The cointegration relationship between insurance investment and China's macroeconomic variables
An empirical research based on time series analysis

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Abstract

Along with the construction of China's socialist economy, the financial sector has a greater impact on economic growth. Insurance industry plays an important role in financial sector, but scholars seldom pay attention to its impact on economic growth. We choose the data from 1999 to 2010 and especially study the impact of insurance industry on China's economic growth. We use the methods of unit root test, cointegration test and Granger Test of Causality to make an empirical research. And we find that the insurance investment Granger causes the GDP growth. It means that we can increase insurance investments to stimulate the GDP growth.

1. Introduction

With the development of China's economy and society, the status and role of financial sector in the economic growth have been more important. Foreign scholars think that the financial intermediaries can contribute to economic growth. And the financial intermediation plays an active role in mobilizing savings, evaluating the project, risk management and supervision of managers so as to promote the economic growth. That means financial intermediaries can facilitate economic growth. Also, financial intermediaries develop together with the development of the economy [1].

As one of the three important supports of modern financial system, insurance has been stimulated by economic growth when it also has a positive effect on economic growth [2]. By the end of 2011, China's insurance premium income reached 1.43393 trillion yuan and the insurance investment amounted to 3.77367 trillion yuan. In this paper, we use econometric approaches and focus on the impacts of insurance investment on China's economic growth.

2. Basic Theories and Literature Review
a) Insurance investment

Insurance investments are activities that insurance companies put their accumulated insurance funds into use to increase the value of the insurance funds in their daily business activities (SUN Qi-xiang, 2007). Insurance investments can be classified to direct investment and indirect investment in accordance with the form of investment. Insurance investments can also be classified into domestic investment and foreign investment, basing on the range in which the insurance funds are used. The scope of domestic investment gradually expanded along with the transformation of China's economic situation since the Insurance Law of the People's Republic of China acted in 1995.But it was not until July 25, 2007, the CIRC, the People's Bank of China and the State Administration of Foreign Exchange officially released Measure for the Overseas Investment with Insurance Funds which clearly states: "Allow insurance agencies to use free foreign exchange or purchase foreign exchange to do overseas investments."

b) The significance of insurance investments on the insurance industry

The insurance companies' sources of funds each year can be separated in two parts. One of them is annual premium income of insurance companies. Another important source is the investment income of insurance companies' assets, in anther words, the insurance company's investment income. This can be described as following reasons. First, insurance investment can help insurance companies make more profit in the increasingly fierce competition in the industry. Second,

insurance investment can help insurance companies to have more effective management of their existing assets and decrease the risks of impairments of their assets. Third, insurance investment can help the country to have a stable economic development if the insurance funds are be used appropriately because the insurance companies have a huge amount of insurance funds. By this reasons, insurance investment can help the insurance industry to take a further step in sustained and stable development.

c) Literature review

Scholars make many researches on the relationship between the development of finance and economy. But there are relatively few studies about the interaction between insurance and economic. We can mainly summarize the literatures as follows.

Foreign scholars mainly have the following studies. Kugler & Ofoghi (2005) use Johansen cointegration test and Granger causality test to estimate the long-term relationship between the insurance market size and economic growth in United Kingdom from 1966 to 2003. Marco Arena (2006) uses panel data estimation method (GMM model) to do an empirical research. He uses the data of 56 countries from 1976 to 2004 to make a systematic assessment of the impact of insurance market activities on economic growth. Ward & Zurbruegg (2000) use VAR error correction model on nine leading OECD countries from 1961 to 1996 and found that some of the countries' economic growth has a long-term relationship between insurance market activities.

