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Does Gibrat's Law Hold in the Insurance Industry of China? A Test with Sequential Panel Selection Method

Summary: This study applies the Sequential Panel Selection Method to investigate whether the growth rate of total insurance premium is independent of their size, as postulated by Robert Gibrat's (1931) Law of Proportionate Effects. Time-series data for the total insurance premium of 35 insurance companies in China during the December 2005 to May 2011 period are used. Since other panel-based unit root tests are joint tests of a unit root for all members of a panel and are incapable of determining the mix of I(0) and I(1) series in a panel setting, the SPSM, proposed by Georgios Chortareas and George Kapetanios (2009), classifies a whole panel into a group of stationary series and a group of non-stationary series. In doing so, we can clearly identify how many and which series in the panel are stationary processes. The empirical results from the SPSM tests unequivocally indicate that Gibrat's Law is only valid for one of these 35 companies studied here. Our study has important policy implications for insurance regulation, insurance market construction, and policyholder protection.

Key words: Gibrat's law, Sequential panel selection method, Insurance, China.

JEL: C22, C23.

The development of insurance industry in China encountered huge set-back during the planned economy era when "private insurance was neither much needed nor purchased" (Mark S. Dorfman 2008) because of the exaggerated use of public funds for coverage of losses, comprehensive social insurance and government ownership of the means of production. Most of the domestic insurance business was shut down before the starting of the policy of reform and opening in 1978. Since 1978, the Chinese economic reform has been a spectacular economic success which has generated rapid economic growth over three decades and the country has moved from a centrally planned economy towards a market economy. Privatization incentives the development of risk management and growth of insurance demand and at the same time insurance markets become more and more deregulated and liberalized. Insurance industry keeps growing at an impressively high speed. In 2010, the Chinese insurance market had total gross written premiums of \$214.3 billion, ranking the 6th in the world insurance market, representing a compound annual growth rate (CAGR) of 26.7% between 2006 and 2012. However, it is astonishing that few researches about the growth of insurance companies have been seen for understanding the development of insurance market. In this study, we employ total insurance premium to analyze the relationship between growth rate and firm size for 35 companies in the insurance industry in China. Gibrat (1931) pioneered the theory, which is hereafter called Gibrat's Law of Proportionate Effects or Gibrat's Law for short, that a firm's growth rate is independent of its size at the beginning of the period examined and that the distribution of that firm's sizes towards the lognormal. In other words, the probability of a proportionate change in size during a specified period is the same for all firms in a given industry irrespective of their size at the beginning of the period (Edwin Mansfield 1962). What this indicates is that the size-growth relationship is based on a random growth process.

To investigate whether Gibrat's Law holds true in 35 companies in the insurance industry in China, we test the non-stationarity of the total insurance premium of 35 insurance companies using the Sequential Panel Selection Method (hereafter, SPSM) with panel KSS unit root tests of Kapetanios, Yongcheol Shin, and Andy Snell (2003), (hereafter, KSS). We believe this is the first study in which the SPSM with the panel KSS unit root tests are used to test Gibrat's Law with such a large panel of insurance companies in China. Empirical results indicate that Gibrat's Law only holds in one of these 35 insurance companies in China. Economic significance of the results is analyzed followed with some suggestions about policy making.

The remainder of this empirical study is organized as follows. Section 1 briefly describes the Gibrat's Law. Section 2 surveys the literature on the Gibrat's Law. Section 3 presents the data used in our study. Section 4 describes the methodology, the empirical findings and policy implications. Finally, Section 5 presents some concluding remarks.

1. The Gibrat's Law

According to Gibrat (1931), a firm's growth rate is independent of its size at the beginning of the period examined; in other words, the probability of a proportionate change in size during a specified period is the same for all firms in a given industry regardless of their size at the beginning of the period (Mansfield 1962). Thus, the analysis of the size-growth relationship is based on the random growth process as Gibrat's Law of Proportionate Effects (LPE, Gibrat 1931) indicated. Following Stephen J. Clark and Jack C. Stabler (1991), we employ a simple version of Gibrat's Law, as put forward by Daniel R. Vining (1976). We denote the size of firm i at time t by IP_{it} and consider the following expression to relate firm sizes in different periods:

