

## A new approach for event study of private placement announcement effect: Evidence from China

Yuling Zhao<sup>1,a\*</sup>

<sup>1</sup> Experiment Teaching Center, Dongbei University of Finance and Economics, People's Republic of China.

yulin0415@163.com

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**Abstract.** The importance of understanding the underlying characteristics of Private Placement Announcement effect draw much attention from accounting theory researchers and financial practitioners. Due to the overwhelming complexity of the financial market, many traditional methods such as intervention method and event study fail to generate consistently good analysis results. Empirical Mode Decomposition (EMD), proposed by Huang, seems to be a promising data analysis method for nonlinear and non-stationary time series. In this paper, An innovative EMD-based multi-scale event analysis method is proposed to estimate the impact of Announcement Date Effect on stock price volatility, and then take illustrative Humon Share (002237 in Shenzhen Stock Market) for example to verify the effectiveness of the proposed method, and finally come to the following conclusions: both Private Placement Announcement Date and Issue Date have temporary effect that last 66 trading days and 26 trading days. The average Private Placement Announcement impact on 002237 stock price is RMB 5.57 Yuan and Issue Date impact is RMB 9.12 Yuan. The case study results show that this approach is a promising method from the multi-scale point of view to analyze the impact of announcement day effect in stock market.

### Introduction

Private placements first emerge in the U.S. market, and flourish in other countries. Private placement market emerges from 1995 to 2003 The U.S. private placements grand a total of 7594 cases, and raise more than 333.6 billion U.S. dollars, equivalent to 25% of the funding level of the same period public offering. Since then, the private placement maintains an annual growth rate of more than 10 billion U.S. dollars. It's shown that private placement in foreign markets has widespread positive announcement effect. Wruck finds that in U.S. market from 1979 to 1985, 128 cases of the private placement gained the average excess return of 4.5% [1]. It's indicted that reaction of the private placement announcement effect in the Japanese stock market is significantly positive [2].

The event study method is applied to investigative private placement announcement effect in many empirical literature, and emerging as a standard analysis tool designed to assess the impact of event in economics, accounting and financial field [3]. The normal return of the event window is calculated, then cumulative abnormal return of the event window is estimated and tested if it is significantly different from zero. Cumulative abnormal return is often considered as abnormal events caused by the event

In summary, event study method considering the time series as sum of the normal development and a special impact, then they impose a "divide and conquer" strategy respectively to separate mode into two parts. But the solution of Huang [8], a complex time series can be regarded as summary of a few simple oscillating modes, generally the number of these modes is two or more. Furthermore, as a special impact, extreme events, may make different type of impulses to these modes. Therefore, a feasible decomposition method which can extract the inherent oscillation from the time series. It will be more useful to explore extreme events. In this paper, a promising decomposition algorithm is applied, Empirical Mode Decomposition [8], to analyze the events effect, and establish an innovative EMD-based extreme event analysis approach.

## Literature Review

From the institutional level, China's securities issued audit using the approval system, listed companies in non-public issue of new shares sponsored by the Sponsor to the SFC whether to approve the resolution. If approved, the listed companies in the next six months, select the appropriate point in time to complete the private placement. Capital markets in the United States and other issued securities registration system audit, that the enterprise is not registered the substantive judgments [4], after the issuance of securities based on the information disclosure system, by the public enterprises supervision. Non-public offering, the United States adopted a policy of exempt transaction, that a listed company non-public row exemption from registration, the resale of the shares required to be registered. "Exempt transaction" with the United States compared to the longer of the implementation process of the private placement. From May 18, 2006 to August 9, 2012, China completed a total of 659 time of private placement. The daily average interval from the first time to the private placement announcement is 248.55 days, 90% of the sample of lasts more than 128 days.