Native scholars mainly have the following studies. SHI Li-yuan (2012) uses econometric methods, the VEC model and the Granger causality test, coming to a conclusion that the economic growth is driven by the development of insurance industry but the impacts of insurance on economic growth is not obvious. ZHAO Shang-mei, LI Yong and PANG Yu-feng (2009) use the theory of relationship between financial development and economic growth and take the two-sector model to study. This study reveals that the insurance industry plays an important role on economic growth and there are spillover effects on non-insurance sectors. CAO Qian and HE Jian-min (2006) use the auto-regressive model (VAR) and error correction model (ECM) to study the relationship between the two macroeconomic variables, China's GDP and premium income, coming to a conclusion that there is not significant Granger causality between the premium income and economic growth.

3. The Status of China's Insurance Industry

a) Overview of China's insurance market

By the end of the year 2010, there were totally 8 Insurance Group, 126 insurance companies and 10 insurance asset management companies in China. And by the end of 2011, China's premium income has reached 1.43393 trillion yuan. Among these premium income, property insurance premium income was 461.78 billion yuan, accounting for 32.2%; life insurance premium income was 869.56 billion yuan, accounting for 60.6%; health insurance premium income was 69.17 billion yuan, accounting for 4.8%, personal accident insurance premium income was 33.41 billion yuan, accounting for 2.3%. China's premium income in 2011 was 19.7 times that of 1999, an average annual growth rate of 28.2% during the 12 years, which indicated a rapid growth of China's insurance industry. Moreover, in the use of insurance funds, from January to December in the year of 2011, the insurance investments amounted to 3.77367 trillion yuan, which was 42.3 times that of 1999, 89.14 billion yuan, an average annual growth rate of 36.6%. From here we see that China's insurance industry developed very rapidly during the 12 years and we can conjecture that the impact of insurance investment on the economy also increased.

b) Insurance investment channels and the use of insurance funds

Insurance investment channel refers to the types of specific projects in which insurance company funds are used. From the international experiences, insurance investment channels include bank deposits, bonds (government bonds, corporate bonds, financial bonds, etc.), funds, stocks, loans, real estate and overseas investment. According to the Insurance Law of the People's Re-public of China acted which acted in 1995, the use of insurance funds is limited to bank deposits, treasury bonds, financial bonds and other ways to use the insurance funds which are regulated by the State Council. Insurance investment channels have been widen and regulated for the use of insurance funds, since CIRC was established in 1998. The use of insurance funds in China, now, limits to bank

deposits, government bonds, financial bonds, central corporate bonds which are specified by China Insurance Regulatory Commission, subordinated bonds, securities investment funds, convertible bonds, stocks, infrastructure projects, overseas investments and other ways to use the insurance funds which are regulated by the State Council.

c)   Trend of the use of insurance funds

Insurance companies (especially life insurance companies) invest huge amount of money in the economy and have become important institutional investors in the financial markets. In such economic circumstances, the use of insurance funds faces the following trends. First, insurance companies will focus on portfolio investment and stress on the combination of a wide range of investment strategies. By this way, they can reduce the risks of insurance investment effectively and increase the return rates of insurance investments, to ensure the safety of the insurance funds. Second, it is necessary for insurance companies to train professional insurance investors. The use of insurance funds has to meet the characteristics of the funds. So, professional talents are urgently needed to analyze and manage the use of insurance funds. Third, insurance companies have to enhance risk control and improve the regulatory system. Due to the special characteristics of the insurance funds, insurance companies must implement a parallel strategy both on internal supervision and external supervision to reduce the risks of the insurance investment.

4.   Date Selection

In order to study the interaction between insurance in-vestment and China's macro-economy, we select insurance investment and macroeconomic variables to make an empirical study. Insurance investment in this paper refers to the cumulative amount of the insurance investments in the economy which is provided by the CIRC. For macroeconomic variables, we select the gross domestic product (GDP) and money supply (M1). These two macroeconomic variables, GDP is closely related to economic growth in China and the money supply is closely related to China's investment environment. So, these two economic variables can be able to reflect the macroeconomic environment, which insurance investment depends on, more effectively.

