

# Asset Pricing Bubbles and Investor Emotions: An Empirical Analysis of the 2014 – 2016 Chinese Stock Market Bubble

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## Abstract

*Conventional economic and financial models find difficulty in explaining asset pricing bubbles in a way that is compatible with the underlying investor social and emotional processes at work. This paper empirically tests a five-stage path dependent emotionally driven model of speculative bubbles based on Minsky and Aliber and Kindleberger (2015). Specifically, we explore the nature of the powerful emotions investors are held sway by as prices shoot up and then collapse using formal content analysis of media reports and original domain-specific constructed emotion category word dictionaries. In particular, we show how emotions such as excitement and anxiety, mania and panic are associated with, and potentially help drive, speculative bubbles. We apply our model to the very recent Chinese stock market bubble and show empirically how different investor emotional states are an important factor in helping explain the dramatic movements in the Chinese market. The paper also conducts vector autoregressive (VAR) analysis and demonstrates the predictive ability of a formal empirical model fitted to investor emotions during the earlier 2005-2008 Chinese stock market bubble accurately to forecast the different stages and bursting of the 2014-2016 Chinese stock market bubble.*

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# **Asset Pricing Bubbles and Investor Emotions: An Empirical Analysis of the 2014 – 2016 Chinese Stock Market Bubble**

## **Abstract**

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## **1. Introduction**

Extant financial and economic theories find great difficulty in explaining asset pricing bubbles within the context of traditional economic models (for summaries of attempts see e.g., the surveys of Brunnermeier and Oehnike, 2013; Scherbina, 2013; Jarrow, 2015). Even the definition of a bubble is contentious and there is a continuing debate as to whether if they actually exist they are “rational” or “irrational” (O’Hara, 2008). Conventional models of bubbles are usually theoretical and of a mathematical nature and variously revolve around ideas of herding, informational cascades and the “greater fool” theory (see Hirshleifer and Teoh, 2003 for an accessible overview). The part played by investor emotions and social and group processes in bubbles is effectively ignored (e.g., Shiller, 2014; Hirshleifer, 2015). In fact, as Hirshleifer (2015, p. 151) argues, were this to be formally acknowledged it would “offer a deeper basis for understanding the causes and consequences of financial bubbles and crises”.

Possibly because of what is arguably the limited success of conventional models of asset pricing bubbles many economists and finance academics make strenuous efforts to deny asset pricing bubbles exist; if markets are efficient and investors are rational such bubbles should not occur. Eugene Fama (2014), for example, even used his 2013 Swedish National Bank (Nobel Memorial) Prize in Economic Sciences address to argue against the existence of asset pricing bubbles and thus that market efficiency is not violated. However, by considering, *inter alia*, the US market index, using a graph with a natural logarithmic scale so major price movements are visually attenuated, and focusing mainly on index values many years apart, rather than the actual bubble trajectory itself, his arguments are less than convincing. Fama's attack on the work of his co-2013 Laureate Robert Shiller, who in his parallel address (2014) questions the rationality of markets, also well illustrates the strong emotions aroused not just during bubbles but also in academic commentators. There is even a tendency among some economists to see bubbles as unavoidable implying trying to understand their causes makes little sense (Shulman, 2016), or alternatively to argue that bubbles are in fact "rational" and thus consistent with neo-classical economic theory (Engsted, 2016).

Accounts of what actually happens in financial crises and asset pricing bubbles (e.g., Mackay, 1995; Galbraith, 1993; Cassidy, 2002; Tuckett and Taffler, 2008; Aliber and Kindelberger, 2015; Taffler and Bellotti, 2015) are first and foremost descriptions of highly emotional speculative processes. Terms such as excited, euphoric, exuberant, manic, depressed, anxious, blame, illusion, delusion and panic etc., abound. In this paper we seek to explore the emotional processes at work in asset pricing bubbles by analysing the underlying social dynamics through the lens of how the financial media contemporaneously reports on the path-dependent trajectory an asset pricing bubble represents as it moves through its different stages. As it starts out, inflates, booms, bursts, implodes and finally leads to increasingly stronger ripple effects in the surrounding economy.

Formal form-orientated content analysis is conducted employing appropriately derived key word dictionaries to measure the relative salience of the various emotions experienced by market participants in different stages of the bubble. Our analysis confirms how investors appear to be driven by deep-seated emotions in asset pricing bubbles and are caught up in the associated excitement in a powerful way denying the underlying risk in the departure from underlying reality. When the bubble bursts emotions go into reverse with the speculative asset now reviled and the search for blame paramount.