$$IP_{it} = \delta_{it} IP_{i,t-1} . \tag{1}$$

If we consider the decomposition of the growth rate in terms of a random factor ε_{it} and a deterministic component involving a constant rate and a previous growth rate, then we have the following expression:

$$\delta_{it} = \varepsilon_{it} C_i \prod_{j=1}^{n} \delta_{i,t-j}^{\gamma_{ij}} \tag{2}$$

where, C_i and γ_{ij} represent constants and j = 1,…, n,. The combination of expressions (1) and (2) yields an empirical model of the form:

$$\Delta \ln IP_{it} = c_i + \beta_i \ln IP_{i,t-1} + \sum_{j=1}^{n} \gamma_{ij} \Delta \ln IP_{i,t-1} + v_{it} \tag{3}$$

where $c_i = \ln C_i$ and $v_{it} = \ln \varepsilon_{it}$. Here we are confronted with a standard augmented Dickey-Fuller (ADF) testing framework. The null hypothesis of a unit root should correspond to $\beta_i = 0$ (against the alternative hypothesis $\beta_i < 0$) and should reflect Gibrat's Law which signals independence between growth rate and firm size (in log form). In other words, Gibrat's Law concerning independence between firm growth and size can be assessed in terms of a unit root test for the log of firm size that involves testing a zero coefficient in expression (3). Rather than seek a comprehensive model to explain firm growth, we explore the time-series implications of Gibrat's Law with respect to firm size (in log form).

2. Literature Review

Previous investigations of Gibrat's Law have empirically tested cross-sectional regressions of logarithmic growth over certain periods, but these empirical results have not been conclusive. Several studies have provided evidence of either no relationship or a positive relationship between the size and growth of a firm (Mansfield 1962; M. A. Utton 1971; Ajit Singh and Geoffrey Whittington 1975; Adrian E. Tschoegl 1983). On the other hand, some researchers have even argued that Gibrat's Law never holds true (Manmohan S. Kumar 1985; David Evans 1987; Bronwyn Hall 1987; Peter Hart and Nicholas Oulton 1996). In the insurance area, Gibrat's Law has rarely been examined. Study by Philip Hardwick and Mike Adams (2002) investigated the firm size and growth relationship using 176 UK life-insurers for the period 1987 and 1996. Their findings generally support Gibrat's Law with no significant difference noted between growth rates and size for small and large life insurance firms. In Choi (2002) using two-stage regression analysis suggested by James J. Heckman (1979) to test the relation between growth rate and size for the US Property-Liability (P-L) insurers during 1992-2001, empirical results strongly supported Gibrat's Law in the U.S. P-L insurance market for the testing periods, Furthermore, the results are consistent for longer time periods and shorter sub-periods.

However, the studies using cross-sectional regressions have not taken time factors into consideration, and this has not only given rise to the problem of low power in the testing process, but has also resulted in biased parameter estimates. Recently, some papers have applied unit root tests to empirically test Gibrat's Law. Worth noting is that non-stationarity of firm size means that a firm's growth rate is independent of its size, which indicates that Gibrat's Law holds for that firm. Conventional unit root tests, however, both fail to consider information across firms and have lower power when compared with near-unit-root but stationary alternatives.

In order to increase the power in testing for a unit root, many researchers have employed panel data (Mark Taylor and Lucio Sarno 1998; Gangadharrao S. Maddala and Shaowen Wu 1999; Andrew Levin, Chien-Fu Lin, and Chia-Shang Chu 2002; Kyung So Im, Hashem Pesaran, and Shin 2003; Ranjpour Reza and Karimi T. Zahra 2008; Yasemin Özerkek and Sadullah Çelik 2010). In this regards, first generation panel-based unit root tests: Levin-Lin-Chu (Levin, Lin, and Chu 2002), the Im-Pesaran-Shin (Im, Pesaran, and Shin 2003), and the MW (Maddala and Wu 1999) tests are developed. A serious drawback of the first generation panel-based unit root tests is that they do not take (possible) cross-sectional dependencies into account in the panel-based unit root test procedure. Hence, four second generation panel-based unit root tests of Choi (2002), Jushan Bai and Serena Ng (2004), Roger H. Moon and Benoit Perron (2004), and Pesaran (2007) are proposed. However, they are not informative in terms of the number of series that are stationary processes when the null hypothesis is rejected.