Wruck tests 1979-1985 U.S. private placement announcement effects of some enterprises in which the event period is  $[-59, 2]$ , and found the window of  $[-3, 0]$ , the average cumulative abnormal returns rate of 4.4%, an event announcement effect of significantly positive[1]. If the private placement investors are the former major shareholders or management, then the private placement make their interests more consistent with the company's other shareholders, reducing the risk of adverse selection [1]; if the investors are an institutional investor or other investor, then the "incremental equity management of external oversight will lead to improved performance"[5] ;

## EMD-based event analysis

An extreme event analysis method is proposed based on EMD's method[8]. The main reasons for choosing EMD method instead of other decomposition methods are as follows: (1) EMD is suitable for nonlinear and non-stationary data analysis and the stock prices just possess the characteristics of non-stationary and nonlinearity. (2) The decomposition process is totally on the basis of time series feature, without any transcendental information. For stock prices time series, it means any extracted oscillation is actually triggered by a specific factor or event in reality.

**The entire process of EMD-based event analysis is described as follows:**(1)Data frequency and analysis window determination: The first step is to select the data according to the event of interest. The analysis window is comprised of estimated window and event window. The estimation window is defined as period of time without impact of the events, and the event window is defined as period of time including the impact of events. The data frequency and size of the window limits the time scale of the IMFs. According to the Nyquist sampling theorem [6], the longest period can be extracted from the signal is no more than half of the data points. Therefore, in order to survey the scale of the wide distribution of the data, the high frequency data with a large window size is preferred.

(2)EMD decomposition. After the preliminary determining data frequency and analysis window of the events, stock price time series is decomposed into several IMFs.

(3)Intrinsic modes analysis. The first task in this step is to find the mode which summarize the overall change of extreme events in the analysis window. As mentioned earlier, each IMF has a specific meaning and represents a meaningful component of the original time series. The effect of extreme events is represented by one or sums of the several IMF. This IMF or sum of the IMF is treated as the dominant mode in the analysis. Since the noise and long-term trend contain in the original time series are eliminated, the dominant mode gives a clear assessment for the pattern and magnitude of the impact by the extreme events in the event window.

(4)Duration and magnitude of the impact. In order to answer the question whether the effect is temporary, i.e., disappear soon after the event, or permanently to a certain extent, the need for a longer range of data. Only in a long period of time, that can be verified as a real structure of the breakpoint.

(5)Economic analysis. Patterns and magnitude are summarized, and the economic explanations are given

## Research design

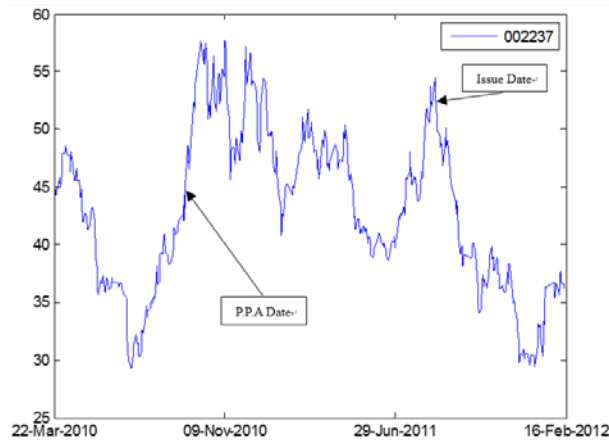


Fig 1 The daily stock prices of 002237 from Mar 22, 2010 to Feb 16, 2012

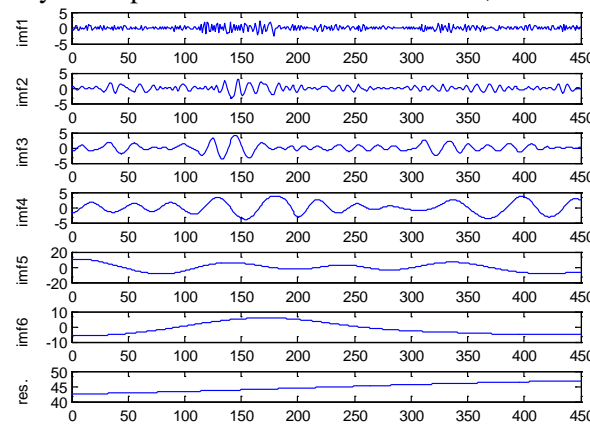


Fig 2 The IMFs and residue for 002237 stock prices from Mar 22, 2010 to Feb 16, 2012

Two most important dates of stocks: Private Placement Announcement Date (P.P.A Date) and Issue Date are chosen to illustrate and verify the proposed EMD-based event analysis method. The target stock is Humon Share in China Stock Market; its stock number is 002237. Private Placement Announcement Date is Sep 13, 2010. Issue Date is Aug 13, 2011. The financial data are taken from the China Stock Market and Accounting Research Database (CSMAR). The impact of the announcement day on stock price is analyzed by five steps proposed in section II.

