Routledge
Taylor & Francis Group

Economic Research-Ekonomska Istraživanja

ISSN: 1331-677X (Print) 1848-9664 (Online) Journal homepage: http://www.tandfonline.com/loi/rero20

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To cite this article: Yi Zhao, Baiqing Sun, Binqing Xiao & Fu Cheng (2018) Selecting a better valuation model to measure bubble level of stocks price: empirical study from internet-based finance stocks in A-share market, Economic Research-Ekonomska Istraživanja, 31:1, 1619-1640, DOI: 10.1080/1331677X.2018.1484787

To link to this article: https://doi.org/10.1080/1331677X.2018.1484787

Published online: 13 Nov 2018.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2018, VOL. 31, NO. 1, 1619–1640
https://doi.org/10.1080/1331677X.2018.1484787

Selecting a better valuation model to measure bubble level of stocks price: empirical study from internet-based finance stocks in A-share market

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ABSTRACT

As a star of emerging industries in China, internet-based finance has been developing rapidly. This paper, considers selecting a more suitable valuation model to measure the intrinsic value and price bubble of Internet-based Finance stocks. By comparing the relative valuation accuracy of the Kim et al. model with the Frankel-Lee model and the F-O model applied in the prior studies, this study finds that the Kim et al. model highlights the industry-specific features and outperforms other models in interpreting stocks price variation. Especially, under the circumstance of soaring and slumping stocks price variation (e.g. 2015), it is essential to study the price bubbles of internet-based finance stocks at different points of Shanghai Stock Exchange Composite Index. Surprisingly, our empirical results suggest that the internet-based finance stocks have negative bubbles at the whole average level, and about half of them are undervalued. Moreover, there are positive correlations between the bubble level and three key factors including the trading volume, the price to book ratio and whether to do cross-industry business on internet-based finance. These findings imply that the Kim et al. model contributes to improving valuation accuracy of internet-based finance stocks and explainability of the price bubbles in A-share market.

ARTICLE HISTORY
Received 19 August 2016
Accepted 19 February 2018

KEYWORDS
Internet-based finance; intrinsic value; valuation model; bubble level

JELS CLASSIFICATION
G11; G1; M41; O16

1. Introduction and literature review

On 18 December 2015, Yirendai Ltd was listed on the New York Stock Exchange (NYSE) and became China's first internet-based finance enterprise listed in an overseas capital market (Wang & Lei, 2016). However, its trading price fell below its issue price twice during the first day of IPO, with the lowest trading price ($8.37) and closing price being $8.99, dropping by over 10%, compared with its IPO price ($10 per

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share). The intrinsic value is the basis of IPO pricing. On the one hand, Yirendai's IPO 'Debut' has caused domestic internet-based finance enterprises to accelerate the preparations for IPO. On the other hand, it aroused reflection upon the intrinsic value of internet-based finance stocks. Is the intrinsic value of internet-based finance stocks overvalued? How much is the intrinsic value of internet-based finance stocks in China's A-share market? Currently, domestic major internet-based finance enterprises, such as JD Finance and Ant Small & Micro Financial Services Group, have disclosed their plans to list on the China's A-share market between 2017 and 2019. Not only does evaluating the intrinsic value of stocks accurately be the basis of IPO pricing for China's internet-based finance enterprises, but also the foremost consideration for ordinary investors conducting value-oriented investment.

Regarding evaluating the intrinsic value of stocks, there are mainly three methods: the dividend discount model (DDM), the free cash flow to equity model (FCFE) and the residual income model (RIM). Francis, Olsson, and Oswald (2000) reported that based on the empirical study on 2907 firm-year observations, the intrinsic value of stocks evaluated by RIM could most strongly explain stock price variations. The intrinsic value of stocks evaluated by RIM can explain 71% stock price variations, while that evaluated by DDM/FCFE can only explain 51%/35% stock price variations. The American Accounting Association (AAA) has confirmed that RIM can utilise existing accounting information more sufficiently and is more accurate than the other two methods. So RIM has been actively introduced to the investment community for application by AAA, and excellent results were obtained in America (Song & Chen, 2006).

RIM was first put forward by Preinreich in 1938 (Feltham & Ohlsonn, 1995). Then Ohlson (1995) epitomised RIM and established the F-O model (1995) including the multidimensional linear information dynamics (LID) process, and the O-J nonlinear residual income growth valuation model (2005), as notable landmarks, are the cornerstone of subsequent model innovations.

The main part of the F-O model (1995) is the sum of discounts of future indefinite-duration residual income. On the basis of existing literature (Feltham & Ohlsonn, 1995; Ohlson & Juettner-Nauroth, 2005; Penman, 2005; Echterling, Eierle, & Ketterer, 2015), three specific application difficulties on the F-O model (1995) are summarised as follows.

1. Forecasting future residual income is difficult because the key of future residual income forecast is the future earnings forecast of an enterprise.
2. No enterprises can guarantee the future indefinite-duration growth of residual income, so how can a indefinite-duration forecast be changed to a definite-duration forecast?
3. The growth of residual income of an enterprise is not necessarily linear, namely, not necessarily consistent with LID assumption.

In this regard, new breakthroughs have been made in follow-up research: Frankel and Lee (1998) introduced analyst earning forecast as a substitution variable of enterprise future earnings for the first time, which can solve difficulties (1) and (3) above. However, it must be assumed that a company's earnings in the coming third year can

continue indefinitely. The application of future three-phase analyst earning forecast has improved the operability of the F-O model (1995). Most of the subsequent studies focus on the model improvement and empirical study of analyst earning forecast, such as Lee, Myers, and Swaminathan (1999) and Gebhardt and Swaminathan, (2001). Ali, Hwang, and Trombley (2003) found that the effect and efficiency of future earnings forecast in the Frankel–Lee model (1998) are superior to the other two models by comparing the Frankel–Lee model (1998) with the Dechow et al. model (1999) and the Gode and Mohanram model (2003).

However, the Frankel–Lee model (1998) still has obvious limitations: an analyst can only conduct a three-year forecast, the third-year earnings growth rate cannot continue indefinitely. For the F-O model (1995), the existing obstacle to the conversion from indefinite-duration forecast to definite-duration forecast has not been eliminated. Attempts have been made in the recent research to solve these problems. Kim, Lee, and Tiras (2013) empirically tested the correlation between the intrinsic value of stocks and return on investment (ROI) by following the analysts' idea of earnings forecast by stages in the O-J model (2005), considering the decline rate of earnings growth, dividing indefinite-duration forecast into the combination of short-term forecast and long-term forecast within the PB indicator that reflects industry-specific features, based on 31,592 firm-year samples from 40 industries all over the U.S.A. from 1976 to 2003. Besides, in the past five years, the accuracy of analyst earnings forecast has been questioned and improved by some scholars: Pae and Thornton (2010) found that there is a negative linear correlation between accounting conservatism and the accuracy of analyst earnings forecast; Hou, Dijk, and Zhang (2012), Eric (2013) as well as Kevin and Mohanram (2014) have used more than 30 years of time-series data (the samples used by Eric contains51,591 firm-year observations and the samples used by the other two authors includes over 110,000 firm-year observations) to construct the cross-section regression model and obtained earnings per share (EPS) from it. It proved that the EPS obtained based on large samples can replace the analyst forecast value on EPS by empirical comparison research.