In particular in this paper we examine the recent Chinese stock market bubble of 2014 – 2016 when in a period of just under a year from July 1 2014 to June 12 2015, when the Shanghai Stock Exchange Composite Index (SSEI) peaked, the Chinese market went up by no less than 150% (with the SSEI rising from 2050 to 5166). It then went into free fall collapsing by 40% over the following 3½ months to September 28 2015 (when the SSEI stood at 3083) despite strenuous attempts by the Chinese government to stem the rout, and after a small reversal over the following three months the SSEI fell further to represent an overall loss of value of almost 50% at its trough on 28 January 2016 (when the index stood at 2655). At the time of writing, the end of November 2016, the SSEI is standing at 3283. In a short period of less than 18 months from peak to trough the Chinese stock market lost \$5.6 trillion or more than half of China’s GNP. Figure 1 which also has volatility levels overlaid, illustrates this trajectory graphically. Interestingly, this bubble closely resembles, albeit on an attenuated time scale, the earlier Chinese share price bubble of 2005 to 2008 when between June 2005 and October 2007 the Chinese market rose five-fold and then fell by over 70% over the following year.

Our analysis shows how speculative bubbles are essentially highly emotional processes. Investors become caught up in wish fulfilling fantasies and are carried away by the excitement the phantastic object represented by the implicit promise of easy wealth implicitly promises with underlying investment fundamentals ignored till the bubble bursts and panic and loss ensue. Specifically, we demonstrate how it is possible to measure the underlying emotional states of investors (the market) in different stages of an asset pricing bubble and, as a result, potentially predict how it is likely to play out. In particular, we model the bubble process empirically using vector autoregression (VAR) and different investor emotions as predictor variables to forecast subsequent movements in the SSECI. We derive our model using data for the 2005 – 2008 Chinese stock market bubble and then apply it out-of-sample to the later bubble and find it has strong predictive ability. These results are consistent with investor fantasy and associated powerful emotions driving market prices during the 2014 – 2016 bubble and, importantly, the evidence for this direction of causality is far stronger than that for market prices driving investors’ states of mind and behaviour. Based on our empirical analysis, we conclude that there is a need both to go beyond traditional theoretical models in seeking to explain asset pricing bubbles and explore more formally the underlying emotional processes at work to be able to understand and manage these more effectively.

This paper proceeds as follows. In the next section we discuss our underlying theory and motivation and in the following one we lay out our path-dependent psychological model

of asset pricing bubbles and establish our hypotheses. Section 4 then describes our content analysis emotion word dictionary construction, our data research corpus and research method. Our empirical tests of our model follow in the results section. In section 6 we present our VAR model and show how investor emotions drove the 2014 – 2016 Chinese stock market bubble. Discussion of the implications of our findings and the associated conclusions we draw about the need to explore the underlying emotional processes at work in asset pricing bubbles to be able to understand and manage these more effectively are provided in our final section.

## **2. Theory and motivation**

A common feature of the myriad of financial crises described in Aliber and Kindleberger (2015) ranging from tulip bulbs, through the South Sea Bubble, canals, railroads, stock prices before the Great Crash, real estate, internet stocks and the recent property led financial crisis is the presence of a five stage path-dependent emotionally driven trajectory. In each case patchy excitement about an innovation leads to euphoria (or mania), denial (or manic defence) and then when reality ultimately intrudes and the bubble bursts panic is followed finally by shame and blame. Tuckett and Taffler (2008) explore dot.com mania from a psychological perspective and point out how throughout this process it is not a question of lack of information about the riskiness of the respective investments, but the way in which this is treated. They view asset pricing bubbles as due to a disturbance in the market's sense of reality brought about by an exciting new idea that captures the financial imagination (which they term a "phantastic object") with an associated move from individuals investing employing the "reality principle" towards judgments based essentially on the "pleasure principle". Collective wishful thinking becomes the order of the day. Mental conflict between what investors on one level "know" to be the underlying or intrinsic value of the asset and how the bubble asset is actually being priced in the market is defended against and avoided with anything that might challenge the very satisfying "fantasy" valuation evacuated from mental awareness. Together these processes allow the exciting phantastic object to be pursued as if it were "real" with any associated anxiety denied and repressed. However, eventually reality has to intrude, panic takes over and the phantastic object is now despised and those who are perceived to have promoted what turns out to have been only a very satisfying wish-fulfilling fantasy now a source of blame.

As the bubble rises to its peak market participants unconsciously collude in collective denial in a fight against underlying reality including recourse to the superficially plausible cover story that “this time it is different” (Aliber and Kindleberger, 2015, p. 41). Sceptical commentators felt to be denying the value of the phantastic object, and spoiling the party are treated with contempt and dismissal (e.g., Cassidy, 2002). Their warnings are viewed as an attack motivated either by “deficient understanding or uncontrolled envy, on the wonderful process of enrichment ... [or] thought to demonstrate a lack of faith in the inherent wisdom of the market itself.” (Galbraith, 1993, p.2) Importantly, observation of actual bubbles demonstrates how when the bubble eventually bursts this is not due to new information but that the repressed anxieties can no longer be rendered unconscious. The whole process then goes into reverse with investors now taking flight in a headlong panic to rid themselves of the now despised phantastic object. Anger and blame of others rather than feelings of personal guilt erupt allowing investors to avoid the painful realisation of how they have been caught up in the temporarily very enriching and exciting wish-fulfilling fantasy. Psychologically, anxiety will change into even more painful feelings of loss, humiliation and guilt when unconscious defences against reality no longer work.