To classify a whole panel into a group of stationary series and a group of non-stationary series, this paper adopts the SPSM, proposed by Chortareas and Kapetanios (2009). This method uses a sequence of panel unit root tests to distinguish between stationary and non-stationary series. For a large panel such as the data in this study, remarked by Chortareas and Kapetanios (2009), if more than one series are actually non-stationary then the use of panel methods to investigate the unit root properties of the set of series may indeed be more efficient and powerful compared to univariate methods. This method first implements a panel unit root test to all time series in the panel and if the null is not rejected we accept the non-stationary hypothesis and the procedure stops. If the null is rejected then we remove from the set of series the one with the minimum individual Dickey-Fuller (DF) *t*-test (and/or KSS statistics in our study) and redo the panel unit root test on the remaining set of series. The procedure is continued until either the test does not reject the null hypothesis or all the series are removed from the set. The end result is a separation of the set of variables into a set of stationary variables and a set of non-stationary variables. Based on these advantages, this study applies the SPSM to investigate whether the growth rate of total insurance premium is independent of their size, as postulated by Gibrat's (1931) Law.

3. Data

In this study, we use monthly data for total insurance premium collected from 35 insurance companies in China over the 2005:12 to 2011:05 period. The source of the data is the website of China Insurance Regulation Commission (CIRC). This paper uses total insurance premium collected as a measure of firm size on the argument that among all size variables, the total insurance premium collected is the most important source of growth for an insurance company. The datasets for total insurance premium indicate that China Life and Samsung Air China Life, respectively, have the highest and lowest total insurance premium collected in 35 insurance companies of China, as shown in Table 1. The Jarque-Bera test results indicate that the datasets for total insurance premium collected for 31 of the 35 insurance companies are approximately non-normal.

4. Methodology and Empirical Findings

4.1 Panel KSS Unit Root Test and SPSM

Studies have found that many macroeconomic and financial time series not only contain unit roots but also exhibit nonlinearities, conventional unit root tests, such as the ADF unit root test, have low power in detecting the mean-reverting tendency of the series. For this reason, stationary tests in a nonlinear framework must be applied. Here, we use the nonlinear stationary test advanced by Kapetanios, Shin, and Snell (2003) (KSS).

In line with Kapetanios, Shin, and Snell (2003), the KSS test is based on detecting the presence of non-stationarity against a nonlinear but globally stationary exponential smooth transition autoregressive (ESTAR) process. The main idea is that time series data may revert to their mean only when they are sufficiently far away from it. When they are close to their mean, they may behave as non-stationary processes. Accordingly, the model is given by

$$\Delta IP_t = \gamma IP_{t-1}\{1-\exp(-\theta IP_{t-1}^2)\} + v_t \tag{4}$$

where IP_t is the data series of interest, v_t is an i.i.d. error with zero mean and constant variance, and $\theta \geq 0$ is the transition parameter of the ESTAR model and governs the speed of transition. Under the null hypothesis IP_t follows a linear unit root process, but IP_t follows a nonlinear stationary ESTAR process under the alternative. One shortcoming of this framework is that the parameter γ is not identified under the null hypothesis. Kapetanios, Shin, and Snell (2003) used a first-order Taylor series approximation for $\{1-\exp(-\theta IP_{t-1}^2)\}$ under the null hypothesis $\theta = 0$ and then approximated equation (4) by using the following auxiliary regression:

$$\Delta IP_t = \xi + \beta IP_{t-1}^3 + \sum_{i=1}^{k} b_i \Delta IP_{t-i} + v_t \text{ , } t = 1, 2, \ldots, T \tag{5}$$

In this framework the null hypothesis and alternative hypotheses are expressed as $\beta = 0$ (non-stationarity) against $\beta < 0$ (non-linear ESTAR stationarity). Nuri Ucar and Tolga Omay (2009) expanded a nonlinear panel data unit root test based on regression (5). The regression is:

$$\Delta IP_{i,t} = \gamma_i IP_{i,t-1}\{1-\exp(-\theta_i IP_{i,t-1}^2)\} + v_{i,t} \tag{6}$$