Different from the foreign researches concentrating on improving the classic F-O model (1995) to increase RIM's operability and accuracy, Chinese researchers mainly perform empirical tests based on real-world data from China's capital markets to verify these theories. In the past 10 years, RIM has been a research hotspot in China's asset pricing field. Yu and Gaoo (2005) empirically validated the value correlation between the prices of China's financial stocks (bank stocks) and accounting information by RIM. Zhang, Meng, and Lu (2006) compared the explainability of DDM, FCFE and RIM empirically by evaluating the intrinsic value of China's stocks based on large-samples data (2561 firm-year observations) from China's A-share market, and found that the explainability of RIM is more significant than that of DDM and FCFE.

In view of the special background about emerging stock markets during China's transition period, Ding (2013) found that RIM is the most proper method for IPO valuation and IPO bubble measurement, in terms of the empirical research on 538 IPO companies from 2001 to 2008 in China's A-share primary market. Notably, in light of the Frankel–Lee model (1998) of RIM, Rao and Yued Yue (2012) used the real-world large-sample data (7987 firm-year observations) in China's A-share market.

They estimated the listed companies' intrinsic value and validated the correlation between the intrinsic value and the stock future returns. Then, Xu and Xund Xu (2015) also used 12,674 observations of listed companies from 2006 to 2013 to estimate their intrinsic value by the same Frankel–Lee model (1998), and further explored how information disclosure quality influences the deviation of firm stock price from its intrinsic value by means of KV method. During the application of the Frankel–Lee model (1998) in recent literature, attempts have been made to apply the earnings forecast formula in Hou et al. (2012) to estimate EPS to substitute analysts' earnings estimates. However, such replacement requires a precondition: a sufficient number of samples, whereas internet-based finance, as an emerging industry which has developed rapidly in recent years, does not have enough available valid samples. Consequently, the above methods are not applicable to internet-based finance stocks.

So far, there has not been one internet-based finance enterprise to be listed in China's A-share market. However, with the implementation of the 'Internet+' action plan, many listed companies in other industries have started internet-based finance businesss one after another and accelerated their own business model transformation. According to the statistics from the Wind database, there were only 51 listed firms' stocks with internet-based finance concept in China's A-share market by the end of April 2016, and 29 of them (accounting for 56.86%) had started their internet-based finance business since 2015. Because of the lack of sufficient time-series samples to estimate EPS, the forecast role of analysts cannot be replaced.

Additionally, the O-J nonlinear residual income model (2005) cannot be applied to the enterprises whose earnings growth has suddenly rocketed up. In China, the net profit growth rate of internet-based finance enterprises fluctuates dramatically. Just as Yirendai, its net profit in 2013, 2014 and 2015were –8.34, –4.5 and 43.80 million dollars, respectively. Namely, the net profit growth rates were 46% (2013–2014) and 1073% (2014–2015), respectively. Obviously, the change in the net profit growth rate reaches up to 1027%, so the O-J Model cannot be applied to the evaluation of the intrinsic value of internet-based finance stocks either. Currently, both theorists and practice experts believe that China's internet-based finance industry may have an explosive growth in the next 10 years, which corresponds to the 10-year long-term forecast period set by Kim et al. (2013).

As a result, after excluding above inapplicable models of RIM one by one, we chose the Frankel–Lee model (1998) and the Kim et al. model (2013) to evaluate the intrinsic value of China's internet-based finance stocks. Then we need to select an alternative model with a stronger explainability for the price variations of China's internet-based finance stocks. Moreover, enlightened by the comparative analysis approach between FCFE and EVA methodology from the research of Mielcarz and Mlinaričč (2014), we conduct the comparative research on these two models.

In recent years, with the continual improvement of the information disclosure system in China's capital market, the recognition of earnings on conservative principle can help the listed companies transfer more efficient evaluation information to the investors, so more and more investors have their own independent views on the intrinsic value of stocks. In case of disagreement between the investors and managers of listed companies, the managers will be motivated to rethink and improve their

operation decisions to enhance the companies' value. In regard to this, we explain why the intrinsic value of internet-based finance stocks is undervalued by investors and provide some countermeasures to restore investors' confidence. The contributions of this paper lie in the following.

1. So far, we have not yet found any scholars who studied the intrinsic value of China's internet-based finance stocks. This paper involves research on the intrinsic value of internet-based finance stocks in China's A-share market for the first time.
2. The Frankel–Lee model (1998) and the Kim et al. model (2013) are both applied to evaluating the intrinsic value of China's internet-based finance stocks. Moreover, comparative study on the two models is conducted to further validate that the Kim et al. model (2013) has more accurate capability to interpret stock price variations than the Frankel–Lee model (1998). Especially, the industrial features of internet-based finance stocks are highlighted in the Kim et al. model (2013) by introducing the industry PB into the valuation model.
3. The practical implications of these findings are included as follows. First, a new empirical proof for the application of RIM to the internet-based finance industry is given. As a result, the empirical research results provide a direct approach to evaluate the intrinsic value of IPO stocks of massive internet-based finance enterprises which are to be listed in China's A-share market. Second, these findings suggest that regulators should be concerned not only with how to measure price bubbles of internet-based finance stocks, but also with how key factors impact the price bubbles. Third, these conclusions are contributed to provide a more accurate and feasible valuation method for investors in China. As a consequence, it can help them reshape value investing ideals and make rational decisions to improve their purchase determination effect and efficiency.

The remainder of this paper is organised as follows. Section 2 presents the theoretical model. Section 3 describes the sample and conducts empirical tests. In Section 4, we calculate and analyse the stock bubbles based on the intrinsic value obtained in the third section. Then, the reasons underlying undervaluation are given in Section 5. Finally, the solutions and suggestions on enhancing internet-based finance business to boost investors' confidence are proposed.

2. Theoretical models

The F-O model (1995), the Frankel–Lee model (1998) and the Kim et al. model (2013) are part of a long line of RIM. The Frankel–Lee model (1998) and the Kim et al. model (2013) are modified from the F-O model (1995) by scholars at different stages, with the aim to overcome the F-O model-related three application difficulties stated above. The F-O model (1995) is generally expressed as follows:

$$V_t = BV_t + \sum_{i=1}^{\infty} E\left[\frac{ROE_{t+i} - \rho_t}{(1+\rho_t)^i}\right] \bullet BV_{t+i-1} \tag{1}$$

where

V_t represents the stock's intrinsic value at time t,

BV_t represents the stock's book value of net assets at time t,

ROE_{t+i} represents the company's return of equity (ROE) at time $t+i$,

ρ represents the cost of equity capital.

