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Full Length Research Paper

Dynamic interactions between real exchange rate and international fund flows in China

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As the progress of capital account liberalization in China, the volume and volatility of international fund flows has increased significantly since 2000. Therefore, it is of vital importance to investigate their influence on domestic financial market. Based on a novel database, EPFR Global, we get the monthly fund flows in China from January 2005 to June 2013. Vector autoregression (VAR) models are employed to investigate the dynamic relationships between real exchange rate and international fund flows.The following conclusions can be drawn: (i) large amount of international fund investments tend to result in RMB appreciation; (ii) the appreciation of real effective exchange rate leads to the decrease of fund flows in the first month and attracts more fund investments afterwards; (iii) the interaction between equity flows and exchange rate is more significant than bond flows.

Key words: International fund flows, exchange rates, vector autoregression (VAR) model, equity flows, bond flows.

INTRODUCTION

In most countries, the capital inflows are often associated with the real exchange rate appreciation and increased exchange rate volatility (Calvo et al., 1993). The role of international capital flows in the exchange rate dynamics gets a broad-based interest due to their significant increase during the past few decades. Their relationship also affects the stability of the financial system as well as broader economic developments and conditions (Gyntelberg et al., 2014).

As an increasingly important part of international capital flows, international fund flows also affect the fluctuations of exchange rates directly. A large amount of literature has examined the role of foreign exchange order flows, which are at least partially determined by investors' portfolio rebalance behavior, on the dynamics of exchange rates (Evans and Lyons, 1999; Hau et al., 2002; Hau and Rey, 2006; Killeen et al., 2006). Therefore, it suggests a significant linkage between international fund flows and exchange rates. The portfolio balance approach developed by Hau and Rey (2006) explains the mechanism. On one hand, as international investors change their portfolios, the demand forforeign currencies changes as well, which will lead to the fluctuations of exchange rates. Specifically in China, as fund investments in China increase, the demand for Renminbi (RMB) in exchange market also increases. It

will lead to the appreciation of RMB. In the context of managed flexible exchange rate regime, if the amplitude of RMB appreciation exceeds the expectation of central bank, it will sell RMB in foreign exchange market through open market operations to eliminate its appreciation pressure. Consequently, the money supply increases and so does the domestic inflation rate, and therefore leads to real exchange rate appreciation. On the other hand, the dynamics of exchange rate also affect fund investments. With incomplete hedgeing of foreign exchange risks [1], foreign investors tend to diversify their portfolios both denominated in domestic currency and in various foreign currencies. Therefore, the return of exchange rate will affect international investors' asset allocation. Meanwhile, the exchange rate appreciation is usually associated with the expectation of further appreciation, and investment returns tend to increase due to the higher currency returns. Thus, the appreciation of RMB tends to attract more fund investments in China. During this process, exchange rates, portfolio investments and domestic equity returns are jointly and endogenously determined.

Vector autoregression (VAR) models can illustrate these dynamic interactions properly. VAR models were constructed in this research. This research aims to answer the following questions: (i) what are the dynamic interactions between exchange rate and international fund flows in China? and (ii) is there any difference between international equity flows and bond flows? In the context of managed flexible exchange rate regime, the fluctuation amplitude of nominal exchange rate is limited. Therefore, real effective exchange rate is used in our research. Based on a novel database, EPFR Global, the monthly fund flows in China was gotten from January 2005 to June 2013. To observe their dynamic interactions and compare the differences, we employ VAR models for equity flows and bond flows separately. It is concluded that large amount of international fund investments tends to increase the demand of RMB, and therefore leads to RMB appreciation. Meanwhile, the appreciation of RMB attracts more international fund investments afterwards. Besides, the interaction between equity flows and exchange rate is more significant than bond flows, because the amount of equity flows is much larger than bond flows.

LITERATURE REVIEW

Three strands of literature are closely related to our research question, (i) the role of international capital flows in the exchange rate dynamics, (ii) the influence of the volatility and uncertainty of exchange rate

movements, and (iii) literature on international fund flows.

As to the first topic, a large amount of studies have appeared since 1990s. For example, based on monthly data of ten Latin American countries [2] covering the period January 1988 to December 1991, Calvo et al. (1993) conclude that international capital flows (proxy by official reserves) and exchange rate demonstrated a sizable degree of co-movement and the degree of co-movement in exchange rate increased during capital inflow episodes. Granger causality test shows that reserve accumulation precedes the real exchange rate appreciation. Hau and Rey (2006) develop a two-country framework to analyze the joint equilibrium dynamics of equity returns, exchange rate returns and investors' portfolio choices. As the markets are incomplete to hedge all the FX risk, foreign investors tend to diversify their portfolios of stocks, bond, and other financial assets denominated in domestic currency and various foreign currencies. Therefore, as they change their portfolios, international capital flows occur. In the meantime, foreign investors will buy or sell domestic currencies, which leads to exchange rate appreciation or depreciation. Afterwards, Gyntelberg et al. (2014) give some empirical support for this framework. Employing a daily frequency dataset for Thailand during 2005 to 2006, they investigate the interaction between exchange rate fluctuations and returns on risky financial assets. The results indicate that net purchases of Thai equities by nonresident investors will lead to an appreciation of Thai baht, and higher returns of Thai equities are accompanied by a depreciation of Thai baht.

Since the generalized floating of exchange rates in 1973, amounts of researchers have focused on the impacts of its volatility and uncertainty (Chowdhury, 1993). Some of them argue that the exchange rate volatility tends to enhance costs for risk averse market participants, decrease their profits, and therefore hamper the trade flows (Akhtar and Hilton, 1984; Coes, 1981; Cushman, 1983, Thursby and Thursby, 1987). Other empirical studies indicate that trade tend to benefits from exchange rate risks (Franke, 1991; Giovannini, 1988; Sercu and Vanhulle, 1992). In the context of an Error-Correction Model and based on the quarterly data for G7 [3] countries from 1973 to 1990, Chowdhury (1993) conclude that exchange rate volatility has a significant negative impact on the volume of exports.

As to the research on international fund flows, three topics have been examined: (i) the behavior of international fund investments (Gelos, 2012; Hsieh et al., 2011; Jinjarak et al., 2011; Patro, 2006), (ii) the role of these investments in the transmission of financial shocks between countries (Gelos, 2012), and (iii) the drivers of international portfolio flows (Fratzscher, 2012; Puy,

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[1] (Levich *et al.,* 1999) calculated that only 8% of the total foreign equity investment had their foreign exchange risk hedged. (Hau and Rey, 2006) also point out that evidence from U.S. global mutual funds indicate that foreign exchange risk in international equity portfolios is mostly un-hedged. (Gyntelberg *et al.,* 2014) also support evidence of imperfect hedging in Thailand stock market.

[2] Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay and Venezuela.

[3] Canada, France, Germany, Italy, Japan, the United Kingdom and the United States

2016). However, the interaction between exchange rates and international fund flows has never been investigated. As the dynamic of exchange rates is one of the most important parts in domestic financial market, it is increasingly important to explore the influence of fund flows on exchange rates.

DATA AND METHOD

Data

The EPFR Global Database is used to describe the international fund flows. Fund flows are international investments in domestic financial markets by institutional investors, including mutual funds, exchange traded funds (ETFs), closed-end funds and hedge funds. EPFR Global covers more than 33,735 equity funds and 21,716 bond funds, which are registered in most major markets and allocate their assets globally. Since 2000, the assets under management by international funds have increased dramatically and the total amount came to more than 16 trillion in 2013. The database collects the purchase and redemption information of each fund as well as their asset allocation, and then calculates the total amount of fund flows flowing into or out of each country.

A couple of other studies are based on this database as well (Borensztein and Gelos, 2003; Fratzscher, 2012; Jotikasthira et al., 2012; Kaminsky et al., 2001; Raddatz and Schmukler, 2012) and Jotikasthira et al. (2012) show in detail the close match between EPFR Global fund flows and portfolio flows stemming from balance of payments (BOP) data. As China set up its exchange rate regime reform in 2005, the time span of our study is from January 2005 to June 2013.