Shiller (2015, chapter 10) postulates bubbles develop through word of mouth communication; investing ideas can spread like epidemics. In particular, Shiller (2014, p. 1487) defines a speculative bubble as:

“A situation in which news of price increases spurs investor enthusiasm which spreads by psychological contagion from person to person, in the process amplifying stories that might justify the price increases and bringing in a larger and larger class of investors, who, despite doubts about the real value of an investment, are drawn to it partly through envy of others’ successes and partly through a gambler’s excitement.”

The key components of this definition are epidemic spread, the emotions of investors, and the nature of the news and information media. Shiller argues that bubbles are not about the “craziness” of investors but how they are “buffeted en masse from one superficially plausible theory about conventional valuation to another.” However, his definition does not mention anything about the bursting of the bubble and its subsequent collapse, which Aliber and Kindleberger (2015) stress are just as much an integral part of a bubble as its initial inflation.

Nor does Shiller attempt to go into any of the underlying psychological processes at work in any detail either at individual investor or market level.

Recurrent asset pricing bubbles can be viewed on one level as the inevitable consequence of investors' unconscious search for transformational phantastic objects. Conventional attempts to explain such events are constrained by economists' assumptions about individuals' rational utility maximising behaviour or in the case of behavioural finance models, the operation of individual level cognitive processing errors. This paper suggests that explicitly recognising the inherently emotional nature of investor relationships with their assets, and their fantasies and unconscious needs, may well be helpful in understanding the nature and trajectory of asset pricing bubbles and how such damaging repetitive tendencies in financial markets might be alleviated.

In exploring the path-dependent trajectory of an asset pricing bubble the role played by the media is key. Not only does it disseminate value-relevant information to market participants, but also provides (superficially) plausible explanations or meaning for the events as they unfold (Gamson et al., 1992). Kury (2014) claims that investors, as readers/audiences, understand financial markets through the media; in other words, investors' emotions can be influenced by the media. In parallel, media stories reflect investors' emotions as they are acted out in their investment decisions in the way in which they report on what is going on in the market. Therefore, in this paper we utilise the Chinese financial media, its news reports, comments, opinions and press releases, as a lens through which to explore the different emotions of investors in the market as the dynamic of the bubble evolves through its different stages. To test whether stock market valuations during the recent Chinese stock market bubble were essentially driven by investor emotions and fantasies rather more than by rational analysis we test our 5-stage path-dependent model of investor emotion against what was actually happening in the Chinese stock market from 2014 to 2016. Specifically, we conduct formal content analysis of Chinese media reports on the Chinese stock market employing eight different emotion word dictionaries to measure market sentiments and explore how these change and the interrelationships between them in different stages of the bubble.

In addition, we test formally whether being able to measure investor fantasies and emotions dynamically can help us predict prices in a stock market bubble directly. Specifically, we test our underlying theory of investor behaviour empirically by fitting a VAR model to investor emotions derived via content analysis of associated market media coverage during the Chinese 2005 – 2008 stock market bubble and then use it to predict

movements in the SSECI during 2014 – 2016. Evidence consistent with investor emotions predicting subsequent market prices in this period rather than emotions simply reflecting market prices would support our main thesis about the key role investor fantasy plays in driving market bubbles.

### **3. Hypothesis construction**

#### **3.1 Five-stage path dependent emotional asset pricing bubble trajectory**

Kindleberger and Aliber (2005, p.25) define an asset pricing bubble as “an upward price movement over an extended period of 15-40 months that then implodes”. That such bubbles or ‘manias’ constitute an essentially emotional process is highlighted by the language conventionally used to describe them (Taffler and Tuckett, 2008). Based on a general model of financial crises originating with Hyman Minsky, Aliberger and Kindleberger (2015) characterize a 3-stage model for asset pricing bubbles in terms of the path-dependent process of: initial “displacement” or some exogenous shock, “boom” and “euphoria”, and then “revulsion” or “panic”.<sup>2</sup> However, a more formal reading of such bubbles would tend to distinguish both between euphoria and boom, and panic and revulsion because the former psychologically leads to the latter. As such, we work with a 5-phase model in our subsequent analysis though noting that although these phases are presented sequentially for exposition purposes, there is inevitably some overlap as the psychological drama of the bubble unfolds. The underlying research question is whether the nature of this emotionally-driven path-dependent trajectory we hypothesize can help explain why the recent Chinese stock market bubble, and how, and its rapid inflation and subsequent implosion as in the parallel case of the equally dramatic dot.com mania only a few years earlier (Tuckett and Taffler, 2008) and the equivalent Chinese bubble of the last decade (Taffler and Bellotti, 2015). Is this psychologically-informed model consistent with the way Chinese stocks were being treated and valued by investors between 2014 and 2016, and what were the consequences?