As is shown in Eq. (1), the F-O model (1995) shows that the intrinsic value of a company's stock equals the sum of the current net assets and the residual income discount in each coming period. When a company's anticipated residual income is 0, i.e., the anticipated ROE equals to the costs of equity capital, the company's intrinsic value is equal to the book value of net assets. The intrinsic value of a stock depends on the net assets of the stock, the profitability of such assets and the duration of profitability. However, because the forecast of the residual income in each period is the core difficulty in the application of the F-O model (1995), Frankel and Lee (1998) have introduced analyst earnings forecast as a proxy for residual income to overcome this difficulty and proved that the earnings growth rate of the following years can maintain the same as the third year. The Frankel–Lee model (1998) can be expressed as the following form:

$$V_t = b_t + \frac{f(1)_t - rb_t}{(1+r)} + \frac{f(2)_t - rb(1)_t}{(1+r)^2} + \frac{f(3)_t - rb(2)_t}{(1+r)^2 r} \tag{2}$$

where

V_t represents the stock's intrinsic value at time t,

$f(i)_t$ represents analysts' consensus forecasts of the $t+i$ time's average earnings per share at time t,

b_t represents net assets per share at time t.

Eq. (2) shows that the Frankel–Lee model (1998) makes it possible to determine the three-year residual income forecast value after the base period, but its indefinite-duration fixed earnings growth rate assumption does not comply with the industry life cycle theory. For example, the earnings growth rate of an enterprise at maturity and recession stages may decline instead of growing indefinitely, while for enterprises at the growth stage, they are significantly exiting a definite-duration earnings growth trend and the growth rate is not necessarily fixed. The earnings growth modes of different enterprises depend on the features of the industries they belong to. Kim et al. (2013) introduced the industrial average PB into the valuation model, divided the indefinite-duration forecast in the F-O model (1995) into a short-term forecast period and a long-term forecast period, and deduced the enterprise earnings growth decline rate of $\omega \approx 0.75$. More importantly, the fixed earnings growth rate assumption in the Frankel–Lee model (1998) is inconsistent with the actual situation described by Kim et al. (2013), which is particularly suitable for China's internet-based finance enterprises. It needs to be noted that Frankel and Lee (1998) proved that in the case of use of analyst earnings forecast for the evaluation of the intrinsic value of stocks, the cost of equity capital has little effect on valuation results. Therefore, based on the methods of Dechow et al. (1999) and Xu and Xund Xu (2015), 5% is selected as the cost of fixed capital, i.e., $r_e = 5\%$. The

Kim et al. model (2013) is expressed as follows:

$$\begin{aligned}\left[\frac{V}{B}\right]_t &= \left[\frac{P}{B}\right]_t^I + \sum_{j=1}^{3}\rho^j\left(ROE_{t+j} - indROE_{t+j}\right) + \sum_{j=4}^{13}\rho^j\omega^{j-3}\left(ROE_{t+3} - indROE_{t+3}\right) \\ &+ \sum_{s=2}^{3}\rho^s\left[\left(ROE_{t+s} - r_e\right)\frac{\Delta B_{t+s-1}}{B_t} - \frac{1}{N}\sum_{k=1}^{N}\left(ROE_{k,t+s} - r_e\right)\frac{\Delta B_{k,t+s-1}}{B_{kt}}\right] \\ &+ \sum_{s=4}^{13}\rho^s\omega^{s-3}\left[\left(ROE_{t+3} - r_e\right)\frac{\Delta B_{t+2}}{B_t} - \frac{1}{N}\sum_{k=1}^{N}\left(ROE_{k,t+3} - r_e\right)\frac{\Delta B_{k,t+2}}{B_{kt}}\right]\end{aligned} \tag{3}$$

where

B_t represents net assets per share at time t,

r_e represents costs of equity capital,

ROE_{t+j} represents analysts' consensus forecasts of ROE at time $t+j$.

Additionally,

$$\rho = \frac{1}{1+r_e},\ indROE_{t+j} = \frac{1}{N}\sum_{k=1}^{N}ROE_{k,t+j},\ \left[\frac{P}{B}\right]_t^I = \frac{1}{N}\sum_{k=1}^{N}PB_{k,t}.$$

3. Sample selection and empirical analysis

3.1. Sample selection

On the last trading day of April 2016, based on the statistics from Wind, there were 51 listed companies with an internet-based finance concept. The accounting and market data of the 51 listed companies are mainly from the Wind database, and the missing data are supplemented by SINA Finance Data Center. Only one listed company, i.e., LETV, started an internet-based finance business in 2016 and the other 50 companies started an internet-based finance business between 2013 and 2015, in which 28 of them started in 2015, accounting for 54.90%. Therefore, according to the Kim et al. model (2013), the base period should be set as $t=2015$. The missing key indicators or those inconsistent with the application assumption of the Kim et al. model (2013) were excluded from samples. Finally, there are 38 valid samples of internet-based finance stocks available in our research, i.e., $N=38$.

3.2. Descriptive statistics

First and foremost, the descriptive statistics of valuation variables are shown in Table 1, where the basic time $t=2015$, $f(t+i)$ represents analysts' consensus forecasts of the average earnings per share at time $t+i$ ($i=1,2,3$); ROE_{t+i} represents analysts' consensus forecasts of the company's return of equity (ROE) at time $t+i$; BPS_{t+i} represents analysts' consensus forecasts of net assets per share at time $t+i$.

As shown in Table 1, by the end of 2015, the industrial PB of China's internet-based finance stocks was up to 8.81 times, which is second only to that of health and

Table 1. Descriptive statistics of valuation variables.

Variables	Mean	Std Dev.	Min.	Max.
ROE_{2016} (%)	13.27	8.31	−4.90	39.65
ROE_{2017} (%)	15.74	8.74	−1.80	34.49
ROE_{2018} (%)	16.51	9.30	−0.66	40.75
f(2016) (yuan)	0.57	0.46	−0.06	2.00
f(2017) (yuan)	0.82	0.64	−0.02	2.90
f(2018) (yuan)	0.97	0.73	−0.01	3.40
BPS_{2016} (yuan)	4.52	3.07	0.72	14.75
BPS_{2017} (yuan)	5.26	3.38	0.86	16.36
Annual average stock price in 2015 P_{2015} (yuan)	37.94	23.63	8.42	89.20
Annual average market-to-book ratio in 2015 PB_{2015} (times)	8.81	6.37	1.41	26.38
Net assets per share in 2015 BPS_{2015} (yuan)	3.62	2.04	0.44	10.50

Source: Wind

social work industry, even higher than that of information transmission, software and IT service industry. So the internet-based finance industry is a typical high-growth industry. In the coming three years, the annual average of ROE and EPS based on analysts' consensus forecast exceeds 13% and 0.5 Yuan, respectively. The two indicators also show a year-on-year growth trend. Namely, China's internet-based finance industry has good profitability prospect and expected returns. Also, there exist significant differences in the ROE of different stocks according to analysts' consensus forecast and possibility of gradual expansion year after year, suggesting that fiercer competition among internet-based finance enterprises would happen. Besides, with the rapid growth of the whole internet-based finance industry, the expected net asset per share would also show a year-on-year growth trend.

