit rate and the development of insurance industry is not significant. Based on the results shown in Column 6 of Table 4, the coefficient of \(r_{deposit}\) is significant, but the \(R^2\) is only .005, which means less contribution to the optimization of the final model.

Model tests. A series of tests consisting of model residual autocorrelation test and VECM system stability test should be performed to insure the VECM model is optimum.

The model residual autocorrelation test aims to determine whether there is any autocorrelation in the residuals of the model. If any autocorrelation is present, the lag order should be increased. Table 10 shows the results that the original assumption of “no autocorrelation” is accepted, which means the lag order of 13 is the optimum one.

In this article, we examine whether the VECM features a stationary process through characteristic values. A stationary process requires all characteristic values inside the unit circle. Table 11 and Figure 1 show the results of the stability test; all characteristic values of the matrix, except the hypothetical unit roots of the VECM model itself, are located inside the unit circle. Therefore, it can be confirmed that this VECM model is stable.

Conclusion

In this article, we conducted the research using the incremental indicators which can influence the development of insurance industry in China, and analyzed the relationship between inflation, increase of investment in fixed assets, financial openness which was rarely considered in the past, national savings, macro-economic climate index, deposit rate, and
premium income which can evaluate the development of insurance industry. We constructed an initial model by applying multiple linear regression, then found an optimal combination of variables for feature extraction using a stepwise regression, performed a robustness analysis to test the variable stationarity, built a VECM model, and finally related tests. Moreover, we used the monthly data samples during the period of January 2004 to December 2017 for empirical analysis. The analysis result shows that (a) the major factors that influence the development of insurance industry in China include the financial openness, national savings, and deposit rate by now; (b) the financial openness should be further expanded to inject vitality into the development of the insurance industry; and (c) national savings should be improved to guarantee the development of insurance.

In the future work, we will focus on how to improve the lack of competitive vitality in the whole insurance market and expand financial openness for better development of insurance industry in China.

Table 10. Model Residual Autocorrelation Test Results.

| Lag | $\chi^2$ | df | $p > \chi^2$ |
|-----|-----------|----|----------------|
| 1   | 55.5398   | 16 | .0000          |
| 2   | 23.3032   | 16 | .10578         |
| 3   | 16.3810   | 16 | .42670         |
| 4   | 15.2848   | 16 | .50389         |
| 5   | 22.4796   | 16 | .12837         |
| 6   | 15.6817   | 16 | .47538         |
| 7   | 28.6327   | 16 | .02653         |
| 8   | 8.5051    | 16 | .93239         |
| 9   | 19.4835   | 16 | .24439         |
| 10  | 22.9477   | 16 | .11514         |
| 11  | 18.5656   | 16 | .29183         |
| 12  | 23.5777   | 16 | .09914         |
| 13  | 18.2083   | 16 | .31184         |

H0: no autocorrelation at lag order

Table 11. Model Stability Test Results.

| Eigen value | Modulus          |
|-------------|------------------|
| 0.859 + 0.494i | 0.99138        |
| 0.859 − 0.494i | 0.99138        |
| 0.984         | 0.984          |
| −0.121 + 0.981i | 0.981        |
| −0.121 − 0.981i | 0.980        |
| ...           | ...            |
| 0.219 + 0.335i | 0.399         |
| 0.219 − 0.335i | 0.399         |

The VECM specification imposes three-unit moduli

Note. VECM = vector error correction model.

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Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research is supported by the R&D Program of Beijing Municipal Education commission (Grant No. KJZD20191000401). We also thank for the support of the Program of the Co-Construction with Beijing Municipal Commission of Education of China (Grant Nos. B20H100020, B19H1000010), and thank for the funding from the Key Project of Beijing Social Science Foundation Research Base (Grant No. 19JDYJA001).

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References
Anghelache, C., Anghel, M. G., Capusneanu, S., & Topor, D. (2019). Econometric model used for GDP correlation analysis and economic aggregates. *Economic Computation and Economic Cybernetics Studies and Research*, 53(1), 183–197.
Arnau, M. (2008). Does insurance market activity promote economic growth? A cross-country study for industrialized and developing countries. *Journal of Risk and Insurance*, 75(4), 921–946.
Dong, D. D. (2017). Research on regional differences and influencing factors of insurance industry development in China [Doctoral thesis]. Chongqing Technology and Business University.
Dong, J. (2019). Research on the growth effect crisis effect of the level of financial openness-based on the data of 85 countries and regions from 2005 to 2017 [PhD thesis]. Shandong University.