Representing Aliber and Kindleberger’s (2015) anatomy of an asset pricing bubble more formally we term the beginning phase of “displacement” or exogenous shock as “emerging to view”, when Chinese stocks began to be perceived as transformational phantastic objects in the minds of investors. Next, once these unconscious mental images are established in this way, we predict a headlong and compulsive craze among investors to

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<sup>2</sup> Or *Torschlusspanik* (door-shut panic) (p. 46) in German as investors crowd to get out before the door slams shut.

acquire more of such assets at almost any price helped by observing how other investors have profited so well from their speculative activity, inter alia, assisted by the media. This we term the “rush to possess” phase.

Following these two stages we predict a crucial third stage with Chinese stock prices continuing to boom, and departing even further from fundamental value, despite increasing evidence that such stock valuations are clearly unrealistic and unsustainable. We argue, however, that normal investment criteria are no longer salient when applied to phantastic objects. This is due to the specific ways investors unconsciously collude to maintain their exciting idealized wish-fulfilling fantasy against the external challenges of material reality. This is the phase of “psychic defense”. Ultimately, however, such exciting fantasies are unsustainable, however pleasurable and emotionally satisfying; external reality cannot be held at bay forever. The emotional logic underpinning the extreme stock valuations is no longer maintainable and the stock market bubble implodes. Conscious awareness of having been caught up in what has turned out to be only an investment fantasy which was not real is now paramount, together with the pain of loss. This is felt both in terms of what the phantastic object represented emotionally, as well as the pain of having to give it up and the resulting financial loss. Investors now seek to liquidate their investments as fast as possible. This is the “panic” phase.

Fifth and finally, after the dramatic collapse in stock market valuations, we predict feelings of embarrassment, shame, guilt and loss will continue to predominate in markets. Investors will be wary of further involvement in the market that has let them down so badly, leading to potentially adverse consequences for rational asset pricing over quite a significant period of time subsequently. Those caught up in the bubble will look for other parties to blame for being caught up in the wish-fulfilling fantasy and the inevitable unwanted and very painful consequences that result. This we term the “revulsion and blame” phase.

Although clearly these five phases of a speculative bubble, emerging to view, rush to possess, psychic defense, panic and revulsion and blame will overlap to some degree, nonetheless our figures break the 2014 to 2016 Chinese bubble down into our five phases for illustrative purposes.

### **3.2 Hypotheses**

Drawing on our eight content analysis key word dictionaries constructed to measure the following different investor emotions: excitement, anxiety, happiness, worry, mania, panic,

revulsion and denial as motivated and described below, we set up the following hypotheses to test our 5-stage path-dependent bubble theory on our Chinese stock market bubble data:

"Emerging to view" phase (July 2014 to end October 2014)

*H1: the standardised frequency of excitement emotion words will increase in line with the market index.*

"Rush to possess" phase (November 2014 to end February 2015)

*H2: the standardised frequency of mania and excitement type emotion words will continue to move in line with the market index.*

"Psychic defence" phase (March 2015 to 12 June 2015)

*H3: the standardised frequency of mania emotion words will continue to increase to its peak. Simultaneously, the standardised frequency of anxiety emotion words will start to rise while that of excitement will start to fall as the market moves towards its peak with the standardised frequency of panic emotion words increasing in parallel. We also predict the standardised frequency of bubble mention words will increase during this phase.*

"Panic phase" (13th June to end of August 2015)

*H4: the standardised frequency of bubble word mention and negative emotion words anxiety and panic will all increase reaching their local maxima although to some extent ameliorated as mention of government intervention words reaches its peak.*

"Revulsion and blame" phase (September 2015)

*H5: the standardised frequency of revulsion type emotion words should increase to its peak.*

"Dead cat bounce" phase (October 2015 to 25<sup>th</sup> December 2015)

*H6: the standardised frequency of excitement words should increase again while the frequency of negative emotion words (anxiety, panic and revulsion) will decrease as the market appears to be rebounding.*

"Second panic" phase (28th December to end January 2016)

*H7: the standardised frequency of excitement emotion words will fall while that of bubble and negative emotion words anxiety and panic will all rise, reaching again their local maxima, but start to decrease as the standardised frequency of government intervention mentions reaches its local maxima.*

"Second revulsion and blame" phase (since February 2016)

*H8: the standardised frequency of revulsion emotion words will increase.*

“Weak emotion words v. strong emotion words”

*H9: the relationship between standardized frequency of “weak” happy and worry emotion words as the bubble evolves will be similar to that between “strong” emotion words*

“The predictive ability of investor emotions”

*H10: investor emotions predict changes in the SSECI*

*H11: changes in the SSECI predict investor emotions*

*H12: in the case of any endogeneity, investor emotions and the power of investor fantasy in driving subsequent market movements will dominate the impact of movements in the SSECI on investor emotions.*