3.3. Empirical result and analysis

In order to compare the effectiveness of the Kim et al. model (2013) and the Frankel–Lee model (1998) on the explainability for the price variations of China's internet-based finance stocks, it is necessary to contrast V_{2015} with P_{2015} (the average of closing prices of each stock on all trading days in 2015, respectively). Then, paired-sample *t*-test and Wilcoxon rank sum test are used to validate the significance of difference between the annual average price and the intrinsic value of China's internet-based finance stocks in 2015. Finally, we choose the Kim et al. model (2013) with smaller difference significance. The intrinsic value of internet-based finance stocks and the distribution of key indicators based on the Kim et al. model (2013) and the Frankel–Lee model (1998) are shown in Table 2.

Due to the small sample size and the one-to-one correspondence between the intrinsic value V_{2015} and annual average price P_{2015}, the paired-sample *t*-test and Wilcoxon rank sum test are selected to test the means and medians difference significance of the paired samples, and the detailed results are shown in Table 3.

Table 3 shows that at a confidence level of 99%, through the *t*-test and Wilcoxon rank sum test, both the paired samples of annual average price P_{2015} and the intrinsic value FV_{2015} calculated on the basis of the Frankel–Lee model (1998) pass Levene's homogeneity of variance test. What's more, both the mean difference and median difference of the two paired samples are significant (*t*-test-based *P* value = 0.000–0.005, Wilcoxon test-based *P* value = 0.000–0.005). While using KV_{2015}, i.e., the intrinsic

Table 2. The intrinsic value of China's internet-based finance stocks based on the Kim et al. model (2013) and the Frankel–Lee model (1998) ($t = 2015$).

Company Name	PB2015 (times)	BPS2015 (yuan)	BPS2016 (yuan)	BPS2017 (yuan)	ACF ROE 2016 (%)	ACF ROE 2017 (%)	ACF ROE 2018 (%)	INTRINSIC VALUE V_{2015} (yuan/share) Based on K model	INTRINSIC VALUE V_{2015} (yuan /share) Based on F-L model
Zhongtian	2.5857	2.6939	2.7321	3.4384	23.8000	26.2000	24.7500	24.5052	27.7249
Jinzhou	13.1546	7.1300	4.6073	5.4429	15.6000	17.8000	20.3103	60.6034	37.9942
Suning	2.6764	4.1287	4.0660	4.1037	0.8600	1.4150	2.4000	32.3340	1.3454
Kairuide	21.2629	0.4436	0.7200	0.8600	13.7000	17.3000	21.8460	4.0838	4.1650
HengBao	9.3879	2.1800	2.7730	3.4650	23.7000	22.4750	21.3133	19.8892	18.4673
Baoxiniao	2.1871	2.3900	2.5800	2.7570	7.5000	8.4000	9.4080	19.5650	4.9947
2345Network	5.8173	5.1000	5.1851	6.0979	7.9750	9.9900	12.5141	42.4241	24.5177
Worldunion	4.8292	2.4555	2.0540	2.3610	16.5500	17.2000	17.7000	20.9744	11.1495
CreateSpecial	5.2877	3.9696	4.7337	6.9054	17.6000	32.8000	40.7515	40.6240	47.5141
Keybridge	6.4453	2.1814	2.2800	2.4350	4.5950	5.7400	9.0000	17.6999	4.4268
Haining	2.2607	4.3393	5.4330	6.3467	13.4000	12.7000	12.6000	36.7729	21.2101
Mendale	3.6452	2.0640	2.3400	2.6400	12.0600	12.5000	11.4000	17.2652	6.2489
Gloria	6.3661	4.7000	7.1419	8.3822	18.5750	19.1700	19.7841	42.6819	38.6316
Rongyu	8.5499	2.7474	7.0316	7.3214	6.7000	7.7000	8.7000	22.9374	10.4644
Sinodata	10.9161	5.2117	6.9337	7.7343	11.1100	12.8600	14.0450	44.4455	26.3511
Homa	6.0242	10.5043	14.0072	16.3623	13.4000	13.5100	13.6209	89.8966	52.1082
Europol	7.0014	4.0500	4.8897	5.7546	15.0000	18.3000	22.3260	36.2313	32.6447
DongYiRiSheng	8.2469	3.8400	4.3593	4.9942	14.6000	17.0000	14.8000	32.9088	18.7720
Kingee Culture	6.8792	3.1806	3.5648	3.9648	12.3000	13.8000	15.0950	27.0644	14.2791
Hithink	18.7248	3.9568	5.8204	8.0556	39.6500	34.4900	32.2800	40.9147	73.8899
East Money	8.9131	4.4066	3.0168	3.6058	28.1000	29.3500	19.6000	38.3491	21.5807
Infogem	24.5001	1.7110	2.1302	2.3865	11.1400	12.7000	14.1200	14.5430	10.0994
Tempus	8.9620	2.5039	2.7209	3.2086	14.7400	15.1000	14.0000	21.3121	9.6525
Hongli Zhihui	6.6976	1.7096	2.0853	2.5206	16.6050	17.6000	17.2300	14.9775	11.3329
Ganglian	16.1213	0.5533	2.2100	3.3200	6.9000	21.9000	34.7543	7.6766	18.7746
EverydayNetwork	7.0868	4.7694	5.2584	6.6014	19.8000	26.8000	17.2000	42.1427	29.6734
Hakim Unique	13.7818	2.0978	6.8810	7.5314	16.2400	18.5650	21.2229	21.4127	19.0929
Boomsense	5.7391	4.9624	5.0994	5.3593	2.8000	4.7000	6.3000	39.6834	6.8875
HopeRunSoftware	3.5417	8.9064	10.0971	11.3468	8.6000	10.4000	11.6000	74.0739	30.7616
Ysstech Info-Tech	26.3760	4.1582	3.8386	4.5447	16.3000	20.4650	15.6000	35.5855	20.9733
CitychampDartong	1.4095	4.7465	5.1219	5.5058	8.6200	9.8000	7.5550	38.6746	8.5505
ChangzhengTiancheng	4.6757	2.4934	2.9100	3.9500	11.0000	28.0000	35.6364	24.2132	26.8041
Anyuan Coal Industry	1.4640	3.5588	3.3000	4.0250	1.0000	1.2500	1.5500	27.7390	0.1796
Kingdom Sci-tech	20.1715	1.5400	2.0155	2.5687	21.4000	22.4000	24.3000	14.3084	17.2280
HundsunTechnologies	13.2804	3.9366	4.3457	5.2158	21.8500	23.3500	23.4000	35.5958	37.7863

(*continued*)

Table 2. Continued.