As China employs managed flexible exchange rate regime, the fluctuation amplitude of nominal RMB exchange rate is limited. Therefore, real effective exchange rate is used in our research. Real effective exchange rate (REER) is the weighted average of a country's currency relative to a basket of currencies, which is defined as follows:

$$REER_i = \sum_{j=1} \frac{P_i R_i}{P_j R_j} * w_{i,j}$$

where $REER_i$ indicate the real effective exchange rate of country i; $w_{i,j}$ is the weight according the trade relationship between country i country j; R_i, R_j are nominal exchange rates in US dollars in country i and country j, respectively; P_i, P_j are price indexes in country i and country j, respectively. The RMB real effective exchange rate employed in this research derived from IMF, and higher value of REER indicates the appreciation of RMB.

VAR Model

In order to investigate the interaction of fund flows and exchange rates, a multivariable vector autoregressive (VAR) model is used in this paper. By allowing both the instantaneous and lagged effects of variables, the VAR system illustrates multi-period interaction of endogenous variables. Both endogenous and exogenous variables are included in our VAR model were included (Guo and Huang, 2010). The model can be written as:

$$\begin{bmatrix} y_{1t} \\ y_{2t} \\ y_{3t} \end{bmatrix} = A_1 \begin{bmatrix} y_{1t-1} \\ y_{2t-1} \\ y_{3t-1} \end{bmatrix} + A_2 \begin{bmatrix} y_{1t-2} \\ y_{2t-2} \\ y_{3t-2} \end{bmatrix} + \ldots + BX_t + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix}, t = 1, 2, \ldots, T$$

As exchange rate, fund investments and asset returns are jointly and endogenously determined; three endogenous variables in VAR models are included; y_{1t} indicates the international fund flows at time t; y_{2t} indicates the real effective exchange rate at time t;. y_{3t} is the asset price index at time t; X_t is a vector of exogenous variables, including 3-month NDF exchange rate, interest rate difference, and CBOD Volatility index (VIX). NDF exchange rate is included as the proxy of exchange rate expectation, and we assume that higher appreciation expectation tends to attract more fund investments. Fund investments also increase with higher interest rate differential and lower CBOD Volatility index. In this study, fund flows are scaled by assets under management of each receiving country (c.f. Fratzscher, 2012; Puy, 2016). The definition of variables is shown in Table 1, and the summary statistics for variables are shown in Table 2.

EMPIRICAL RESULTS

VAR model for equity flows

Unit root test

Before the identification of long-term relations of endogenous variables, we have to ensure that they are all time-stationary variables. Therefore, Augmented Dickey-Fuller test is conducted and Table 3 describes the results. It was found that all the endogenous variables in level are I (1) process and the differenced variables are confirmed to be stationary. Hence, our VAR model consists of the difference of endogenous variables.

VAR model for equity flows

According to the rule of FPE and AIC criteria[4], the optimal lag length in the VAR system is two months. A VAR (2) system is constructed. Table 4, the real effective exchange rates and the equity flows interact with each other. Large amount of international equity investments tend to enhance the demand of RMB, and therefore lead to RMB appreciation. Meanwhile, the appreciation of RMB, which increases the investment income denominated by foreign currencies and implies the further expectation of RMB appreciation, attracts more international equity investments. As to the exogenous variables, NDF and interest rate differential exert little impact both on real effective exchange rates and on the equity flows.

However, the VIX index is significant in the three equations. It is positively related with real effective exchange rates and negatively related with international equity flows.With the higher volatility in US market, investors tend to flight and US dollars are under the pressure of depreciation. Meanwhile, international equity

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[4] FPE stands for final prediction error, and AIC stands for Akaike information criterion. The significance of each test is at 5% level.

Table 1. Definition of VAR variables.

Variables	Description	Data source
Endogenous variable		
International fund flows	International equity/bond flows scaled by assets under management	EPFR Global
REER	Real effective exchange rate	IMF
Asset price index	Shanghai stock exchange (SEE) composite index OR SSE government bond index	CEIC
Exogenous variable		
NDF	3-Month NDF exchange rate	Bloomberg
Interest rate differential	Difference between 3-month Shanghai interbank offered rate and the 3-month United States Treasury Bills	CEIC
VIX	CBOD volatility index, implied volatility of S&P 500 index options over the next 30 day period	Thomson Reuters

Table 2. Summary statistics of VAR variables.

Variable	Obs	Mean	Std. Dev.	Min.	Max.
International equity flows	102	0.581	1.853	-4.191	6.321
International bond flows	102	1.311	2.578	-10.262	8.737
REER	102	97.454	9.655	82.480	117.140
Stock index	102	2529.077	1003.512	1060.740	5954.770
Bond index	102	120.198	10.697	97.270	138.650
NDF	102	7.015	0.641	6.176	8.218
Interest rate differential	81	2.468	2.249	-2.302	6.362
VIX	102	20.905	8.904	11.100	46.350

Table 3. Results of augmented Dickey-Fuller test: equity flows.

Null hypothesis	Lag length (Based on SIC)	Number of obs.	Test Statistic Z(t)	MacKinnon approximate p-value for Z(t)
D (equity flows) has a unit root	7	95	-6.925	0.000
D (REER) has a unit root	0	102	-7.520	0.000
D (stock index) has a unit root	1	101	-5.284	0.000

investments in China, mainly from developed countries, tend to decrease with the higher market volatility.

Generalized impulse response functions for equity flows

In order to trace the time paths of the interactions between exchange rate and equity flows, we apply the generalized impulse response, which does not depend on the VAR ordering. In each case, the shock to each equation is equal to one standard deviation of the equation residual, and we trace the impulse responses of all the variables for 10 months. The upper and lower standard error bonds (±2 standard errors) of the impulses are also presented. As shown in Figure 1, the real effective exchange rates perform a large degree of persistence. The impulse response of real effective exchange rates to a positive shock of equity flows is significantly positive 3 months later, and this influence tends to disappear 5 months after the shock. This indicates that international equity flows tend to provoke the pressure of RMB appreciation in three to four months. However, the impulse response of equity flows to real effective exchange rates is negative in the first month and significantly positive in the second month as well as afterwards. This effect also disappears in five

Table 4. Result of VAR Model: equity flows.

Variable	D (REER)	D (equity flow)	D (stock index)
D (REER(-1))	0.369*** (3.32)	-0.132 (-0.91)	-10.149 (-0.41)
D (REER(-2))	-0.093 (-0.87)	0.269** (1.95)	6.840 (0.29)
D (equity flow (-1))	0.044 (0.44)	-0.223** (-1.72)	13.621 (0.61)
D (equity flow (-2))	0.158** (1.76)	-0.153* (-1.30)	-36.072** (-1.79)
D (stock index (-1))	-0.001* (-1.34)	-0.002*** (-2.85)	-0.132 (-1.12)
D (stock index (-2))	0.000 (0.52)	0.000 (0.56)	0.333*** (2.61)
Constant	0.204 (0.85)	0.253 (0.81)	161.778*** (3.02)
D (NDF)	1.402 (0.46)	2.544 (0.64)	2066.318*** (3.01)
Interest rate differential	0.038 (0.55)	-0.109 (-1.19)	-47.585*** (-3.02)
D (VIX)	0.094*** (3.10)	-0.076** (1.91)	-17.816*** (2.63)
Adj. R-squared	0.23	0.22	0.26
N	81	81	81

t statistics in parentheses and *p < 0.10, **p < 0.05, ***p < 0.01. First difference of the variable is used in the regression, including REER, international equity flow, stock index, NDF and VIX.

Figure 1. Response to generalized one S.D. Innovations and ±2 standard errors: equity flows.

months.