#### **4. Dictionary construction, data and research process**

#### **4.1 Selection of emotion word categories**

Investment decisions create strong emotions of both excitement (associated with the pleasurable idea or fantasy of actual or imagined future gains) and anxiety (over the potential pain of actual or potential future loss). These emotions and their dynamic inter-relationship can be empirically measured using appropriate content analysis techniques (e.g., Tuckett, Smith and Nyman, 2014); Kuhnen and Knutson (2011) describe some of the underlying neuropsychology. As such, in seeking to test the role investor emotions play as potential drivers of asset pricing bubbles, measuring the levels of Excitement and Anxiety in the market in different stages of a bubble is fundamental, hence our use of excitement and anxiety key word dictionaries. Construction of our Mania, Panic Revulsion and Denial key word dictionaries are also required to test our 5-stage path dependent asset pricing model. We finally establish Happiness and Worry word dictionaries which represent less powerful emotions or feelings to test whether such weaker feelings impact market pricing during the 2014 – 2016 Chinese stock market bubble in the same way as we hypothesise our five categories of strong emotions do.

#### **4.2 Construction of key word emotion dictionaries**

Henry and Leone (2016) show that domain specific wordlists in content analysis perform better than general wordlists and also equal weighting of words is just as successful as more complex weighting procedures. Since there are no existing emotion word dictionaries in Chinese to the knowledge of the authors, and certainly none relevant to analyzing the Chinese financial media, we needed to build domain specific ones ourselves. To do this we divided our 30 month bubble period into 10 quarters and in each quarter ranked publications by article frequency. News stories and articles published in the five top sources were then downloaded and physically inspected for content appropriate for our emotion word dictionary construction purposes. Of those articles meeting our dictionary construction needs the number retained for detailed analysis from each source in each quarter depended on their length. In total, we ended up with 532 news articles with clear emotional content spread across 16 different journals. All articles were then carefully read and all words with an emotional component tabulated; around 1,000 separate words in total. These were then categorized into our eight different emotion categories (Mania, Excitement, Happy, Worry, Anxiety, Panic, Revulsion and Denial) by two researchers independently with the small number of classification disagreements resolved by discussion. However, the volume of

words in a number of our emotion categories was too great for ready application in the main stage of our research which involved analysis of our full article corpus (see below) so words appearing with very low frequency in it were removed leaving 439 in total across our eight key word emotion categories. Appendix 1 provides our key word dictionary by emotion word category in Chinese together with English translation and the associated word frequency cut off criteria for inclusion. Subsequently, an additional two word categories were added: “Bubble” and “Government Intervention” to address the level of awareness of the existence of the asset pricing bubble at its different stages and to reflect action by the Chinese government in an attempt to stabilise the market after the bubble had burst. Bubble classification key words (8 in number) were taken from the “Panic” emotion word dictionary and those in the Government Intervention one (7 in number) from the “Happy” emotion word dictionary.

### **4.3 Research corpus**

All the media reports we analyse are published in Chinese and as such are directly accessible to Chinese investors; they are all downloaded from the Factiva database. To arrive at the corpus of news stories and articles we work with for our 30 month period 1/1/2014-6/30/2016 on a month by month basis. We first search systematically in Factiva each month using the following search conditions:

Searching key words: (all in Chinese) *Chinese stock/share market OR Chinese stock/share OR stock/share market OR stock/share*

Region: *China; Beijing; Shanghai; Shenzhen etc.*

Language: *Simplified Chinese*

Sort by: *Relevance*

Subject: *Equity markets*

However, the resulting high volume of articles identified included a large proportion which simply reported firm results, were public company notices or mentioned the formation of new investment funds and thus not relevant for our purposes. As such, all news reports downloaded in the initial screening process had to be checked for appropriateness by looking at their headlines and if these were not clear enough, by inspection of the actual article

content to guarantee their relevance. Our target was to work with three hundred news articles each month. If the total number of the relevant articles for a specific month was less than three hundred, all were chosen to work with; if the number of available articles exceeded three hundred, the three hundred were chosen spread equally by date across the whole month.

In total, we ended up working with a corpus of around 6,700 suitable news stories and articles, an average of around 225 a month. Our ten principal media sources accounting for in total almost 2/3 of the articles we worked with (63.5%) with the Dow Jones Newswires and The Wall Street Journal (Chinese Edition) together accounting for almost 3 out of 10. Since all downloadable media news and articles published in China in Chinese are censored by the Chinese government, there is unlikely to be any particular bias in the way we constructed our research database.

#### **4.4 Data analysis and standardisation**

Wordscount,<sup>3</sup> a Chinese software package, is used to count the frequency of occurrence of words in each of our eight emotion key word dictionaries and two additional categories in our 6,700 article research corpus broken down by each of the 30 months in our data period. There are many benefits in using this software. First, it can count the frequency of words in both the Chinese and English languages.<sup>4</sup> Secondly, it can count not only single words such as “amazing” but also word combinations such as “government support”. Finally, the frequency of each word in each category in any period can be ranked from top to the bottom or vice versa making our empirical analysis more straightforward.