Ucar and Omay (2009) also applied first-order Taylor series approximation to the Panel ESTAR (6) model around θ_i=0 for all *i*, and obtained the auxiliary regression:

$$\Delta IP_{i,t} = \xi_i + \beta_i IP_{i,t-1}^3 + \sum_{j=1}^{k} \theta_{i,j} \Delta IP_{i,t-j} + v_{i,t} \tag{7}$$

where $\beta_i = \theta_i \gamma_i$ and the hypotheses established for unit root testing based on regression (7) are as follows:

$$\begin{aligned} &H_0 : \beta_i = 0 \text{, for all } i \text{, (linear nonstationarity)} \\ &H_1 : \beta_i < 0 \text{, for some } i \text{, (nonlinear stationarity)} \end{aligned} \tag{8}$$

Then the SPSM proposed by Chortareas and Kapetanios (2009) are based on the following steps:

(1) The Panel KSS test is first conducted to all log of the insurance premium IP_t in the panel. If the unit-root null cannot be rejected, the procedure is stopped, and all the series in the panel are non-stationary. If the null is rejected, go to Step 2.
(2) Remove the series with the minimum KSS statistic since it is identified as being stationary.
(3) Return to Step 1 for the remaining series, or stop the procedure if all the series are removed from the panel.

Final result is a separation of the whole panel into a set of mean-reverting series and a set of non-stationary series.

4.2 Empirical Findings

Tables 2 and 3 report the results for the first generation and second generation panel-based unit root tests. In Table 2, three first generation panel-based unit root tests all yield similar results, indicating that Gibrat's Law holds true for all 35 insurance companies in China. Table 3 shows that, among the second generation panel-based unit root tests, both Bai-Ng and Pesaran tests support the Gibrat's Law whereas both Moon-Perron and Choi tests indicate that Gibrat's Law not hold in the 35 insurance companies.

To identify how many and which firms in the panel support the Gibrat's Law (non-stationary process) we proceed to the SPSM procedure mixed with the Panel KSS test. Table 4 shows that, the null hypothesis of unit root was rejected when the Panel KSS test was first applied to the whole panel, producing a value of -3.828 with a very small p-value approximating to zero. After implementing the SPSM procedure, we found GeneralI China Life with the minimum KSS value of -5.18 among the panel. Then, GeneralI China Life was removed from the panel and the Panel KSS test was implemented again to the remaining set of series. After that, we found that the Panel KSS test still rejected the unit root null with a value of -3.788 (p-value of nearly zero), and AIA was found to be stationary with the minimum KSS value of -5.147 among the panel this time. Then, AIA was removed from the panel and the Panel KSS test was implemented again to the remaining set of series. The procedure was continued until the Panel KSS test failed to reject the unit root null hypothesis at the 10% significance level. To check the robustness of our test, we continued the procedure until the last sequence. Apparently, the SPSM procedure using the Panel KSS test provided strong stationary evidence in the insurance premium for 34 out of the 35 companies. This result indicates that Gibrat's Law only holds true for one of these 35 insurance companies in China. Our findings are very different from previous tests conducted for insurance markets in the US and the UK in which Gibrat's Law was generally supported for insurance companies. However, our empirical results are well justified if we take a quick survey on the development of insurance market in China during the period under study. From 2005 to 2011, the insurance market has gone through radical changes. The number of insurance companies in the insurance market of China increased from 35 to more than 100, with 52 for non-life insurance sectors and 55 for life insurance sectors. The market structure changed dramatically. Life insurance industry generally gained a high growth rate than non-life. The concentration ratio for both life and non-life insurance markets decreased significantly, a lot of small companies and new entrants, either domestic or foreign, grew at a higher growth rate than state-owned big companies on average, with a few exceptions. At the same time, unfair competition and illegal operation were common to see too. In all, the insurance market of China is still immature, most insurance companies in it failed to grow regularly, thus the hypothesis of Gibrat (1931) of which each company has the same growth rate disregarding the original size does not hold true. Though we can't draw a direct conclusion on the efficiency of the insurance industry in China from the test results, we still have reasons to believe that the efficiency of the insurance industry is low at the stage of extensive growth. Besides, the unbalanced growth among different companies makes it full of risk for specific companies and the whole industry as well. The results of this study have important policy implication for policymakers. In light of the new insight gained here into the relationship between firm growth rate and firm size, policymakers are suggested to consider following strategies. First, though deregulation is a global trend in insurance sector, regulation on the operation risk of insurance company to prevent the policyholders from suffering losses due to failure of insurance companies in such an unstable market should be strengthened. Second, market order should be well maintained and even enhanced when more companies are encouraged to enter the market to promote the competition. Third, policyholder protection should be realized as the priority during the process of insurance market expansion, especially at the elementary state.