VAR model for bond flows

Unit Root Test

Before a VAR model for bond flows is constructed, the time-stationary feature of endogenous variables is also checked. Table 5 presents the result of Augmented Dickey-Fuller test. Endogenous variables, including bond flows, real efficient exchange rate and bond index, are I (1) process in level and the differenced variables are stationary.

Therefore, our VAR model is based on the difference of endogenous variables.

Table 5. Results of augmented Dickey-Fuller test for unit root: bond flows.

Null hypothesis	Lag length (Based on SIC)	Number of obs.	Test Statistic Z(t)	MacKinnon approximate p-value for Z(t)
D (bond flow) has a unit root	0	102	-12.931	0.000
D (REER) has a unit root	0	102	-7.520	0.000
D (bond index) has a unit root	0	102	-8.141	0.000

Table 6. Result of VAR Model: bond flows.

Variable	D (REER)	D (bond flow)	D (bond index)
D (REER(-1))	0.226** (2.15)	-0.101 (-0.64)	0.160*** (4.53)
D (bond flows (-1))	-0.138** (-1.76)	-0.202** (-1.71)	0.085*** (3.21)
D (bond index (-1))	0.270 (0.97)	1.045*** (2.47)	0.289*** (3.08)
Constant	0.138 (0.60)	-0.071 (-0.20)	0.101* (1.30)
D (NDF)	1.583 (0.533)	-3.139 (-0.70)	1.966** (1.96)
Interest rate differential	0.036 (0.56)	-0.148* (-1.51)	0.043** (1.99)
D (VIX)	0.103*** (3.51)	-0.160*** (-3.61)	0.016** (1.66)
Adjusted R-squared	0.24	0.20	0.39
N	81	81	81

t statistics in parentheses and *p < 0.10, **p < 0.05, ***p < 0.01. First difference of the variable is used in the regression, including REER, bond flows, bond index, NDF and VIX.
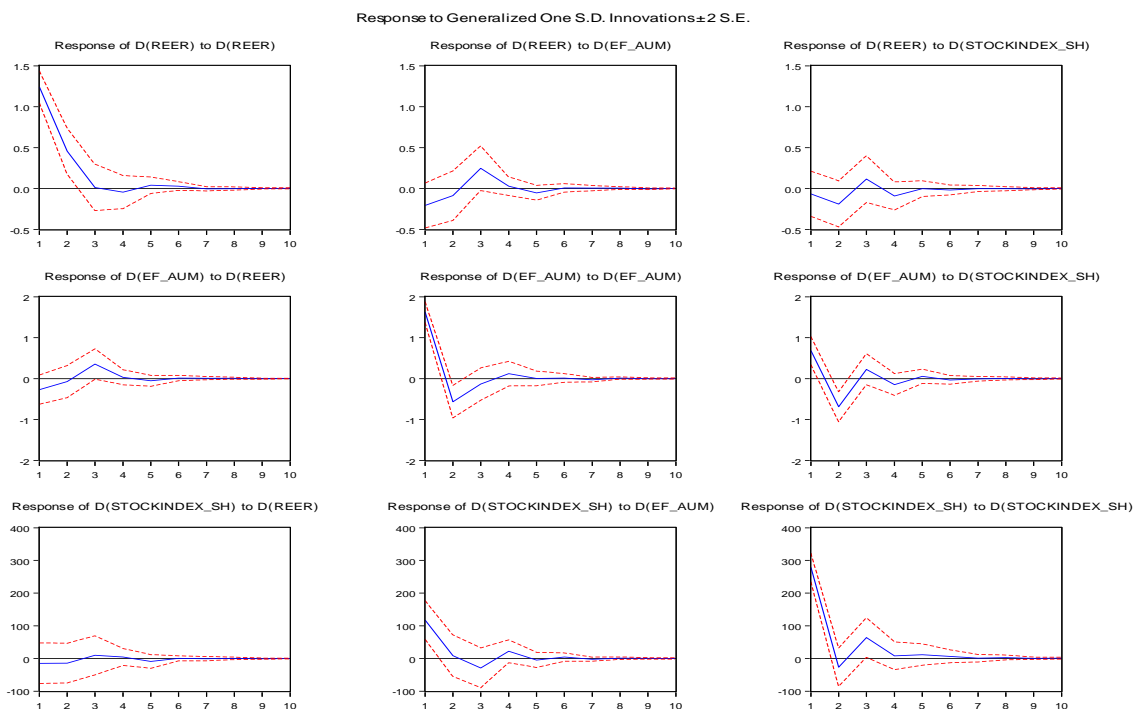
VAR model for bond flows

According to the LR, FPE, AIC, SC, and HQ criteria[5], a VAR (1) model is constructed for bond flows. Table 6 shows that the interaction between international bond flows and real effective exchange rate is also significant. In the real effective exchange rate equation, bond flows, which are different from equity flows, tend to be negatively related with real effective exchange rates, which indicate that large amount of bond flows lead to RMB depreciation in short term. The VIX index has significantly positive effect on real effective exchange rates, which means the increase of volatility in US market tends to be associated with the comparative appreciation of RMB. In the bond flow equation, the change of real effective exchange rates exerts little influence on the dynamics of bond flows, and the increase of bond index in China tend to attract more international bond investment significantly. The increase of VIX index tends to reduce the international bond investments in China, which is similar to equity flows. In the bond index equation, large amount of international bond investments in China will enhance the bond index. The interest rate differential and exchange rate expectation also exert positive influence on the bond index.

Generalized impulse response functions for bond flows

The time paths of interaction between exchange rates and bond flows were also present as shown in Figure 2. Generalized impulse response is used and Figure 2 also presents the upper and lower standard error bonds (±2 standard errors) of the impulses. The response of real effective exchange rate to a positive shock of bond flows is negative in the first two month and becomes slightly positive in the third month. The impulse response of bond flows to the change of real effective exchange rate is also negative in the first two month and the effect disappears after four months.

Differences between equity flows and bond flows

In order to capture the dynamic interactions between international fund investments and exchange rate in China and compare the differences between equity flows and bond flows, we construct VAR models for equity flows and bond flows separately. According to the lag structure test, we carry out a VAR (2) model for equity flows with three endogenous variables, which are international equity flows flowing into China, real effective exchange rate and Shanghai Stock Exchange composite index. For bond flows, a VAR (1) model is constructed with international bond flows into China, real effective exchange rate and Shanghai Stock Exchange bond index

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[5] LR indicates sequential modified LR test; FPE stands for final prediction error; AIC stands for Akaike information criterion; SC stands for Schwarz information criterion; and HQ stands for Hannan-Quinn information criterion. The significance of each test is at 5% level.