As there are different volumes of articles in our research corpus each month and these will be of different length the total frequency of emotion words in a particular category in a month cannot be compared with that for the same category in other months directly due to the differing total number of words. However, comparison can be realized through the following relationship:

$$\text{Key word dictionary category monthly frequency standardization} = \frac{\text{total frequency of emotion words in the respective category in the month}}{\text{total amount of words in all the news and articles downloaded in that month}} \quad (1)$$

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<sup>3</sup> Available at <http://www.yuneach.com/soft/WordsCount.asp>.

<sup>4</sup> We replicate this analysis using Western media sources and parallel English key word emotion dictionaries although our results are broadly similar and thus not reported here. *Inter alia*, we would expect that because Western financial journalists are not directly caught up in the stock market bubble in the same way as Chinese financial journalists would be, emotional engagement would less charged and this is what we find in our content analysis and empirical results with results a little attenuated in comparison.

All frequencies used in this paper are standardized in this way.

#### **4.5 SSECI index vs standardized emotion category word frequency**

To test our five-step emotional trajectory asset pricing bubble theory we need to explore the relationship between the relative salience of our different investor emotions as reflected in media reports as the Chinese stock market bubble evolves, bursts and deflates as measured by movements in the Shanghai Stock Exchange Composite Index between 2014 and 2016. We do this by overlaying the monthly standardized frequency of words in the respective emotion category plotted in bar chart form on the daily value of SSECI index so the dynamic relationship between the market index and investor emotions can be tracked through each phase of the bubble. In particular, to aid interpretation, the value of the standardized frequency of the emotion words in each category for each month post-June 2014 as the bubble started to take off is divided by its average value during the pre-bubble period from January of 2014 to June of 2014. Specifically, the actual standardized frequency of the emotion words of each category plotted in this paper is transformed into a ratio via the following equation:

$$\text{Actual standardized frequency of emotion words} = \frac{\text{standardized frequency of emotion words in the respective category in a month}}{\text{average standardized frequency of emotion words of that category in the period between January 2014 to June 2014}} \quad (2)$$

Since all standardized emotion word frequencies are transformed to a relative value via the above equation, in the rest of the paper for convenience of expression we just use the term “standardized frequency” rather than “actual standardized frequency” in reporting our results. Our line and bar charts are presented with the SSECI represented by primary axis (on the left side of the chart) and the respective emotion word standardized frequency as the secondary axis (on the right hand side).

### **5. Results**

In this paper we explore the extent to which investor emotions and fantasies are a prime driver of asset pricing bubbles. This section presents our empirical results. In the first subsection below we conduct an initial analysis to examine our underlying thesis before testing our formal hypotheses in subsequent sub-sections as the Chinese stock market bubble evolves.

## 5.1 Overview

As outlined in section 3.1 above our psychological bubble model is built around the idea of how the continuing search by investors for 'transformational' phantastic objects can help explain the morphology of asset pricing bubbles as they unfold. Investors become increasingly aroused and stimulated as the bubble inflates and the phantastic object appears to be 'real' and this is then followed by their anger and despair when the bubble bursts and the phantastic object turns out to be 'worthless'. To explore our general proposition that investors' emotional states both serve to drive and reflect the different stages of an asset pricing bubble, and the way in which they experience associated market movements, figure 2 plots our monthly excitement and anxiety variables against the SSECI between January 2014 and June 2016. As can be seen levels of excitement and anxiety are highly volatile and negatively correlated at  $r = -0.66$  as the correlation matrix of table 1 shows. The stock market is a very emotional environment for investors on this basis with investors experiencing considerable mental stress. This picture is confirmed in figure 3 which plots mania and panic emotion keyword frequencies against the SSECI. The relationship between mania and movements in the SSECI is clearly shown with the former mapping directly onto the latter ( $r = 0.57$  in table 1). Interestingly, panic is also positively correlated with the SSECI ( $r = 0.45$ ) providing some preliminary evidence that on one level investors "know" that the phantastic object is not real and there is continuing unconscious or pre-conscious fear that the bubble will collapse at some stage even as prices continue to shoot up. In fact, it is interesting to observe how between July and October 2015 when the Chinese stock market collapsed, and again between January and April 2016, our panic measure fell by three quarters suggesting perhaps almost some sense of emotional relief that reality had at last intruded despite the pain of financial loss? Levels of anxiety are also positively correlated with the SSECI ( $r = 0.39$ ).

Another way of exploring this issue is to recognise that the tension between investor excitement and anxiety and mania and panic which continuously contend in asset pricing bubbles and the resulting levels of uncertainty will be reflected in stock market volatility. Figure 1 plots monthly SSECI standard deviation against the SSECI index during our bubble period and shows that although the two series are highly correlated ( $r = 0.83$ ) volatility rises much more dramatically from the start of the bubble to its peak and again increases significantly at different stages as the bubble implodes. For example when the SSECI peaks in June 2015 it is standing at 2.5x its value a year earlier whereas the equivalent ratio for

monthly standard deviation is no less 7.5x with continuing high levels of volatility maintaining through to the early part of 2016.