5. Conclusions

Using monthly data over the 2005:12 to 2011:05 period, this study empirically tests whether Gibrat's Law holds in China's insurance industry. In this empirical study, we employ the SPSM with panel KSS unit root tests of Kapetanios, Shin, and Snell (2003) to assess the non-stationary properties of the total insurance premium of 35 insurance companies in China. The results from the first generation panel-based unit root tests of the Levin-Lin-Chu, Im-Pesaran-Smith and MW all support the hypothesis that Gibrat's Law holds throughout China's insurance industry - that means firm growth rate is independent of firm size. However, the second generation panel-based unit root tests of Bai-Ng, Choi, Pesaran and Moon-Perron give us mixed results. Furthermore, when we conduct the SPSM with panel KSS unit root tests of Kapetanios, Shin, and Snell (2003) we find that Gibrat's Law only holds true for one company, Huatai Life, in China. Our empirical results have important policy implications for regulation of insurance market and policyholder protection.

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Appendix

Table 1 Summary Statistics of Total Premium Incomes

Company	Mean	Max.	Min.	Std. Dev.	Skew	Kurt	J-B
AEGON-CNOOC Life	66702.22	171970.80	3989.50	45902.21	0.532	2.055	5.562*
AIA	393912.50	889649.80	12753.60	238357.90	0.250	1.949	3.721
Allianz China Life	97129.37	300058.40	4103.80	77335.09	0.883	2.872	8.629**
Aviva-COFCO Life	176962.20	492545.30	7716.52	132334.40	0.564	2.151	5.484*
AXA-Minmetals	40615.55	117786.80	3282.62	27084.71	0.729	2.832	5.930*
Cathay Life	28281.07	61861.47	946.12	17632.79	0.290	1.883	4.353
China CMG Life	17828.92	71286.81	549.29	15285.97	1.401	5.181	34.682***
China Life	15179001.00	33303977.00	2026223.00	8025759.00	0.349	2.312	2.645
CIGNA and CMC Life	91593.56	323564.10	1698.73	81138.39	1.060	3.177	12.449***
CITIC-Prudential Life	170646.00	541415.50	7822.06	128652.10	0.879	3.050	8.498**
Citigroup Life	55090.79	208557.40	413.58	53293.10	1.031	3.397	12.137***
Generall China Life	265913.20	1997195.00	12722.79	262494.40	4.451	29.814	2195.177***
Greatwall Life	82486.55	251538.60	2999.17	58893.74	0.726	2.917	5.809**
Haier New York Life	21752.77	118373.20	2683.36	16917.72	2.911	17.139	643.037***
Heng An Standard Life	62050.93	203603.60	2827.03	48919.23	0.803	2.745	7.273**
Huatai Life	148470.80	606414.00	936.99	166176.70	1.165	3.361	15.293***
ING Capital Life	55846.96	182214.90	3629.55	47117.64	1.028	3.056	11.625***
Manulife-Sinochen Life	305489.90	15759300.00	5201.88	1932034.00	7.931	63.944	10906.09***
Minsheng Life Insurance	255575.70	812945.40	4519.69	210991.20	0.784	2.625	7.141**
New China Life	3006710.00	9364308.00	243816.70	2199513.00	1.044	3.450	12.540***
Nissay-SVA Life	7879.92	27032.04	463.00	6067.70	1.072	3.508	13.340***
Pacific Life	43897.89	104754.90	3140.00	29015.24	0.429	2.085	4.324
Pacific-Antna Life	3485411.00	9199987.00	327247.20	2107229.00	0.661	2.836	4.879*
PICC Health	358810.20	1377691.00	1167.10	417879.40	1.255	3.406	17.767***
PICC Life	1860134.00	8242552.00	126.01	2166170.00	1.185	3.612	16.474***
Ping An Life	5904622.00	15906385.00	631050.10	3646365.00	0.775	3.028	6.602**
Samsung Air China Life	7497.91	34195.29	54.34	8867.58	1.348	3.951	22.473***
Sino Life	445511.00	1531810.00	22021.30	347243.40	1.120	3.863	15.848***
Sino-US MetLife	75215.39	253967.80	1920.94	65079.90	0.791	2.616	7.281**
Skandia-BSM Life	42606.48	186098.60	204.72	44683.40	1.735	5.491	50.165***
Sun Life Everbright Life	111708.60	510595.40	2205.64	114256.00	1.685	5.425	47.393***
Tai Kang Life	2970325.00	8676460.00	209029.70	2096232.00	0.867	2.940	8.276**
Taiping Life	1107001.00	3302455.00	86446.37	738817.00	0.948	3.517	10.611***
Tianan Life	17681.05	45545.54	1025.04	11536.06	0.637	2.481	5.209*
Union Life	258747.20	772221.80	8259.91	190192.40	0.732	2.568	6.408**