Company Name	PB2015 (times)	BPS2015 (yuan)	BPS2016 (yuan)	BPS2017 (yuan)	ACF ROE 2016 (%)	ACF ROE 2017 (%)	ACF ROE 2018 (%)	INTRINSIC VALUE V_{2015} (yuan/share) Based on K model	INTRINSIC VALUE V_{2015} (yuan /share) Based on F-L model
Sunriver Culture	8.2620	2.7052	1.5890	2.1273	12.7850	12.7000	15.3300	22.5448	15.1628
PandaFinancialHolding	5.5040	4.2315	14.7500	15.2500	2.6000	3.3000	3.9000	32.9450	0.9793
Shanghai DZH	6.1980	1.4589	1.2200	1.2500	−4.9000	−1.8000	−0.6612	11.2193	−0.3173

Note: ACF ROE represents analysts' consensus forecasts of ROE in one year.
Source: Wind

Table 3. Significance test on difference between market price and the intrinsic value of China's internet-based finance stocks based on the Frankel–Lee model (1998) and the Kim et al. model (2013).

	Paired-Sample *t*-Test							Wilcoxon Rank Sum Test			
	Std dev.	*F*	*P* value	Mean	Mean difference	*t*	*P* value	Median	Median difference	*Z*	*P* value
FV_{2015}	15.995	2.183	0.011	20.055	17.883	5.257	0.000	18.620	13.241	3.698	0.000
KV_{2015}	17.149	1.899	0.027	31.337	6.601	1.586	0.121	30.037	1.824	0.779	0.436
P_{2015}	23.634			37.938				31.861			

Confidence level: 99%.
Source: Wind

value V_{2015} calculated based on the Kim et al. model (2013), it is shown that both of the paired samples pass Levene's homogeneity of variance test, and the means and medians of the two paired samples show insignificant difference (*t*-test-based *P* value $= 0.121 > 0.005$, Wilcoxon test-based *P* value $= 0.436 > 0.005$). Furthermore, for the existing samples, it is proved that the deviation of the means of P_{2015} from FV_{2015} is more significant than the result using KV_{2015}, with the difference between the two deviations reaching up to 11.282. The above empirical result shows that in contrast with the traditional Frankel–Lee model (1998), the Kim et al. model (2013) has more accurate capability to interpret price variations for China's internet-based finance stocks.

4. Measurement and analysis of price bubbles of internet-based finance stocks

After selecting the Kim et al. model (2013) to evaluate the intrinsic value of China's internet-based finance stocks, we further study the price bubbles level of internet-based finance stocks. According to Xu Ainong's method (2007) of measuring stock price bubbles level, we build a stock price bubbles level measurement model to test whether there is price bubbles of internet-based finance stocks in the extraordinarily fluctuating year of 2015, and what the bubble level is. Furthermore, it is feasible to judge which stock is overvalued or undervalued. The stock price bubbles level measurement model is shown as follows:

$$Q_t = \frac{P_t - V_t}{P_t} \tag{4}$$

where

P_t represents the stock price at time t,

V_t represents the stock's intrinsic value at time t,

Q_t represents the bubble level of the stock price at time t, i.e., the bubble ratio of the stock price at time t.

Then, $Q_t = 0$ shows that the market price of the internet-based finance stock can perfectly reflects its intrinsic value. $Q_t < 0$ shows that investors undervalue the intrinsic value of the stock. Moreover, the smaller Q_t is, the more the intrinsic value is undervalued, while $Q_t > 0$ shows that investors overvalue the intrinsic value of the

Table 4. The bubble level of China's internet-based finance stocks in 2015.

Stock Code	The time of beginning Internet-based finance business (year/month)	Intrinsic Value V_{2015} (yuan/share)	The highest point of Shanghai Stock Exchange Composite Index in 2015 is 5178.19 (2015/6/12)		The lowest point of Shanghai Stock Exchange Composite Index in 2015 is 2850.71 (2015/8/26)		Annual average stock price in 2015P2015 (yuan/share)	Q_{2015}
			Closing price of the day P_1 (yuan/share)	$(P_1 - V_{2015})/P_1$	Closing price of the day P_2 (yuan/share)	$(P_2 - V_{2015})/P_2$		
Zhongtian	2014/8	24.5052	17.3000	−0.4165	7.2400	−2.3847	13.5882	−0.8034
Jinzhou	2015/4	60.6034	37.1600	−0.6309	19.6000	−2.0920	22.3257	−1.7145
Suning	2013/8	32.3340	21.6500	−0.4935	13.6000	−1.3775	15.1593	−1.1329
Kairuide	2015/5	4.0838	38.2900	0.8933	20.5000	0.8008	24.6315	0.8342
HengBao	2015/5	19.8892	34.7700	0.4280	13.5000	−0.4733	21.5983	0.0791
Baoxiniao	2015/5	19.5650	14.5800	−0.3419	5.8000	−2.3733	9.6775	−1.0217
2345Network	2015/2	42.4241	62.9600	0.3262	22.6000	−0.8772	48.4276	0.1240
Worldunion	2015/3	20.9744	33.5100	0.3741	11.3900	−0.8415	21.7578	0.0360
CreateSpecial	2015/5	40.6240	64.1300	0.3665	18.1500	−1.2382	30.4177	−0.3355
Keybridge	2015/10	17.6999	11.0100	−0.6076	11.0000	−0.6091	17.4288	−0.0156
Haining	2014/11	36.7729	29.2400	−0.2576	12.1400	−2.0291	18.8815	−0.9476
Mendale	2015/6	17.2652	17.8900	0.0349	8.1100	−1.1289	12.6033	−0.3699
Gloria	2015/6	42.6819	40.0400	−0.0660	22.6500	−0.8844	31.6389	−0.3490
Rongyu	2015/12	22.9374	39.4600	0.4187	25.2800	0.0927	33.4371	0.3140
Sinodata	2013/7	44.4455	138.3800	0.6788	55.5300	0.1996	84.6323	0.4748
Homa	2015/11	89.8966	39.3300	−1.2857	35.2200	−1.5524	49.8632	−0.8029
Europol	2015/12	36.2313	112.3400	0.6775	19.4400	−0.8637	42.0093	0.1375
DongYiRiSheng	2015/2	32.9088	48.8300	0.3261	17.3900	−0.8924	33.8752	0.0285
Kingee Culture	2014/6	27.0644	87.8300	0.6919	60.0300	0.5492	33.0390	0.1808
Hithink	2013/8	40.9147	114.0000	0.6411	42.0300	0.0265	84.1472	0.5138
East Money	2013/8	38.3491	82.7000	0.5363	30.0600	−0.2758	56.5161	0.3214
Infogem	2013/12	14.5430	114.9000	0.8734	31.9000	0.5441	55.1977	0.7365
Tempus	2013/4	21.3121	48.0100	0.5561	19.0300	−0.1199	36.8883	0.4223
Hongli Zhihui	2015/5	14.9775	41.5400	0.6394	21.5900	0.3063	22.7928	0.3429
Ganglian	2014/12	7.6766	131.0000	0.9414	34.3400	0.7765	70.4015	0.8910
EverydayNetwork	2014/11	42.1427	195.8000	0.7848	51.2900	0.1783	89.2033	0.5276
Hakim Unique	2015/5	21.4127	94.9800	0.7746	26.5500	0.1935	31.0860	0.3112
Boomsense	2014/5	39.6834	76.7800	0.4832	27.3600	−0.4504	38.5776	−0.0287
HopeRunSoftware	2014/5	74.0739	76.0000	0.0253	26.2000	−1.8272	44.8147	−0.6529
Ysstech Info-Tech	2015/3	35.5855	187.7700	0.8105	45.5200	0.2182	80.4494	0.5577
CitychampDartong	2015/3	38.6746	14.8900	−1.5974	7.1800	−4.3864	9.7042	−2.9853

(*continued*)

Table 4. Continued.