Response to Generalized One S.D. Innovations ± 2 S.E.
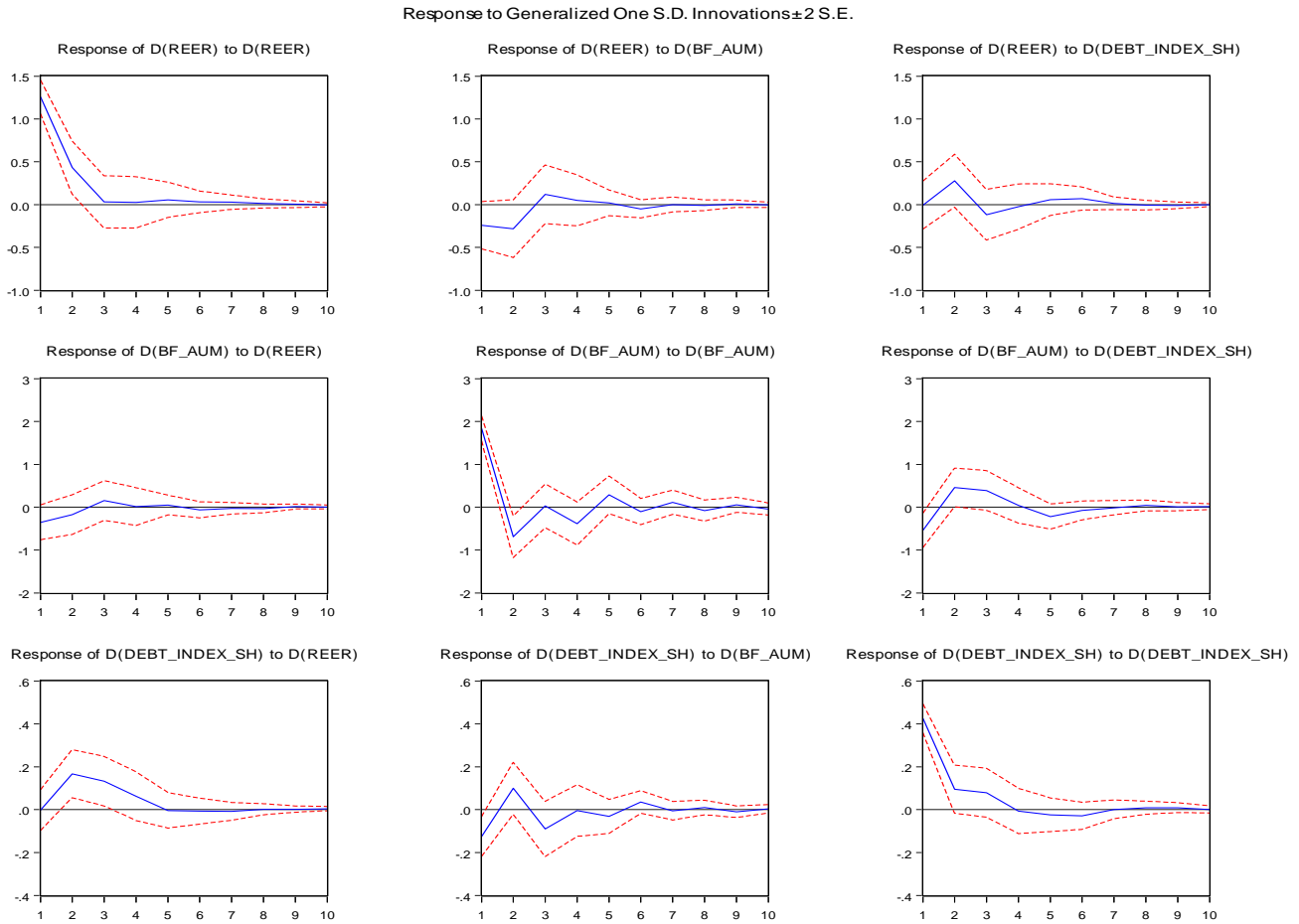
Figure 2. Response to Generalized One S.D. Innovations and ±2 standard errors: bond flows.

as endogenous variables. Same exogenous variables are included in both VAR models.

As to the interaction with exchange rate, equity flows and bond flows behave differently. The interaction between equity flows and exchange rate is more significant than bond flows. Specifically, in the VAR model, two-month lagged equity flows exert significantly positive effect on the exchange rate appreciation, while one-month bond flows exert negative effect. Besides, two-month lagged exchange rate has significantly positive influence on equity investments but has little influence on bond investments. This phenomenon may be due to that the amount of equity flows is much larger than that of bond flows in China, and thus illustrates more significant dynamics. In January 2013, the amount of equity flows in China is 7415.17 million US dollars while there is 737.38 million US dollars for bond flows. As to the generalized impulse response functions, there is no significant difference between the time paths of interaction of equity flows and bond flows, which shows the relationship between fund flows and exchange rate is robust. However, the response of exchange rate to the shock of equity flows is much larger.

Conclusions

In this paper, the time variation of the interaction between exchange rate and international fund flows in China is analyzed. Equity flows and bond flows are analyzed separately, and VAR models are employed. Our analysis leads to the following conclusions. Firstly, large amount of international fund investments tend to enhance the demand of RMB, and therefore result in RMB appreciation. This effect begins to work especially in three to five months. Secondly, the appreciation of real effective exchange rate leads to the decrease of fund flows in the first month and attracts more fund investments afterwards. This is because appreciation of RMB implies the further expectation of RMB appreciation and it attracts more fund investments in the third and later months. Thirdly, the VIX index is significantly positively related with real effective exchange rates and negatively related with international fund flows. As to the differences

between equity flows and bond flows, the interaction between equity flows and exchange rate is more significant than bond flows, which may because that the amount of equity flows is much larger than that of bond flows, and thus illustrates more significant dynamics.

Our findings provide new evidence on the interaction of fund flows and exchange rates, which is meaningful both for researchers and for policy-makers. During the liberalization of capital account in China, this study also provides the potential risk analysis of the opening of domestic security market.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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REFERENCES

Akhtar MA, Spence RH (1984). Effects of Exchange Rate Uncertainty on German and U.S. Trade. Federal Reserve Bank of New York Quarterly Review 9:7-16.

Borensztein E, Gelos RG (2003). A panic-prone pack? The behavior of emerging market mutual funds. IMF Staff papers 50(1):43-63.

Calvo GA, Leiderman L, Reinhart CM (1993). Capital inflows and real exchange rate appreciation in Latin America: the role of external factors. Staff Papers 40(1):108-151.

Coes DV (1981). The crawling peg and exchange rate uncertainty. In Exchange Rate Rules. Palgrave Macmillan UK. pp. 113-139

Cushman DO (1983). The effects of real exchange rate risk on international trade. J. Int. Econ. 15(1-2):45-63.

Chowdhury AR (1993). Does exchange rate volatility depress trade flows? Evidence from error-correction models. The Review of Economics and Statistics pp. 700-706.

Puy D (2016). Mutual funds flows and the geography of contagion. J. Int. Money. Financ. 60:73-93.

Evans MD, Lyons RK (1999). Order flow and exchange rate dynamics (No. w7317). National bureau of economic research.

Fratzscher M (2012). Capital flows, push versus pull factors and the global financial crisis. J. Int. Econ. 88(2):341-356.

Franke G (1991). Exchange rate volatility and international trading strategy. J. Int. Money. Financ. 10(2):292-307.

Giovannini A (1988). Exchange rates and traded goods prices. J. Int. Econ. 24(1-2):45-68.

Gelos G (2012). International mutual funds, capital flow volatility, and contagion-a survey. IMF Working Papers pp. 1-27.

Guo F, Huang YS (2010). Does "hot money" drive China's real estate and stock markets? Int. Rev. Econ. Financ. 19(3):452-466.

Gyntelberg J, Loretan M, Subhanij T, Chan E (2014). Exchange rate fluctuations and international portfolio rebalancing. Emerg. Markets Rev. 18(0):34-44.

Hau H, Killeen W, Moore M (2002). How has the euro changed the foreign exchange market? Econ. Policy 17(34):149-192.

Hau H, Rey H (2004). Can portfolio rebalancing explain the dynamics of equity returns, equity flows, and exchange rates? National Bureau of Economic Research. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.484.2386&rep=rep1&type=pdf

Hau H, Rey H (2006). Exchange rates, equity prices, and capital flows. Rev. Financ. Stud. 19(1):273-317.

Hsieh MF, Yang TY, Yang YT, Lee JS (2011). Evidence of herding and positive feedback trading for mutual funds in emerging Asian countries. Quant. Financ. 11(3):423-435.

Jinjarak Y, Wongswan J, Zheng H (2011). International fund investment and local market returns. J. Bank. Financ. 35(3):572-587.

Jotikasthira C, Lundblad C, Ramadorai T (2012). Asset Fire Sales and Purchases and the International Transmission of Funding Shocks. The J. Financ. 67(6): 2015-2050.

Kaminsky G, Lyons R, Schmukler S (2001). Mutual fund investment in emerging markets: An overview. In International financial contagion. Springer US. pp157-185

Killeen WP, Lyons RK, Moore MJ (2006). Fixed versus flexible: Lessons from EMS order flow. J. Int. Money Financ. 25(4):551-579.

Levich RM, Hayt GS, Ripston BA (1999). 1998 Survey of derivatives and risk management practices by US institutional investors.