Feng, Z. J., Liu, Y. H., Wang, W., Wang, H., Guo, J. L., Zheng, W., . . . Li, P. (2018). Accelerating the opening and internationalization of the insurance industry. *Insurance Theory & Practice*, 6, 1–23.

Fu, S. Y., & Wang, Y. M. (2017). An analysis on the dynamic relationship between macroeconomic and different types of insurance. *Contemporary Economics*, 30, 120–122.

Gao, X. J. (2018). Research on the relationship between insurance development and economic growth in China. *China Collective Economy*, 3, 20–22.

Gu, H. B., & Wang, Y. H. (2008). A study on the monitoring and early warning paradigm of China’s insurance industry safety. *Academic Research*, 5, 75–76.

Guo, J. L., & Dong, Y. Y. (2018). Thoughts on accelerating the development of a new pattern of full opening of the insurance industry. *Insurance Theory & Practice*, 5, 17–30.

He, X. G., Liang, Q. X., & Wang, S. L. (2019). Information technology, labor structure and enterprise productivity to solve the paradox of information technology productivity. *Management World*, 35(9), 65–80.

Hong, M., Huang, H. Z., & Jiao, J. Y. (2014). An empirical research on factors influencing the growth of Chinese insurance industry. *Insurance Studies*, 2, 11–22.

Hu, L., & Chen, J. (2012). An analysis on the influence of inflation on the development of insurance industry. *Insurance Studies*, 1, 30–35.

Hu, X. K. (2018). *Research on influencing factors and predictions of insurance development in china* [PhD thesis]. Chengdu University of Information Technology, China.

Lee, C. C., & Chang, C. H. (2015). Financial police and insurance development: Do financial reforms matter and how? *International Review of Economics and Finance*, 38, 258–278.

Lee, C. C., Chang, C. H., Mohamed, A., & Lee, C. C. (2016). Economic growth and insurance development: The role of institutional environments. *Economic Modeling*, 59, 361–369.

Paunica, M., Manole, A., Motofei, C., & Tanase, G. I. (2019). The impact of remittances on GDP and household consumption. An European union countries analysis. *Economic Computation and Economic Cybernetics Studies and Research*, 53(4), 97–114.

Rudra, P., Mak, B. A., Mathendhiran, N., John, H. H., & Atul, G. (2017). Is there a link between economic growth and insurance and banking sector activities in the G-20 countries? *Review of Financial Economics*, 33, 12–28.

Rudra, P., Pradhan, B., Mak, A., Newville, R., Norman, M. N., & John, H. H. (2016). Insurance penetration and economic growth nexus: Cross-country evidence from ASEAN. *Research in International Business and Finance*, 36, 447–458.

Tang, X. T. (2015). *Econometrical analysis of the influence factors of Chinese insurance industry development* [PhD thesis]. Dongbei University of Finance and Economics.

Tian, X. Y. (2017). *The influential factors analysis and the time series analysis of the Chinese insurance industry development* [PhD thesis]. Beijing University of Technology.

Wang, X. (2019). An empirical analysis of insurance and macroeconomics in China. *Marketing Research*, 12, 24–26.

Wu, H., & Zhao, G. Q. (2011). Evolution and interpretation of regional development differences in insurance industry: A decomposition method based on shapely value. *Insurance Research*, 10, 14–21.

Yang, R., & Zhu, J. M. (2019). An empirical study on monetary policy and insurance development based on VAR model. *Journal of Liaoning University of Technology (Social Science Edition)*, 21(3), 13–16.

Yuan, Y. M. (2015). An analysis on the influence of China’s monetary policy on insurance industry. *Fujian Finance*, 7, 27–30.

Zheng, X. T., & Zheng, K. (2017). Analysis of influencing factors and policy implications of regional unbalanced development of property insurance industry: Empirical evidence from China’s provincial panel data. *Journal of Regional Financial Research*, 7, 34–38.

Zhou, F. J. (2014). An analysis on the relation between property insurance premium income and money supply in China. *Business*, 16, Article 89.

Zhou, H. L., & Guo, J. L. (2012). Analysis on affecting factors of China’s life insurance product supply. *Insurance Studies*, 11, 62–74.