Stock Code	The time of beginning Internet-based finance business (year/month)	Intrinsic Value V_{2015} (yuan/share)	The highest point of Shanghai Stock Exchange Composite Index in 2015 is 5178.19 (2015/6/12)		The lowest point of Shanghai Stock Exchange Composite Index in 2015 is 2850.71 (2015/8/26)		Annual average stock price in 2015P2015 (yuan/share)	Q_{2015}
			Closing price of the day P_1 (yuan/share)	$(P_1 - V_{2015})/P_1$	Closing price of the day P_2 (yuan/share)	$(P_2 - V_{2015})/P_2$		
ChangzhengTiancheng	2013/11	24.2132	31.4900	0.2311	12.5200	−0.9340	18.8685	−0.2833
Anyuan Coal Industry	2015/4	27.7390	14.0700	−0.9715	5.1900	−4.3447	8.4216	−2.2938
Kingdom Sci-tech	2013/6	14.3084	220.4100	0.9351	101.5500	0.8591	69.5594	0.7943
HundsunTechnologies	2014/11	35.5958	166.1700	0.7858	44.7400	0.2044	79.4021	0.5517
Sunriver Culture	2014/6	22.5448	68.1300	0.6691	19.2600	−0.1705	27.6625	0.1850
PandaFinancialHolding	2015/3	32.9450	36.6300	0.1006	24.1400	−0.3647	32.0825	−0.0269
Shanghai DZH	2014/8	11.2193	27.8400	0.5970	9.1500	−0.2262	20.8867	0.4628
Mean		31.33732	69.2581579	0.235058	25.7571053	−0.73074	37.93827	−0.12992
Median		30.0365	44.775	0.42335	21.045	−0.46185	31.8607	0.10155
Std.dev		17.14974	55.1930749	0.636635	18.9138325	1.238457	23.63365	0.851569
Min		4.0838	11.01	−1.5974	5.19	−4.3864	8.4216	−2.9853
Max		89.8966	220.41	0.9414	101.55	1.238457	89.2033	0.891

Source: Wind

stock. Moreover, the larger Q_t is, the more the intrinsic value is overvalued. Based on the Kim et al. model (2013) and the bubble level measurement model, the bubble level of China's internet-based finance stocks is as shown in Table 4 at different points of Shanghai Stock Exchange Composite Index in 2015.

Xu Ainong (2007) considers 6.54–41.59% as the normal range of stock price bubbles, within which stock price bubbles are simulative to market activity and increase participation of social public investors. The negative impact of stock price bubbles gradually emerges in the tolerable range of 41.59–62.62%, but the stock price bubbles can still be tolerated by the market and social public investors. When the stock price bubbles exceed 62.62%, it indicates serious stock price deviations from the intrinsic value, which may result in a stock market crisis.

Based on the above criteria for stock price bubbles level and the statistics in Table 4, it can be found that the internet-based finance stocks have negative bubbles on average in the extraordinarily fluctuating year of 2015. At the highest point of Shanghai Stock Exchange Composite Index, the price bubbles of 14 stocks go beyond the tolerable range, the prices of another 14 stocks are in the rational range and the prices of 10 stocks are negative bubbles, indicating that 26.32% of the internet-based finance stocks are undervalued, even under the overheated investors sentiment. While at the lowest point of Shanghai Stock Exchange Composite Index, the price bubbles of only three stocks go beyond the tolerable range, the price bubbles of 14 stocks are in the rational range and the prices of 25 stocks are negative bubbles, indicating that 65.79% of the internet-based finance stocks are undervalued. In relation to the average stock price in 2015, only four stocks go beyond the tolerable range, 18 stocks are in the rational range and 16 stocks are negative bubbles. Namely, 42.11% of the internet-based finance stocks are undervalued.

In a word, the internet-based finance stocks are not seriously overvalued as expected. Moreover, in terms of the overall average bubble level in 2015, the majority of the internet-based finance stocks go beyond their intrinsic value tolerable range. What's more, about half of them are undervalued significantly.

5. Impact factors modelling on price bubbles of internet-based finance stocks

5.1. Indicator selection

Based on the particular price bubbles forming mechanism of China's A-share market (Tan, Cai, & Cai et al., 2011; Liu, 2005) and the related literature review (Echterling et al., 2015; Fama & Frenchch, 2015), the indicators of the impact of price bubbles of internet-based finance stocks can be divided into internal factors and external factors, such as firm characteristics and investment sentiment.

1. Market value (MV). Market value could reflect the scale of a company effectively (Rapp, Schellong, Schmidt, & Wolff, 2011). In China's A-share market, the market value of trash stock is still really high. The main reason behind this is that investors expect the government to restructure these firms (Yi, Ju, & Liu et al., 2016). As a result, the difference between prices of trash stocks and blue ships is

not significant, and this unique phenomenon shows strong evidence that the Chinese government intervenes excessively in the stock market.

2. Price to book ratio (PB). PB is the ratio of price per share and book value per share, reflecting the growth opportunity of a firm, especially for these firms with high risks. Theoretically, PB is positively related to the investment risk. For instance, a company with a lower PB value has more capital to pay its debt when facing collapse (Chuliá, Guillén, & Uribe, 2016). On the other hand, investors could select the listed companies with lower input and higher output according to PB (Herwartz & Kholodilinin, 2014). Therefore, we hypothesise that there is a positive relationship between PB and stock price bubble.
3. Financial reporting indicators. Financial reporting indicators include net profit to sales ratio, total asset turnover ratio, research and development expenditure. These indicators can reflect the relationship between stock market and listed company in China (Zhou, Xie, & Li, 2017). Net profit sales ratio represents the profitability of a company and a company with higher profitability has more pricing flexibility and stronger anti-risk capability. Total asset turnover ratio represents operation capacities, especially under the circumstances of turbulent economic conditions. The higher the total asset turnover ratio, the more secure the company. Research and development expenditure measures the potential competitiveness of a company. These indicators above show the internal motive of a company's virtuous development and the intrinsic value.
4. Investors' sentiment. This is easily affected by noise traders in China, so other types of investors use trading strategies of noise traders to achieve excess profit (Ramiah, Xu, & Moosa, 2015). Furthermore, this is the micro basis of the formation of price bubbles and the non-rational characteristics of China's A-share market. Based on the volume–volatility relationship and China's A-share market practice, trading volume is the leading indicator of price, which is more important than other technical indicators (Dhaoui, 2015). Hence, rational investors usually predicate future price tendency mainly according to trading volume. We choose the logarithm of trading volume (LgTV) to measure investors' sentiment.
5. Cross-industry operation indicators. Based on real-world internet-based finance business in China (Nguyen & Pana & Pana, 2016), the listed firms engaging in internet-based finance business in China's A-share market can be divided into two types: (1) the original main business is related to internet-based finance, so the cross-industry operation does not exist, such as Sinodata (002657.SZ), Eastmoney (300059.SZ) and so on; (2) the original main business is unrelated to internet-based finance, thus the cross-industry operation exists, such as Global pharmaceutical (002437.SZ), Anyuan Coal (600397.SH). There are huge differences in terms of foundations of internet-based finance business. In addition, a majority of these companies had not started an internet-based finance business until 2015. Thus, profit conditions have not been shown in the short run. Investors hold different attitudes towards different types of internet-based finance concept companies. We introduce dummy variables D ($D = 0,1$) in the model in order to improve the robustness of empirical results, and overcome the limitation of small sample. $D = 1$ represents companies in condition (1), whereas $D = 0$ represents companies in condition (2).