Based on this initial analysis our main proposition that there is a clear relationship between investors' different emotional states and what they experience during an asset pricing bubble is confirmed, and our evidence is also consistent with the underlying idea that in such speculative bubbles investors appear to believe they have been given licence to search for and find the phantastic object. On this basis we suggest that the associated visceral investor passions and antipathies unleashed in this process can be a key driver of asset pricing in bubble markets. Our specific hypotheses are tested using our data in the following sub-sections.

## **5.2 "Emerging to view" phase (July 2014 to end October 2014)**

*H1: the standardised frequency of excitement emotion words will increase in line with the market index.*

During this initial phase of the Chinese stock market bubble we predict that Chinese stocks will begin to be viewed by investors as phantastic objects and hypothesise an increase in the associated sense of enthusiasm in the market. Figure 4 shows how in line with an increase in the SSECI of 20% in this period the standardised frequency of excitement emotion words in the media is around 50% higher than its average pre-bubble level highlighting the strong positive tone of the Chinese media. Figure 5 also shows in parallel how the standardised frequency of mania type emotion words is significantly increased compared with its average level in the pre-bubble period. Clearly the heating up of the Chinese market and levels of investor excitement are closely associated.

Typical media comments during this market refer to such things as how the “market is ready to break the bottleneck of the bear market”, “the worst time has passed”, “the bull is unstoppable” and “the bull has revived” etc.<sup>5</sup> In parallel human interest stories about Chinese grandmothers giving up investing in gold to buy stocks and grandfathers ready to sell their houses to devote themselves to the market are evidently reflecting investor sentiment and what investors want to read and hear about.<sup>6</sup> Clearly the Chinese stock market is starting to

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<sup>5</sup> Sources to be added.

<sup>6</sup> Sources to be added.

resemble a phantastic with our evidence consistent with hypothesis H1. Nonetheless, in October 2014 delay in the expected opening of the much trumpeted electronic trading link between Shanghai and Hong Kong, the “Shanghai – Hong Kong Connect” was announced serving to dampen investor excitement somewhat as figure 4 shows.

### **5.3 "Rush to possess" phase (November 2014 to end February 2015)**

*H2: the standardised frequency of mania and excitement type emotion words will continue to move in line with the market index.*

In the rush to possess phase of the bubble we predict an increasing headlong and compulsive desire among investors to speculate and not be left out with media content reflecting this need directly. During this four month period the SSECI increased by around a third in value. As figure 6 shows the level of investor excitement maintains at a high level during the first two months of this phase of the market although collapsing in January and February 2015 as the market temporarily falls by around 10% following news that the China Securities Regulatory Commission (CSRC) had punished several violations of margin trading regulations leading presumably to investor concerns about market trustworthiness. This is reflected in the increase in our anxiety variable in figure 6 in January 2015. A similar pattern is displayed in figures 5 and 7 relating to mania and panic. However, by the end of this rush to possess phase confidence in the market had started to return inter alia in the expectation of good news associated with the forthcoming session of China's parliament and legislature to be held at the beginning of March which was expected to strengthen market reforms and emphasise the continuing key role of the stock market in China's development.

Our empirical evidence appears somewhat supportive of our hypothesis 2.

### **5.4 "Psychic defence" phase (March 2015 to 12 June 2015)**

*H3: the standardised frequency of mania emotion words will continue to increase to its peak. Simultaneously, the standardised frequency of anxiety emotion words will start to rise while that of excitement will start to fall as the market moves towards its peak with the standardised*

*frequency of panic emotion words increasing in parallel. We also predict the standardised frequency of bubble mention words will increase during this phase.*

In the third stage of an asset pricing bubble our model predicts that prices will continue to boom with stock valuations increasingly at variance with reality and unsustainable. Pursuit of the phantastic object dominates investor thinking with any questioning voices dismissed and ignored as prices race to their peak and the bubble bursts. Any challenges to the enormously rewarding wish fulfilling fantasy that prices will continue to go up in effect for ever are denied in the forlorn hope the party will never end until the bubble inevitably implodes.

In this boom or euphoria phase of the Chinese stock market bubble the SSECI increases by no less than 60% in 3½ months. Our mania emotion word variable reaches its peak in line with the Shanghai Stock Exchange Composite Index standing at around five times its pre-bubble level as figure 5 shows although levels of excitement as the bubble races to its peak seen to decline (figure 4). Figure 7 shows how panic emotions are held in abeyance under the onslaught of the market rollercoaster or are at least repressed and denied, and similarly with anxiety (figure 6); there seems to be nothing holding back the market juggernaut in investors' minds. Nonetheless there is an increasing awareness of the fragile bubble state in the market as figure 9, which measures standardized frequency of bubble mention, illustrates and which stands at five times its level in the pre-bubble period.