Patro DK (2006). International mutual fund flows. Available at: SSRN 936410.

Raddatz C, Schmukler SL (2012). On the international transmission of shocks: Micro-evidence from mutual fund portfolios. J. Int. Econ. 88(2):357-374.

Sercu P, Vanhulle C (1992). Exchange rate volatility, international trade, and the value of exporting firms. J. Bank. Financ. 16(1):155-182.

Thursby JG, Thursby MC (1987). Bilateral trade flows, the Linder hypothesis, and exchange risk. The Rev. Econ. Stat. pp. 488-495.

African Journal of Business Management

Full Length Research Paper

The dynamic relationship between insurance development and economic growth: New evidence from China's coastal areas

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Insurance was widely recognized as a useful tool for risk management in regional economic growth. Lots of analysis focused on building a fixed functional relationship between insurance development and economic growth. However, the effects of this mechanism varied widely across countries. And there was a clear gap in the understanding of how this mechanism works in coastal areas, the forward position of one country. Could it be reflected by fixed function or a more complex one? The answer was crucial to realize the harmonious development, especially for China, the most important emerging economy. This study assessed China's 11 coastal cities, focusing on the dynamic linkages between insurance development and economic growth. Non-parametric local polynomial regression was used to obtain the change between insurance development and economic growth, and fit the curve relationship between insurance density per capita GDP, with the purpose of gaining the suitable function model. The result demonstrated that it was certain that insurance growth had a positive effect on the economic development of the coastal area, and the law of diminishing marginal returns held in most cases. We further classified research into three parts the Northern, Eastern and Southern coastal areas (China's administrative division), and found that, there were obvious differences in output efficiency and marginal revenue among the three regions. This relationship in the Northern and Southern area was stable, but the curve changed complicatedly in the Eastern area. So fixed function was not qualified to describe the linkage between insurance development and economic growth in China's coastal areas. Those conclusions offered several countermeasures for policy-makers and researchers.

Key words: Coastal regions, insurance density, economic growth, non-parameter local polynomial model.

INTRODUCTION

The relationship between insurance development and economic growth has gained more attention during the past few decades because of the rapid expansion of the insurance industry. For the period 1985 to 2007, the world's total real insurance premiums had increased by approximately 5.5 times from US$0.63 trillion to US$4.13 trillion (Chiu and Lee, 2012), with an insurance premiums growth rate of 57% in developed countries

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compared to 27% in developing countries (Arena, 2008).

As one of the most important developing nations, China's insurance premiums reached 242.8 billion Yuan in 2015, nearly 1.52 times higher than that of 2000; meanwhile, 180 insurance companies had set up branches across China, including 57 foreign institutions.

Studies examining the insurance-growth nexus have been primarily based on data from developed economies (Lee et al., 2011; Billio et al., 2012; Law et al., 2014). As the importance of the insurance industry's significance in loss compensation, financial intermediation and risk management for emerging markets began to be realized, more researchers have become involved in the study of the influence of the development of insurance market on economic growth (Webb et al., 2002; Liedtke, 2007; Roe and Siegel, 2011), while little is known about this mechanism between insurance development and economy growth in China.

With the further implementation of China's strategy of building an ocean power, coastal regions played important role in regional economic development by virtue of the special geographical conditions. Accordingly, examining the role of insurance industry in economy and investigating the changes of the linkages between insurance development, and economy growth was vital to promote China's marine economy fast and healthy developing.

The main purpose of this study is to illustrate the dynamic relationship between insurance development and economic growth in China's coastal areas. Based on the non-parametric local polynomial regression, the paper fits the curve of insurance density and GDP per capita. The action mechanism will be analyzed from the view of monotonicity, convexity and dynamic change characteristics of the curve.

LITERATURE REVIEW

The remarkable effects of insurance during the course of economic development were formally acknowledged in 1964 (UNCTAD conferences). In the long run, the insurance industry accelerates economic growth by appealing to the following channels:

1. Benefiting risk identification, reinforcement and repairing
2. Strengthening financial management of enterprises
3. Enhancing the risk management of individuals
4. Stabilizing personal and family life
5. Managing civil compensation liabilities
6. Improving credit for the entire society.

As life and nonlife insurance (property or liability) take on different functions, there are usually distinctive effects on economic growth. Related research can be divided into theoretical and empirical research.

Theoretical research has primarily been conducted from two perspectives: the supply-following angle and the demand-leading angle (Patrick, 1966). From the supply-following point of view, non-banking financial institutions usually have positive externalities and intermediates of accommodation, which could result in stimulating economic innovation and enhancing economic growth. In addition, the demand-leading angle means that the growth of the real economy will bring profound changes to the economy and to society. Namely, these changes include alterations in the relationship between risk spread and transmission in population structure and in income levels, etc. All of these undoubtedly generate new requirements for risk diversification and particularly relevant insurance services.

According to Hsu et al. (2015), Yang et al. (2014) and Hsu and Liao (2015), the development of insurance in certain areas will depend on psychological and social factors, such as willingness to pay, level of education and age. Beck and Webb (2003), Li et al. (2007), and Lee et al. (2010) determined economy growth had a positive relationship with insurance and explained this by demonstrating how life insurance and real incomes have grown.

Feyen et al. (2011) further confirmed that different income levels would have various insurance demands. Empirically, different subjects and methods result in various conclusions. Employing time-series or cross-sectional datasets to analyze insurance premiums and macroeconomics in a country or among certain areas has been the mainstream approach.

Several articles employed panel unit root, panel cointegration, and panel causality tests to explore the relationship between per capita real gross domestic product and per capita real insurance premiums, then determined insurance markets and economic growth exhibit long run and short run bidirectional causalities (Chen et al., 2013; Abdul and Vera, 2014; Samargandi et al.,2015). Haiss and Sümegi (2008) researched the relationship between insurance and economic growth based on a panel data model for all European countries, and concluded that there had been an insignificant effect between insurance (life insurance and non-life insurance) and economic growth.

Lee and Chiu (2012) applied a panel smooth transition regression (PSTR) model to obtain a non-linear insurance-income nexus. The calculations demonstrated that as economic bases were different in each sample, the relationships between insurance premiums (life and non-life) and economic growth were also much.

In addition, Han et al. (2010) brought a gaussian mixture model (GMM) approach to studying the relationship between insurance development and economic growth for 77 countries. The results illustrated insurance development had a positive effect on economic growth, which had significant different forms between developing countries and developed countries.

Specifically, Ward and Zurbruegg (2000) investigated the causal relationship between insurance industry

growth (real insurance premiums) and economic growth (real GDP) for Australia, Canada, Italy, Japan, and France. The long-term conclusion stated that most samples had bidirectional causal relationships, but a few countries had a unidirectional causality relationship, such as France.

Considering the specific performance of the two variables, different areas were prone to display various effects. Choong (2012) found insurance development had a one-way causal relationship to economic growth. Alhassan and Fiador (2014) employed an autoregressive distributed lag (ARDL) bounds approach (Pesaran et al. ,2001) to examine the long run causal relationship between insurance and economic growth in Ghana from 1990 to 2010, and found there were a long run positive relationship and unidirectional causality from aggregate insurance penetration, life and non-life insurance penetration to economic growth.

Cristea et al. (2014) established a correlation between insurance and economic growth in Romania by considering insurance penetration and insurance density. Hansen et al. (2014) analyze the corresponding impacts and financing burden of a potential health insurance reform in the US. Shen et al. (2017) proposed a two-stage hybrid MCDM model to measure the plausible synergy effects between life insurance industry and economy attributes.

Most existing studies, however, investigate either the impact of economic growth on insurance or, conversely, the impact of insurance on economic growth of certain areas by one specific model, for example Cobb-Douglas function, but neglect the dynamic changes in the relationship of the economic growth and insurance market.