5.2. Model

To analyse the above factors' influence on internet-based finance stock price bubbles in China's A-share market, we conduct the bubble level Q_t of 38 stocks mentioned above as the explained variable, and use indicators to reflect the above influencing factors of listed companies as the explaining variables for cross-sectional regression. Given that 2015 is an extremely special year in China's A-share market for Shanghai Composite Index vibrating by 72% in soars and slumps, which marks an unprecedented shock in the China's A-share market. Correspondingly, the stepwise regression is adopted to explore the relationship between the internet-based finance stock price bubble and its influencing factors in 2015. The following three optimal models are concluded through stepwise regression method at the highest point, lowest point of Shanghai Composite Index and annual average price, respectively.

$$\bar{Q}_{2015} = \mu_0 + \mu_1 D + \mu_2 \overline{PB}_{2015} + \mu_3 Lg\overline{TV}_{2015} \tag{5}$$

$$Q_{\max} = \omega_0 + \omega_1 D + \omega_2 PB_{\max} + \omega_3 LgTV_{\max} \tag{6}$$

$$Q_{\min} = \rho_0 + \rho_1 D + \rho_2 PB_{\min} + \rho_3 LgTV_{\min} \tag{7}$$

Based on models (5)–(7), the stock price bubbles have three identical influencing factors: PB ratio, trading volume and whether the cross-industry operation exists. See the specific variables instruction in Table 5.

The above index is gathered from the Wind database by conducting least-squares regression on the three formulas above via Stata and checking multicollinearity among independent variables, as well as serial correlation and heteroscedasticity of random error term. The model verification and regression coefficient are demonstrated in Table 6.

Table 6 shows that Eqs. (5)–(7) have passed the significance test with 1% level and all of regression coefficients do not exist multicollinearity because of variance inflation factors (VIF) with a reference value of 2. In addition, all of Durbin–Watson statistics are approximately 2 in the Durbin–Watson test, so there is no presence of autocorrelation for random error terms. Besides, the null hypothesis of homoscedasticity is accepted based on *P*-values obtained from White's test, which are significantly higher than 0.1. That is, overwhelming evidence indicates that there is no heteroscedasticity for the random error terms in our regression model. As a consequence, above results suggest that the Kim et al. model (2013), as an alternative estimation method, and three identical impact factors are robust to evaluate the intrinsic values and the price bubbles of China's internet-based finance stocks.

5.3. Results analysis

In the first place, positive regression coefficients of three explaining variables imply that PB ratio, trading volume and existing cross-industry operation impose positive effects on stock price bubble. Among these factors, the bullish effect of trading volume is consistent with the theory of the volume–volatility relationship, reflecting

Table 5. Variables instruction of regression model (5)–(7).

Regression model (5)		Regression model (6)		Regression model (7)	
$\bar{Q}_{2015}$	Average bubble level of China's internet-based finance stocks price in 2015	Q_{max}	Bubble level of China's internet-based finance stocks price at the highest point of Shanghai Stock Exchange Composite Index in 2015 (2015.6.12)	Q_{min}	Bubble level of China's internet-based finance stocks price at the lowest point of Shanghai Stock Exchange Composite Index in 2015 (2015.8.26)
$\bar{PB}_{2015}$	Average price to book ratio in 2015	PB_{max}	Price to book ratio at 12 June 2015	PB_{min}	Price to book ratio at 26 August 2015
$Lg\bar{TV}_{2015}$	Base-10 logarithm to average trading volume in 2015	$LgTV_{max}$	Base-10 logarithm to trading volume at 12 June 2015	$LgTV_{min}$	Base-10 logarithm to trading volume at 26 August 2015
μ_0	Error term	ω_0	Error term	ρ_0	Error term

$D = 0$ represents that original main business is unrelated to internet-based finance business, so cross-industry operation exists, whereas $D = 1$.

Source: Wind

active influence of investors' confidence on the stock price bubble. Meanwhile, the largest LgTV regression coefficient in these models indicates that trading volume is the most important factor in forming an internet-based finance stock price bubble in China's A-share market. The trading volume's positive influence on the stock price bubble is much more significant when the Shanghai Composite Index stays relatively low. Taking model (5)–(7) for example, LgTV's regression coefficient is 1.074 (at the lowest point of Shanghai Composite Index), higher than 0.681 (annual average) and 0.461 (at the highest point).

Moreover, listed companies will widen growth potential by developing internet-based finance business, although it has the nature of high risk, high investment and light asset for any listed companies. The PB ratio would exceed 1 when market price surpasses book value, which indicates the enterprise has high-quality assets and huge development potential. Otherwise, the PB ratio would be assessed below 1. The PB ratios of internet-based finance stock samples in this paper are all larger than 1, implying relatively wide growth space. According to the empirical regression coefficient, all the PB ratios in model (5)–(7) have a positive impact on stock price bubble, especially when the Shanghai Composite Index hits the bottom.

More importantly, whether the listed company relates to internet-based finance is a crucial factor for the internet-based finance stock price bubble. In terms of regression coefficient, D coefficients are larger than PB coefficients in all the three equations, suggesting that its positive influence is stronger than the PB. Meanwhile, compared with cross-industry business, listed companies whose original main businesses associate with internet-based finance is much easier to cause a stock price bubble, especially at the bottom of the Shanghai Composite Index. Taking model (7) as an example, the listed companies that related to internet-based finance business increase by 0.707 units of price bubble on average, in contrast with those companies without cross-industry

Table 6. Regression results of impact factors on price bubbles of internet-based finance stocks.