Note: The sample period is from December 2005 to May 2011. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Source: Authors' estimations.

Table 2 Panel Unit Root Tests - First Generation Panel Unit Root Test

Levin, Lin, and Chu (2002)	t_ρ^*	$\hat{\rho}$	t_ρ^{*B}	t_ρ^{*C}	
	22.265 (1.000)	-0.129** (0.000)	12.327 (1.000)	12.952 (1.000)	
Im, Pesaran, and Shin (2003)	t_bar_{NT}	$W_{t,bar}$	$Z_{t,bar}$	$t\_bar_{NT}^{DF}$	$Z_{t,bar}^{DF}$
	-1.689	-1.103 (0.135)	-1.898** (0.029)	-3.893	-16.05** (0.000)
Maddala and Wu (1999)	P_{MW}	Z_{MW}			
	70.365 (0.465)	0.031 (0.488)			

Note: Levin, Lin, and Chu (2002): t_p^* denotes the adjusted t-statistic computed with a Bartlett kernel function and a common lag truncation parameter given by $\bar{K} = 3.21T^{1/3}$ (Levin, Lin, and Chu 2002). Corresponding p-value is in parentheses. $\hat{\rho}$ is the pooled least squares estimator. Corresponding standard error is in parentheses. t_p^{*B} denotes the adjusted t-statistic computed with a Bartlett kernel function and individual bandwidth parameters (Whitney K. Newey and Kenneth D. West 1994). t_p^{*C} denotes the adjusted t-statistic computed with a Quadratic Spectral kernel function and individual bandwidth parameters. Finally, t_ρ^* denotes the adjusted t-statistic computed with a Bartlett kernel function and a common lag truncation parameter. Corresponding p-value is in parentheses. ** indicates significant at the 5% level. Im, Pesaran, and Shin (2003): $t\_bar_{NT}^{DF}$ (respectively t_bar_{NT}) denotes the mean of Dickey Fuller (respectively Augmented Dickey Fuller) individual statistics. $Z_{t,bar}^{DF}$ is the standardized $t\_bar_{NT}^{DF}$ statistic and associated p-values are in parentheses. $Z_{t,bar}$ is the standardized t_bar_{NT} statistic based on the moments of the Dickey Fuller distribution. $W_{t,bar}$ denotes the standardized t_bar_{NT} statistic based on simulated approximated moments (Im, Pesaran, and Shin 2003, Table 3). The corresponding p-values are in parentheses. ** indicates significant at the 5% level. Maddala and Wu (1999): P_{MW} denotes the Fisher's test statistic defined as $P_{MW} = -2\sum \log(p_i)$; where p_i are the p-values from ADF unit root tests for each cross-section. Under H_0; P_{MW} has χ^2 distribution with 2N of freedom when T tends to infinity and N is fixed. ZMW is the standardized statistic used for large N samples: under H0; Z_{MW} has a N (0, 1) distribution when T and N tend to infinity.

Source: Authors' estimations.