Among them, the insurance investment (Insurance In-vestment, hereinafter referred to as II) data is from the website of CIRC and the data of money supply (M1) can be obtained from the website of the People's Bank of China. Also, the GDP figures are from the website of National Bureau of Statistics. The insurance investment figures provided by the CIRC website date back to 1999 and the gross domestic product (GDP) provided by the National Bureau of Statistics website at least date to 2010. Therefore, according to the data availability, we select the year from1999 to 2010 and choose the time series date by the end of the four quarters to make the study, a total of 48 sets of data. Specific explanations for the symbols in this article are as follows. The money supply (M1) values refer to the incremental values of the money supply each quarter. The GDP values refer to the incremental values of the gross domestic product (GDP) values each quarter. II refers to the amount of accumulated values of insurance investment at the end of each quarter. iII, iGDP and iM1 refer to the first difference series of II, GDP and M1 in turn.

5.   Research Method

The selected economic variables are all time series which are all non-stationary series. Therefore, it is not possible to process the figures with traditional time series model such as regression analysis. Enger and Granger came up with the analysis method of cointegration relationship between the non-stationary time series in 1987. The basic idea of this approach is that if two (or more) variables showing non-stationary, but some of their linear combinations are stationary, in long-term, there is a stable relationship between variables. This long term relationship is named cointegration relationship. Cointegration relationship describes the equilibrium relationship between economic variables in a long run. In the economic senses, the existence of cointegration relationship means that the value change of one of the economic variables can affect the value change of another variable.

Therefore, this paper uses cointegration relationship analysis method to describe the long-term equilibrium relationship among insurance investment (II), gross domestic product (GDP) and money supply (M1). The paper establishes a long-term equilibrium model of multi-factors to analyze the causal relationship between the selected variables.

6. An Empirical Study

To explore the cointegration relationship between insurance investment (II) and macroeconomic variables (M1, GDP), we must have data which is stationary, because the cointegration relationship is usually based on a foundation of stationary variable series. According to the econometric approaches dealing with time series, we take the following steps for this research.

a) Unit root tests

We use unit root test to verify the stationarity of the data. We can use regression analysis method of econometric only on stationary time series. If the data is non-stationary, we are supposed to verify the stationary of their first difference series. We use Eviews software to do the ADF test on the insurance investment (II) series, the money supply series (M1) and domestic Product (GDP) series (GDP). The ADF test results are as follows.

TABLE-1 RESULTS OF UNIT ROOT TESTS

Variables	t-Statistic	1% level	5% level	Prob.	I (d)
II	-0.580752	-4.165756	-3.508508	0.9756	I (1)
iII	-5.855858	-4.170583	-3.510740	0.0001	
GDP	-0.528462	-4.192337	-3.520787	0.9781	I (1)
iGDP	-5.544507	-4.198503	-3.523623	0.0002	
M1	1.721379	-4.205004	-3.526609	1.0000	I (1)
iM1	-6.094252	-4.205004	-3.526609	0.0001	

Note: This ADF model includes trend and intercept in the test equation.

The test results show that the insurance investment series (II), money supply series (M1) and gross domestic product (GDP) series are all non-stationary and they cannot be directly used in regression analysis. So the variable series are all nonintegrated. Next, we continue to use the Eviews software to check the stationarity of the first difference series of the selected variables, using ADF test method. And we find the first difference series of insurance investment series (II), money supply series (M1) and gross domestic product series (GDP) are all stationary series under 5% significance level, which means these first difference series are all integrated of one.

b) Cointegration tests

Because II series, GDP series, M1 series are all integrated of one, we can use cointegration tests on these series, according to cointegration theory. We use multivariable Engle-Granger two-step method （Engle & Granger， 1987） to verify the cointegration relationship among the variables since the cointegration relationship we are studying on is among multiple variables.

First, we use each of the three variables as the dependent variable one by one to make the static regression. The regression results show that only when we put the GDP series as the dependent variables there will be a significant linear correlation among the selected variables. And the result of the static regression is good enough to be accepted (Adjusted R-squared=0.917940). The parameters of the regression model are as follows.