Because of this background, we attempted to indicate the potential hidden covariation between insurance activities and economic growth of China, particularly in the emerging and growth-leading coastal area. With the purpose of obtaining the concrete states of these relation, we classified our research into three parts the Northern, Eastern and Southern coastal areas (China's administrative division). Based on the non-parametric local polynomial regression, the paper aimed at the dynamic change relationship between insurance development and economic growth, and tried to obtain fitting curve for insurance density and GDP per capita, then analyzed the fitting effect by the monotonicity, convexity and dynamic change characteristics of the curve.

METHODOLOGY

Different from the general estimation model, non-parametric estimation usually does not require constraints. We can obtain better fitting precision with fewer limits on the functional distribution of explanatory variables, and explained variables under this model.

Nonparametric estimator $\hat{\beta}(x)$ changed with the variety of variables x. Thus, the local polynomial estimation of the regression equation was estimated as:

$$\hat{m}_{p,h}(x) = \hat{\beta}_0(x) \tag{1}$$

We can obtain the local linear regression estimates according to the former

$$\hat{m}_{1,h}(x) = \hat{\beta}_0(x) = \frac{T_{h,0}(x)S_{h,2}(x) - T_{h,1}(x)S_{h,1}(x)}{S_{h,0}(x)S_{h,2}(x) - S_{h,1}^2(x)}$$

Finally, the local polynomial derivative estimator was

$$\hat{m}_{p,h}^{(v)}(x) = v!\hat{\beta}_v(x) \tag{2}$$

The determination of order, kernel function and bandwidth are the key points to the process of local polynomial estimation (Ye, 2003). Therefore, to illustrate the changing track of the output efficiency and marginal output between insurance development and economy growth among coastal districts, we set the bandwidth by utilizing the cross validation method on the condition that the order $p = 2$ and we selected epanechnikov as the kernel (Ye Azhong,1995). Then, we removed the observations (Y_i, X_i) of group i and obtained the simulated value at point X_i by fitting the regression function with the data of the remaining $n-1$ groups with a certain. We can obtain the formula $CV(h) = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_{(-i)}(h))^2$ by estimating $i = 1, 2, \cdots, n$, then cross validate h_0 to render $CV(h_0) = \min_{h>0} CV(h)$.

RESULTS

Target selection and data process

This study classified subjects into three parts the Northern, Eastern and Southern coastal areas based on China's administrative division for the period 1990 to 2015. Considering that there is a large discrepancy in the size of population and the economic foundations of each city, we utilized insurance penetration and insurance density in analyzing the data property, while only deployed insurance density to verify the dynamic relationship between insurance market development and economic growth. Following the principle of simplicity in econometrics, we set insurance development as the explanatory variable and per capita GDP as the independent variable. Annual data for real GDP per capita was obtained from the Chinese Statistical Yearbook. The data for insurance premiums were taken from the statistical year books of various provinces (1990-2015). All variables involved were converted by the GDP deflator based on 1990.

Table 1. Insurance in china's 11 coastal provinces and cities for the period 2001-2015.

Year	Insurance density (yuan)	Insurance depth (%)	Premium income (billion yuan)
2001	23.31	1.96	119.66
2002	27.97	2.19	147.86
2003	34.39	2.34	183.42
2004	38.02	2.54	204.79
2005	48.23	2.69	260.76
2006	76.87	2.3	421.46
2007	87.26	2.26	484.72
2008	94.50	2.48	531.25
2009	93.17	2.56	529.98
2010	118.64	2.78	684.4
2011	115.90	2.32	673.08
2012	157.72	2.91	922.07
2013	156.77	2.66	922.91
2014	160.91	2.59	952.63
2015	191.98	2.81	1142.8

Table 2. Insurance development in china's coastal provinces and cities（%）

Year	Liaoning	Hebei	Tianjin	Shandong	Jiangsu	Zhejiang	Fujian	Shanghai	Guangdong	Guangxi	Hainan
2001	12.95	6.65	3.92	12.19	13.61	10.85	4.93	15.98	14.96	3.34	0.65
2002	12.69	7.01	4.24	12.48	15.21	10.25	5.04	14.83	14.33	3.26	0.66
2003	12.29	8.38	3.85	12.55	16.24	9.95	5.12	14.50	13.27	3.16	0.70
2004	12.45	9.30	3.65	12.41	15.77	9.91	5.12	13.71	13.68	3.34	0.68
2005	12.77	9.17	3.76	12.26	15.20	10.00	5.33	14.13	13.30	3.43	0.68
2006	12.30	9.20	3.71	12.11	14.83	9.91	5.29	14.92	13.79	3.24	0.69
2007	11.99	9.86	4.25	12.39	13.66	9.71	5.28	14.16	14.76	3.23	0.70
2008	12.36	10.70	3.50	12.28	13.46	9.50	5.16	13.26	15.92	3.16	0.70
2009	9.03	12.31	2.62	13.01	14.17	9.88	5.29	13.73	16.15	3.12	0.70
2010	8.85	11.97	2.77	13.23	14.15	10.03	5.23	14.54	15.57	2.89	0.76
2011	7.43	11.95	2.67	13.58	14.89	10.97	5.38	12.96	15.87	3.46	0.86
2012	7.56	11.46	2.65	13.54	14.75	11.44	5.36	13.21	15.63	3.50	0.89
2013	6.73	9.07	2.99	13.87	11.15	12.01	6.22	8.90	20.61	2.98	0.78
2014	5.84	9.78	3.32	13.13	16.39	11.03	5.82	10.35	18.81	3.29	0.89
2015	6.20	10.17	3.48	13.50	18.18	10.56	5.52	9.84	18.95	3.37	0.10

Notes: These ratios represent one province's premiums to all provinces' premiums taken together.

Characteristics of the data

According to the CIRC yearbook 2016, the nominal premium income of China's 11 coastal provinces and cities reached 1142.80 billion Yuan, accounting for approximately 47.07% of the total premium income. Table 1 presented the premium income in coastal areas, with an actual average annual growth rate of 18.59%, and an obvious growth trend between 2001 and 2015. Insurance depth was relatively stable and insurance density had an apparent growth trend of approximately 17.32%. Generally speaking, the development of the insurance industry in coastal areas has been consistent with marine economy growth since 2001. Being affected by financial crises in 2007, the insurance investment had two mutation points in 2009 and 2011.

Table 2 displayed the insurance development in China's coastal provinces. Although the insurance development in China's coastal area had been increasing as a whole, the contrast between different regions on scales of insurance market and trends of insurance development were sharp. From 2001 to 2015, Hebei had an obviously rising premium income ratio in contrast to the more slowly increasing trend of Shandong, Jiangsu,
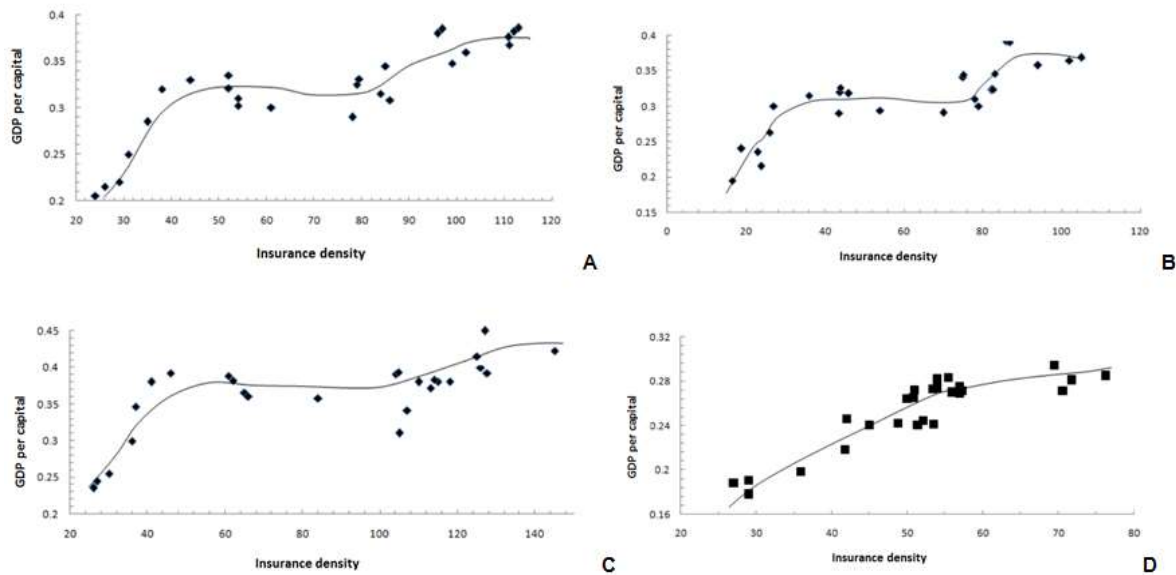
Figure 1. (A) Fitting effects for the reference unit; Fitting effects for the Northern unit; (B) Fitting effects for the Eastern unit; (C) Fitting effects for the Southern unit.