Dependent variables	$\bar{Q}_{2015}$	Q_{max}	Q_{min}
Const C	−3.959	−3.143	−5.897
	(0.032)**	(0.004)***	(0.012)**
D	0.667	0.280	0.707
	(0.002)*** VIF =1.124	(0.086)* VIF =1.254	(0.014)** VIF =1.125
PB	0.055	0.014	0.114
	(0.002)*** VIF =1.204	(0.002)*** VIF =1.325	(0.000)*** VIF =1.111
LgTV	0.681	0.461	1.074
	(0.008)*** VIF =1.204	(0.002)*** VIF =1.070	(0.001)*** VIF =1.028
R^2	0.555	0.572	0.624
Adj-R^2	0.516	0.535	0.591
F	14.125***	15.163***	18.826***
Durbin–Watson	1.818	2.057	2.186
White's test *P*	0.176	0.296	0.184

Note: P-values are in parentheses.*,** and *** denote significance at the 10%, 5% and 1% levels, respectively.
Source: Wind

operation. Therefore, it is useful to reduce the stock price bubble by motivating listed companies to run cross-industry business on internet-based finance.

6. Analysis of the causes of undervalued intrinsic value of the internet-based finance stocks

Now that analysts and experts have high profitability expectations for the listed companies involved in the high-growth internet-based finance business, why are many internet-based finance stocks undervalued? Based on Section 5's impact factors modelling, some reasons behind the undervaluation are explained as follows.

First and foremost, the cross-industry, prospects of operating internet-based finance business for the listed companies in traditional industries have not yet been recognised by investors. At present, there is no single stock of listed companies in internet-based finance industry. The main business of most listed companies with internet-based finance concept is irrelevant with the internet-based finance, such as Anyuan Coal Industry (600397.SH), Yuheng Pharmaceutical (002437.SZ) and so on, except a minority of listed companies whose main business belong to IT or finance industry. According to the statistics in Table 4, even when Shanghai Stock Exchange Composite Index stays at the highest point in 2015, there still exist 10 listed companies whose closing prices are lower than its intrinsic value. All the 10 listed companies belong to the traditional industries, and seven began to engage in internet-based finance business in 2015. Because of their short-term operation, the profit contribution remains to be observed. More importantly, the listed companies in traditional industries face long-term and complex problems dilemma, such as excess capacity and business mode shift pressure. While internet-based finance is an emerging capital-intensive and technology-intensive industry, the traditional industry listed companies have significant disadvantages in capital strength, technology capacity and data resources. Ordinary investors have not shown optimistic attitudes towards the fund, the technology obstacle and the potential development.

More importantly, insufficient information disclosure and negative news on internet-based finance affect investors' decisions. As revealed in the 2015 China's Internet Development Report, the negative news is mainly classified as fraud, insecurity and

information leakage. Particularly, P2P platform-related fraud incidents are becoming increasingly fierce. Based on the statistics from Network Loan Home, there were 1263 sceptical platforms, accounting for 1/3 of the total number in China in 2015. Most of the listed companies engaged in internet-based finance business, especially the listed companies in traditional industries such as Anyuan Coal Industry (600397.SH), usually earn commissions and interests by establishing or directly buying platforms like P2P. So far, in contrast with the investors' structure in mature European and American capital markets, the investors' structure in China's A-share market is still dominated by individual investors, who have serious speculative motivation and express noticeable herd effect. In addition, negative news diffuse through various media channels, resulting in investors' negative attitude towards platforms and even the highest-quality platforms. Finally, investors lose their confidence in investing internet-based finance stocks.

In addition, the regulation of various internet-based finance businesses tends to be standardised. On 18 July 2015, 10 ministries and committees, including the People's Bank of China, issued guidelines on boosting the sustainable development of internet-based finance. China's internet-based finance enterprises have ended savage growth and entered a standardised and sustainable development stage since then. The guidelines provide specific regulatory measures according to each internet-based finance business types. These countermeasures will definitely reduce the income, narrow the previous arbitrage space of internet-based finance while reducing business risks. In conclusion, if internet-based finance business cannot conduct continuous innovation in business ideas and modes, the profitability will definitely be restricted by corresponding regulatory measures.

7. Conclusions and countermeasures

In this study, the Frankel–Lee model (1998) and the Kim et al. model (2013) are applied to evaluating the intrinsic value of China's internet-based finance stocks and comparative research on these two models is conducted. As a result, we select the Kim et al. model (2013), which has a stronger explainability for the prices of China's internet-based finance stocks, to evaluate the intrinsic value which is considered as the benchmark of measuring price bubble level of China's internet-based finance stocks. Through comparison between the intrinsic value and the market prices of internet-based finance stocks at different points of Shanghai Stock Exchange Composite Index in the extraordinarily fluctuating year of 2015, it finds that the internet-based finance stocks have negative bubbles on average in 2015, and nearly half of them are undervalued. What's more, some reasons behind the undervaluation are explained and some countermeasures concerning enhancing internet-based finance business to boost investors' confidence for listed companies in China's A-share market are proposed as follows.

First and foremost, it is essential to operate the internet-based finance business in full compliance with China's related laws and regulations strictly. Respecting and implementing the related laws and regulations is a prerequisite for the sustainable operation of an internet-based finance business. As the 'Basic Law' of the internet-

based finance industry, the *Guidelines on boosting the sustainable development of internet-based finance* implement classified regulations for all kinds of main business. As a consequence, listed companies must increase their risk awareness and strictly conduct compliance operation to avoid various losses caused by violation of regulations.

More importantly, cross-industry cooperation and merger and acquisition can enhance the comprehensive strength of an internet-based finance enterprise as well as improve its competitiveness in China and around the world. By cross-industry cooperation with internet-based finance institutions or direct merger and acquisition, the listed companies in traditional industries can significantly heighten their professional level of operating internet-based finance business and create new commercial modes, which is conducive to the transformation of the listed companies in traditional industries and to promote the long-term profitability of the company. At present, some listed companies in many traditional industries have implemented the cross-industry cooperation or merger and acquisition with internet-based finance institutions, such as bank, agricultural and other traditional industries. It is anticipated that the cross-industry mode of 'traditional industries + internet-based finance' will become the standard configuration which more and more listed companies in traditional industries pursue.

Finally, only by cultivating internet thinking can traditional entrepreneurs convert their management ideas. Both cross-industry and merger and acquisition are concrete manifestations of internet thinking. If the listed companies in traditional industries simply focus on introduction–learning–absorption–application instead of training their own internet thinking from the consciousness level for internet-based finance, e.g., shift from managing a value chain to constructing a value network and from emphasising core competitiveness to advocating complementary force, they will be chasing all the time and unable to transcend themselves. Cross-industry is merely an opportunity for transformation. Ultimately, the key point of sustainable development of the listed companies in traditional industries is to convert management modes by cultivating internet thinking. Only by doing this can enterprises maintain competitive advantages and remain invincible.

Acknowledgements

We are indebted to the editor and a dedicated referee for suggestions that improved the paper greatly.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This study was supported by the National Natural Science Foundation of China (NSFC) (Grant No. 71774042,71532004,71671083,71271109), National Key Research and Development Plan in 2017 (Grant No. 2017YFB1401801) and the Fundamental Research Funds for the Central Universities (Grant No. N160603001).

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