TABLE-2 PARAMETERS OF REGRESSION MODEL

Variables	Coefficient	Std. Error	t-Statistic	Prob.	Adjusted R-squared
II	2.360989	0.163641	14.42786	0.0000	
M1	1.109152	0.316845	3.500617	0.0011	0.917904
C	19772.54	1765.864	11.19709	0.0000	

Note: The dependent variable in this model is GDP.

According to the result of the static regression model, we can draw to a regression equation as follows.
GDP=19772.54+2.360989II+1.109152M1+e

Then we use ADF test to verify the stationary of the residual series which is provided by the regression model. And the results of the ADF tests are as follows.

TABLE-3 RESULTS OF ADF TEST

Variables	t-Statistic	1% level	5% level	Prob.
e	-2.424826	-2.621185	-1.948886	0.0165

Note: This ADF model includes neither trend nor intercept in the test equation.

According to the results of the ADF tests, we can draw a conclusion as follows. The residual series is stationary under 5% significance level which means there is no unit root existing in the series. So, there is a cointegration relationship among the II series, GDP series and M1 series. The results demonstrate that there is a stable long-term equilibrium relationship among the insurance investment (II), gross domestic product (GDP) and money supply (M1).

From the cointegration relationship in this paper, we can conclude that there is a strong positive correlation between China's GDP growth and insurance investments and this positive correlation also exists between the GDP growth and money supply. Furthermore, insurance investment has a greater influence on GDP growth than money supply does.

c)   **Granger Test of Causality**

In economics analysis, we usually tend to identify the causal relationship between two variables which clarifies if one variable is the reason for the other's changes. To further explore the relationship among the insurance investment series (II), domestic gross product series (GDP) and money supply series (M1), we take the method of Granger Test of Causality. The main idea of Granger Test of Causality is as follows. For two variables X and Y, if we can draw a better effect when we use the past and present data of X and Y, in predicting the future data of Y, than when we don't use the past and present date of X, there is causal relationship exiting between X and Y.

We use Eviews software to do Granger Test of Causality on the selected variable series. The results of Granger Test of Causality are as follows.

TABLE-4 RESULTS OF GRANGER TEST OF CAUSALITY

Null Hypothesis:	Obs	F-Statistic	Prob.	conclusion
II does not Granger Cause GDP	46	8.51921	0.0008	Reject
GDP does not Granger Cause II		0.05509	0.9465	Accept
M1 does not Granger Cause GDP	46	5.66734	0.0067	Reject
GDP does not Granger Cause M1		2.96366	0.0628	Accept
M1 does not Granger Cause II	46	0.19066	0.8271	Accept
II does not Granger Cause M1		4.83874	0.0130	Reject

Note: This Granger test is under the lags of 2.

From the results of Granger tests, we can draw following conclusions. In a case of second-order lag and under 5% significance level, the insurance investment (II) Granger causes the GDP growth; the money supply (M1) also Granger causes the GDP growth; insurance investment (II) Granger causes money supply (M1).

7.   Conclusions

By analyzing the cointegration relationships among in-surance investment, gross domestic product and money supply in this paper, using the methods of ADF test, G-E cointegration test and Granger Test of Causality, we can draw following conclusions.

First, seeing from the cointegration tests, there is a cointegration relationship among insurance investment (II), gross domestic product (GDP) and money supply (M1). This means there is a long-term equilibrium relationship among insurance investment, gross domestic product and money supply. This also demonstrates that the insurance investments influence the macroeconomic growth in a long way. Second, seeing from the equation of static regression, there is a strong positive correlation between China's macroeconomic variable GDP and insurance investment. There is also a positive correlation between GDP and money supply in China. Moreover, the insurance investment has a more significant influence on GDP than money supply does. Third, seeing from the results of

Granger Test of Causality, the insurance investment and money supply both Granger cause GDP growth; the insurance investment Granger causes money supply.

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