Table 3 Panel Unit Root Tests - Second Generation Panel Unit Root Test

Bai and Ng (2004)	$\hat{r}$	$Z^c_{\hat{e}}$	$P^c_{\hat{e}}$	MQ_c	MQ_f
	5	-1.263 (0.897)	55.058 (0.905)	1	4
Moon and Perron (2004)	t^*_a	t^*_b	$\hat{\rho}^*_{pool}$	t^{*B}_a	t^{*B}_b
	-61.320** (0.000)	-15.428** (0.000)	0.670	-58.398** (0.000)	-15.155** (0.000)
Choi (2002)	P_m	Z	L^*		
	4.093** (0.000)	-3.112** (0.001)	-3.434** (0.000)		
Pesaran (2007)	P^*	$CIPS$	$CIPS^*$		
	12	-1.570 (0.810)	-1.570 (0.810)		

Note: Bai and Ng (2004): $\hat{r}$ is the estimated number of common factors, based on IC criteria functions. $P^c_{\hat{e}}$ be is a Fisher's type statistic based on p-values of the individual ADF tests. $Z^c_{\hat{e}}$ be is a standardized Choi's type statistic for large N samples. P-values are in parentheses. The first estimated value $\hat{r}_1$ is derived from the filtered test MQ_f and the second one is derived from the corrected test MQ_c . ** indicates significant at the 5% level. Moon and Perron (2004): t^*_a and t^*_b are the unit root test statistics based on de-factored panel data (Moon and Perron 2004). Corresponding p-values are in parentheses. $\hat{\rho}^*_{pool}$ is the corrected pooled estimates of the auto- regressive parameter. t^{*B}_a and t^{*B}_b are computed with a Bartlett kernel function in spite of a Quadratic Spectral kernel function. Choi (2002): the P_m test is a modified Fisher's inverse chi-square test (Choi 2002). The Z test is an inverse normal test. The L^* test is a modified logit test. p-values are in parentheses. Pesaran (2007): $CIPS$ is the mean of individual Cross sectionally augmented ADF statistics (CADF). $CIPS^*$ denotes the mean of truncated individual CADF statistics. Corresponding p-values are in parentheses. P^* denotes the nearest integer of the mean of the individual lag lengths in ADF tests.

Source: Authors' estimations.

Table 4 Results of KSS Test on Total Insurance Premium

Sequence	$S_N p$ statistic	Min. ADF statistic	Series
1	-3.828(0.000)	-5.180	Generall China Life
2	-3.788(0.000)	-5.147	AIA
3	-3.747(0.002)	-5.083	Manulife-Sinochen Life
4	-3.705(0.001)	-4.909	Haier New York Life
5	-3.666(0.001)	-4.817	Pacific-Antna Life
6	-3.628(0.001)	-4.604	China Life
7	-3.594(0.000)	-4.528	Cathay Life
8	-3.561(0.001)	-4.339	CITIC-Prudential Life
9	-3.532(0.000)	-4.279	Heng An Standard Life
10	-3.503(0.004)	-4.138	Pacific Life
11	-3.478(0.001)	-4.108	Allianz China Life
12	-3.452(0.000)	-4.107	Ping An Life
13	-3.423(0.003)	-4.082	AXA-Minmetals
14	-3.393(0.001)	-4.024	AEGON-CNOOC Life
15	-3.363(0.000)	-4.007	Tianan Life
16	-3.331(0.001)	-3.964	Aviva-COFCO Life
17	-3.298(0.003)	-3.962	Taiping Life
18	-3.261(0.003)	-3.883	Sino-US MetLife
19	-3.224(0.003)	-3.873	Greatwall Life
20	-3.184(0.002)	-3.721	Nissay-SVA Life
21	-3.148(0.001)	-3.671	ING Capital Life
22	-3.111(0.004)	-3.534	New China Life
23	-3.078(0.001)	-3.512	Tai Kang Life
24	-3.042(0.000)	-3.509	Citigroup Life
25	-3.000(0.002)	-3.494	Union Life
26	-2.950(0.002)	-3.485	Skandia-BSM Life
27	-2.891(0.001)	-3.369	China CMG Life
28	-2.831(0.010)	-3.260	Sino Life
29	-2.770(0.007)	-3.240	CIGNA and CMC Life
30	-2.691(0.007)	-3.171	Minsheng Life Insurance
31	-2.595(0.030)	-2.890	Sun Life Everbright Life
32	-2.521(0.037)	-2.732	PICC Life
33	-2.451(0.067)	-2.634	PICC Health
34	-2.360(0.025)	-2.421	Samsung Air China Life
35	-2.298(0.196)	-2.298	Huatai Life

Note: Entry in parenthesis stands for the bootstrap p-value. The significance level is 10%. The maximum lag is set to be 8. The bootstrap replications are 5000.

Source: Authors' estimations.