Fujian, Guangdong and Hainan; Tianjin, Zhejiang, Guangxi kept a relatively narrow growing band, and Liaoning, Shanghai exhibited a mildly declining trend.

Fitting results

The dynamic relationship between gross domestic product (GDP) per capita and insurance density

Figure 1 displayed the fitting results between GDP per capita and insurance density. According to China's administrative division, we classified the research into three parts the Northern, Eastern and Southern coastal areas. The entire coastal area was set as the reference unit, and the Northern, Southern, Eastern coastal districts were set as contrast units.

The local polynomial estimation shown in Figure 1 demonstrated that the data points almost near the fitting curve reflected the relationship of regional GDP per capita and insurance density well. Overall, bandwidth was set to 0.396 for reference unit, and the value of insurance density was 24 to 113 Yuan. The distribution of these data points was relatively uniform, which was more intensive in 2002 to 2008.

But the distribution exist great differences among the contrast units. First, for the Northern unit, the bandwidth was set to 0.337, and the insurance density' values were 16.4 to 110.7 Yuan, with a cluster zone of 82 Yuan. As the corresponding period was 2002 to 2008, it was assumed the change process of the relationship between insurance development and economy growth was the same as that of the reference unit. For the Eastern unit, the bandwidth was set to 0.681, and the insurance density' values were 27.3 to 147.2 Yuan, with a cluster zone of 113 Yuan. The corresponding period for this cluster was 2002 to 2006 slightly before the reference unit. So superior resources and geographical advantages indeed brought in more mature insurance market. For the Southern unit, the bandwidth was set to 1.64 and the insurance density' values were 34.7 to 80.2 Yuan, with a cluster of 57 Yuan and the proper period being 2003 to 2005.

Therefore, the speed and quality of insurance development in the Southern area were both behind other coastal areas. It was obvious that the development of insurance had high consistency with the growth of economy. Social progress created increasing demand for insurance products, but economic crisis might also bog down insurance institutes.

Dynamic features of the relationship between insurance development and economic growth

Based on the fundamental analyses of the relationship between insurance development and economic growth in the three coastal areas, monotonicity, concavity and convexity tests were adopted to identify the dynamic characteristics of the interaction between the two variables.

The first derivative was used to represent the ratio of per capita output growth and insurance density growth, and to explain the changes of the marginal product value
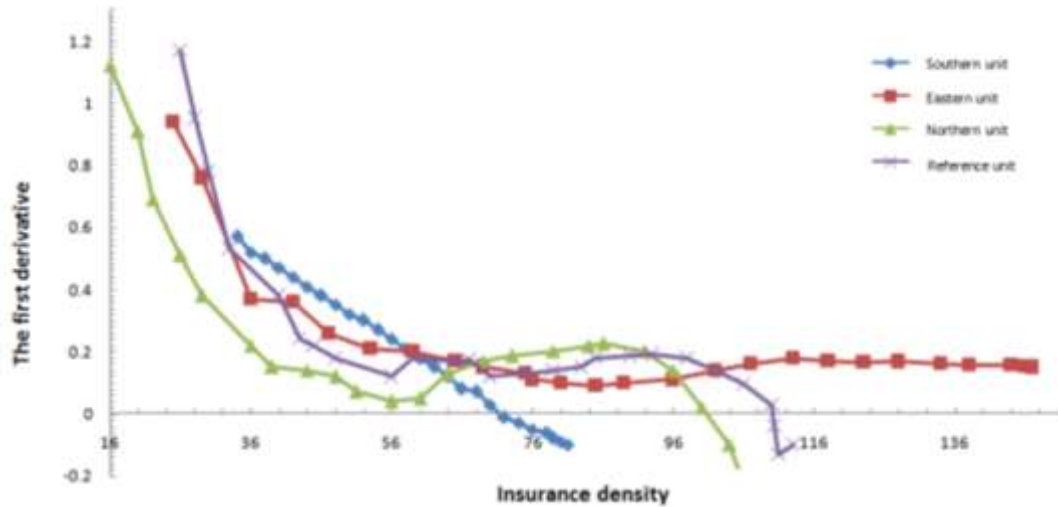
Figure 2. Fitting plot of first-order derivative between GDP per capita and insurance density.
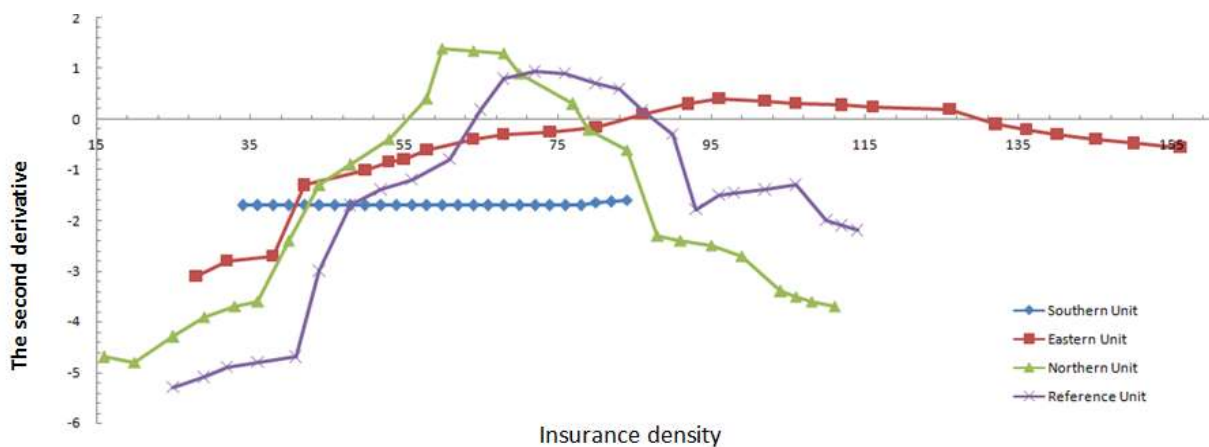

Figure 3. The second derivative trend of per capita GDP and insurance density.

of insurance density. The larger of the first derivative, the higher regional output efficiency would be. Figure 2 illustrated the fitting plots of the first-order derivative, which experienced decline - steady - decline changing process for the Northern unit, the Eastern unit and the reference unit, but exhibited steady declining for the Southern one.

In accordance with the point mutation of insurance density at 56 Yuan / person and 88 Yuan / person, we divided the curves into three intervals. Before the first interval, all of the output efficiency were declining, and the law of diminishing marginal returns did work. In the middle section, most of the units' output efficiency was relatively stable, and all of those turned into decreasing after the second interval. The Eastern unit had stronger economic strength and risk control ability, so its insurance output efficiency was farther right, and had

been changing more slowly.

The fitting plots of the first-order derivative of the Northern unit and the reference unit were similar. The Northern unit's output efficiency was found at the far left and changed faster than others'. Because of long-time historical, economical and cultural factors, the process of the Southern unit's financial market was lagging behind and undermining the speed and the return of its insurance development, the output efficiency of which only had a single declining trend. Besides, the law of diminishing marginal returns held in most cases, but it would be unfeasible due to external shocks, such as the financial crisis during 2008 to 2010.