**Data frequency and analysis window determination.** The event window is defined from Private Placement Announcement Date (Sep 13, 2010) to Issue Date (Aug 13, 2011) and estimation window is defined as half the span of event window before and after the P.P.A Date from Mar 22, 2010 to Feb 16, 2012.

**EMD decomposition.** EMD method is applied to decompose the price series (Fig 1) with total of 450 trading days. The price series is decomposed into 6 IMF and 1 residue (Fig 2). Each component has its own distinct characteristics. The residue is slowly varying around the long term mean. Therefore, it is treated as the long term trend; each sharp up or down of the low frequency component corresponds to a significant event, which should be representative of the effect of these events; the high frequency component, with the characteristics of small amplitudes, contains the effects of stock markets' short term fluctuations.

**Intrinsic modes analysis.** In order to find the dominant mode, we statistically analyze the IMFs. The calculation methods of the three measures are computed: average period, correlation coefficient, and the percentage variance of the original time series. As the frequency and amplitude of the IMF may vary over time, the period is not constant. The average period is defined the value derived by dividing through by the number of the total number of the peak point of each of the IMF. The correlation coefficient was used to measure the various components of the relationship between, IMFs and the original time sequence. Variances of each IMF's percent of the stock series are used to explain the contribution of each IMF, because the IMF components are mutually independent.

Table 1 Measures of IMFs and the residue for stock price

\* Correlation is significant at 0.05 level (2-tailed)

Signal	Average Period	Pearson Correlation	Kendall correlation	Variance as % of prices
IMF1	3.35	0.09	0.07	0.97
IMF2	7.18	0.10	0.08	1.54
IMF3	13.12	0.17	0.10	2.83
IMF4	45.45	0.28*	0.19*	7.41
IMF5	100.84	0.75*	0.57*	55.62
IMF6	300.37	0.62*	0.42*	32.00
Residue		-0.20	-0.19	3.86

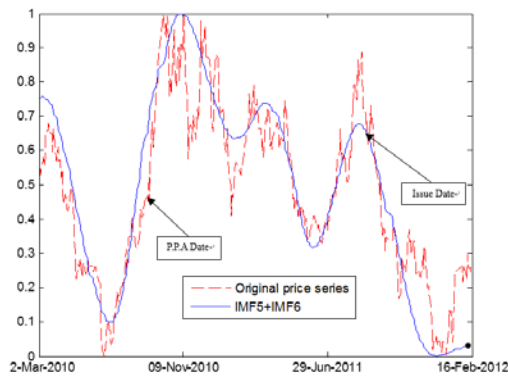


Fig 3 The normalized 002237 stock prices and the sum of IMF5+IMF6 derived from the EMD and structure breakpoints

The dominant mode is identified as the sum of IMF5 and IMF6, instead of a single IMF. The reasons include: (1) both the IMFs are highly correlated with the original time series; (2) the two IMFs individually account for a high variance ratio, compared with other IMFs, and the residue; (3) reconstruction of IMF1 to IMF4 does not statistically differ from zero by t-test but reconstruction of IMF1 to IMF5 does. The sum of variances for the two most important components, the IMF5 and IMF6, contribute 87.62% of total variance. On the other hand, the first two IMFs not only exhibit very low correlation coefficients with the observed data but also account for a little more than 2% of total variance. This means these IMFs do not have serious effect on stock price. So the dominant mode is the sum of IMF5 IMF6.

The dominant mode(IMF5+IMF6) and 002237 stock prices are normalized to interval [0,1] and plotted in. As can be seen from Fig 3, IMF5 + IMF6 almost perfectly match the shape of the original stock price time series. The dominant modes began to increase before the private placement announcement date, means placement information has been leaked before placement.

#### Duration and magnitude of the impact.

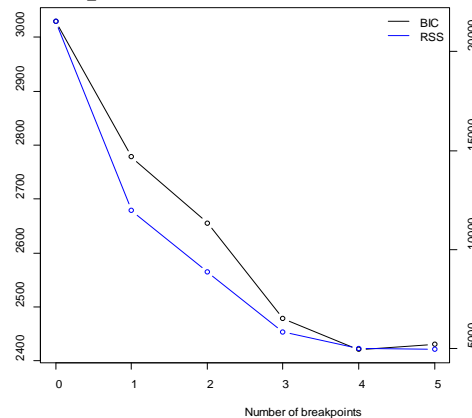


Fig 4 BIC and Residual Sum of Squares

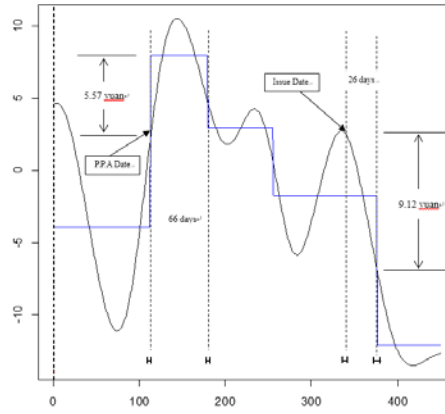


Fig 5 The structure breakpoint of 002237 from Mar 22, 2010 to Feb 16, 2012

Table 2 the RSS and BIC for models with up to five breaks

m	0	1	2	3	4	5
RSS	21551.83	11976.01	8873.248	5826.921	4993.967	4964.464
BIC	3030.299	2778.118	2655.397	2478.367	<b>2421.169</b>	2430.722

Breakpoint test method [7] is proposed to test the dominant mode (IMF5+IM6) whether there is a breakpoint around the outbreak of the event. The "strucchange" package in R software is used to test structure breakpoints within stock price series. A summary with  $m = 1, \dots, 5$ , breaks along with the corresponding values of the BIC is obtained (Table 2) and visualized by yielding a plot of the RSS and BIC (Fig 4). The minimum BIC criterion detects four breaks: 07-Sep-2010 27-Dec-2010 25-Apr-2011 24-Oct-2011, which are represented by dash lines shown in Fig 5, the narrower confidence interval, indicating the narrower break occurs, the greater the likelihood of structural changes.

The closest breakpoint after the Private Placement Announcement Date is Dec 27, 2010 and closest breakpoint to the Issue Date effect is Oct 24, 2011. So both Private Placement Announcement Date and Issue Date have temporary effect that last 66 trading days and 26 trading days. More specifically, the average Private Placement Announcement impact on 002237 stock price is RMB 5.57 Yuan and Issue Date impact is RMB 9.12 Yuan. By analyzing the dominant mode, instead of original one, the duration and magnitude of the impact is very clear.

**Economic analysis.** From the above analysis, some interesting findings about the impact of Announcement Effect can be summarized below: (1) Announcement Effect can cause larger vibration as a delta impulse, which is consistent with the time span of the event; (2) Small fluctuations are represented by the high frequency of the IMFs have no long-term impact on the stock price. (3) They are caused by daily price fluctuations. Announcement Effect on stock prices is like a triangular pulse. This pulse is mainly manifested by the low-frequency IMF, and accounts for majority of the variations during the event.

## Conclusion

Scholars around the world adopt short-term events study method to investigate private placement announcement effect. Taking into account the actual situation of China's private placement from the proposed plan to complete the private placement mostly lasts three months. Study of the private placement announcement effect should be considered not only the short-term window, but also medium-and long-term (3 months window to 19 months).

In this paper, we first proposed the EMD-based event analysis to estimate the impact of Announcement Date Effect on stock price volatility from multi-scale prospect of view, and then take illustrative Humon Share (002237 in Shenzhen Stock Market) to verify the effectiveness of the proposed method. Experimental results show that this approach is promising analysis from the point of view of the multi-scale impact of Announcement Date Effect in stock market.

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