Figure 3 showed the second derivative trend of per capita GDP, and insurance density. We introduced the second derivative to reflect the function between insurance development and economy growth, then the

sign and the value of the derivative displayed the function types and the rates of relative growth of the two variables respectively. Exponential type was the most common function chosen by analysis focused on relationship between insurance development and economic growth, for which the second derivative was always negative.

But Figure 3 illustrated that only the second derivative of the Southern unit was negative and parts of those were positive of the Eastern and Northern units. So the fixed function, such as the exponential function, could not reflect the correct linkage between insurance development and economy growth in China's coastal areas.

The value of the second derivative showed the rates of relative growth of per capita GDP compared to insurance density. The value of the second derivative of the Northern unit had an obvious inverted U-shaped trajectory ahead of similar trend of the reference unit , and the downturn of those value was 70Yuan/ person of insurance density, being consistent with the fitting curve changing into stable in Figures 1 to 2. The value of the second derivative of the Eastern unit was like a J- shaped trajectory, the higher value at the left and the increasing upward trend of which was corresponding to the steep-beginning and rising-ending curve in Figures 1 to 3. But there still was a decreasing trend of the value in the end of the second derivative of the Eastern unit. The value of the second derivative of the Southern unit was steady, and had a slight increasing sign.

FINDINGS

The development of the insurance market played an important role in economy growth of coastal areas, but the effects of this mechanism varied widely across regions. To promote the sustainable development of coastal areas, it was essential to enact targeted policy measures according to the dynamic characteristics of this mechanism.

This study adopted a nonparametric local polynomial to fit the relationship between the insurance development and economy growth of China's coastal areas, and used the monotonic and convex analysis to obtain the changing process of marginal products of regional insurance market and the dynamic function for insurance density and per capita GDP. The nonparametric estimation model avoided the deviation of function form in the parameter estimation, and effectively solved the issues of choosing a random distribution of interference.

The empirical findings of this study were summarized as follows. First, it was certain that insurance market had positive influence on economy growth in China's coastal areas. Stepping into the 20th century, China's marine economy entered a fast development period and improved the external operating environment for insurance industry, so the linkage between insurance

development and economy growth turned from complex to stable after 2005. Second, the law of diminishing marginal returns held in general. But there still were some singular points, for example the Northern unit had a marginal product increasing period, which was just in the recovery of financial crisis. Third, the various values of the second derivative verified that fixed function did not apply to quantify the relationship between insurance development and economic growth in China's coastal areas. The convex fitting curve of insurance density and per capita GDP concluded a vague definition of the dynamic relationship between the two variables.

Conclusion

This study indicates that the development of the insurance industry in coastal areas plays an important role in regional economic growth, and it is essential to enact targeted policy measures according to the external environment's characteristics.

For the Southern coastal area, the most important task is to improve penetration and acceptance of insurance products. For the Eastern coastal area, the exploration of insurance product should be more flexible and diversified. For the Northern coastal area, it was vital to focus on risk management to realize the sustainable development of insurance industry.

Although this study presents an approach for acquiring the dynamic linkage between insurance development and economy growth, it has several limitations. First, only insurance density and per capita GDP were considered in the modeling. Future research could incorporate other dimensions (for example, population structure) to enrich the findings.

Second, the necessary indicators were annual figures, so only yearly dynamic characteristics and changing trend were analyzed, and detailed statement could be gain with more plentiful data. Despite these limitations, future research has two potential directions. First, on the modeling side, the concept of dynamic relations could be integrated with concrete function for improving the explanatory ability. Second, on the application side, collaboration mechanism by using the proposed approach to reduce the region economy development gaps could be undertaken with insurance institutions.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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REFERENCES

Arena M (2008). Does insurance market activity promote economic growth? A cross-country study for industrialized and developing countries. J. Risk Insuranc. 75(4):921–946.

Abdul LA, Vera F (2014) .Insurance-growth nexus in China: An auto regressive distributed lag bounds cointegration approach. Rev. Dev. Finan.13:83-96.

Beck T, Webb I (2003) .Determinants of Insurance Consumption Across Countries, World Bank Economic Review.17:51-88.

Billio M, Getmansky M, Lo AW, Pelizzon L (2012). Econometric measures of connectedness and systemic risk in the finance and insurance sectors. J. Financ. Econ. 104(3):535–559.

Chiu YB, Lee CC (2012). The impact of real income on insurance premiums: Evidence from panel data. Int. Rev. Econ. Financ. 21(1):246-260.

Chang CH, Lee CC (2012).Non-linear between life insurance and economic development: a revisited approach. The Geneva Risk and Insurance Rev. 37:227-275.

Choong CK (2012).Does domestic financial development enhance the linkages between foreign direct investment and economic growth?. Empirical Econ. 42(3):819-834.

Cristea M, Marcu N, Carstina S (2014).The relationship between insurance and economic growth in Romania compared to the main results in Europe-a theoretical and empirical analysis. Procedia Econ. Financ. 8:226-235.

Feyen E, Lester R, Rocha R (2011) .What drives the development of the insurance sector? An empirical analysis based on a panel of developed and developing Countries. World Bank Working Paper, 5572.

Han L, Li DM, Tian Y (2010). Insurance development and economic growth Geneva Papers.The Geneva Papers on Risk and Insurance-Issues and Practice.35(3):183-199.

Han CL, Wang XJ (2012). The empirical research of the relationships between the development of insurance industry and economic growth in China. 5th International Institute of Statistics and Management Engineering Symposium.26,327-332.

Hansen GD, Hsu M, Lee J (2014). Health insurance reform: the impact of a medicare buy-in. J. Econ. Dyn. Control. 45:315-329.

Hsu M, Huang XG, Yupho S (2015).The development of universal health insurance coverage in Thailand: Challenges of population aging and informal economy, Social Science &Medicine,145:227-236.

Hsu M, Liao PJ (2015). Financing national health insurance: challenge of fast population aging. Taiwan Econ. Rev. 43 (2):145-182.

Wang JJ, Meng LL, Chun L (2010).The economic judgment of the agricultural insurance in modern agriculture development phase. 2nd International Conference on Information Science and Engineering, ICISE2010 - Proceedings 8, 708-711.

Li D, Moshirian F, Nguyen P, Wee T (2007). The demand for life insurance in OECD countries.J.Risk and Insurance. 74(3):637-652.

Liedtke PK (2007). What's insurance to a modern economy? Geneva Papers Risk Insurance-Issues Pract. 32:211-221.

Lee CC, Chiu YB, Chang CH (2013). Insurance demand and country risks: A nonlinear panel data analysis. J. Int. Money Financ. 36:68-85.

Law SH, Singh N (2014). Does too much finance harm economic growth?, J. Bank. Financ. 41:36-44.

Patrick H (1966) .Financial development and economic growth in underdeveloped countries, Economic Development and Cultural Change. 14(1):174-189.

Roe MJ, Siegel JI (2011). Political instability: Effects on financial development, roots in the severity of economic inequality, J. Compar. Econ. 39(3): 279–309.

Yang SY, Li HA, Fang HC (2014).The Non-linear relationship between economic and life insurance development in Asia: A panel threshold regression analysis. Computer Science and Its Applications - Ubiquitous Information Technologies. 330(20):1281-1290.

Samargandi N, Fidrmuc J, Ghosh S (2015) .Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income. World Development, 68:66-81.

Shen KY, Hu SK, Tzeng GH (2017) .Financial modeling and improvement planning for the life insurance industry by using a rough knowledge based hybrid MCDM model, Information Sciences.375:296-313.

United Nations Conference on Trade and Development, 1991. Handbook of International Trade and Development Statistics, United Nation :New York.

Ye A (2003). Non-parametric econometrics. Nankai University press, Tianjin. pp.82-92.

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