The belief among investors in this psychic defence phase that the market was unstoppable and would continue to rise further was supported by government officials who described the emergence of the bull market as inevitable and rational.<sup>7</sup> In April 2015 the CSRC removed the restriction constraining investors to “one person, one account” allowing them to open multiple stock trading accounts and this was viewed as support by the Chinese government for the continuing run in the bull market. On 21 April, when the market was standing at around 4200, still 20% below its peak on 12 June, the People's Daily even published an article with heading “4000 only means the start of the bull market” confirming the Chinese government wanted the market to continue to rise a lot further.

On the other hand, there were many negative voices warning that the bubble was unsustainable as the market rocketed such as “the bull market is not sustainable with the bad

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<sup>7</sup> Sources and associated quotations to be added.

economic fundamentals”, “the bull market is created by impulse rather than fundamentals” and “it will slump finally as it did in 2007”<sup>8</sup> however these siren voices were clearly ignored in the euphoria and the collective attempt to ensure this enormously satisfying emotional state could be maintained. Despite increasingly frequent large daily price collapses and exhortations such as that by the official Chinese News Service in an article entitled “Do not let mania destroy the future of the Chinese stock market” (May 5 2015) which criticised investors and attempted to persuade them to be more rational about the market, nothing seemed to challenge investor exhilaration. In each case the SSECI quickly recovered with investors comforted by seemingly plausible stories such as in the case of the 6.5% slump in the SSECI on the 28th May from The Securities Times which explained the one day collapse as being due to profit-taking by investors.

Negative news appeared to have no impact on the headlong surge of investors to participate in the market which was clearly being viewed as a one way bet. The evidence we provide seems consistent with hypothesis 3; despite some increase in our panic variable (figure 7) total as the SSECI surges towards 5166.

### **5.5 "Panic phase" (13th June to end of August 2015)**

*H4: the standardised frequency of bubble word mention and negative emotion words anxiety and panic will all increase reaching their local maxima although to some extent ameliorated as mention of government intervention words reaches its peak.*

Ultimately, our model predicts, the bubble has to burst. External reality cannot continue to be avoided for ever and the story that “this time it is different” is no longer credible with the extreme stock valuations now seen as grounded only in fantasy. As the market collapses the phantastic object is recognised as only a chimera with investors now seeing to exit the market in a state of panic. There is not only the pain of financial loss but also that of having to give up such an enormously satisfying wish fulfilling fantasy and belief in excited wealth creation. In line with our hypothesis 4 the bubble is now recognised for what it is with mention of bubble emotion words at their peak as figure 9 illustrates. Investor mania collapses to pre-

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<sup>8</sup> Sources to be added.

bubble levels as shown in figure 5, and similarly the level of excitement in figure 4. Anxiety is at a peak (figure 6) standing at well over twice its pre-bubble level and with the level of panic now almost 3 times that before the bubble took off (figure 7). As we predict, feelings of panic and anxiety now dominate.

It is always very difficult in a bubble to identify why the market collapses so suddenly and so dramatically. The SSECI fell by almost a third in less than a month from its peak on 12 June and in the 2½ months to the end of August it had collapsed by no less than 40%. The media now reflected both the state of investor panic and the collapse in the market which changed from being represented as an unstoppable engine of wealth generation into something that should be exited from as quickly as possible. There were many warnings about worse to come, and now, after the event, explanations of why the market was going so rapidly into reverse.<sup>9</sup> Crowded selling only served to generate a more rapid decline in prices. Articles in the official Chinese media seeking to halt the flight from the market were ignored by investors seeking to get out of the market as quickly as possible.

Simultaneously the Chinese government tried to stem the tide as demonstrated by the frequency of mention of government intervention in figure 10 in the Chinese media. Attempts included the suspension of more than half of the country's stocks, reducing interest rates, relaxing stock market regulations, stopping new issues and requiring the 21 Chinese securities houses not to sell any stocks if the SSECI fell below 4500. In addition, a \$250 billion investment fund known as the National Team was set up to buy stocks in the SSECI in an attempt to buoy up the index. However, not surprisingly, all these actions proved to be of no avail in the face of investor panic; investors' fantasies were exposed for what they were and any basis of trust in the market was now destroyed. By the end of August 2015 the market had fallen to under 3000 despite the strenuous efforts to reverse its direction by the Chinese government.

On this basis the evidence we report is consistent with hypothesis 4.

## **5.6 "Revulsion and blame" phase (September 2015)**

*H5: the standardised frequency of revulsion type emotion words should increase to its peak.*

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<sup>9</sup> References and associated quotations from the media to be added.

We further predict that after the precipitated fall in stock valuations investors will experience feelings of shame and guilt as well as embarrassment for becoming involved in what ultimately turns out to be nothing more than a very painful wish fulfilling fantasy quite apart from the financial loss incurred, particularly by those who entered the market after it had already taken off. Feelings of revulsion and blame will now predominate with investors looking for scapegoats to avoid having to acknowledge their actions in being caught up in the bubble. Figure 8 shows how mentions of revulsion peak as the market collapses both during the panic phase and in the revulsion and blame phase which overlap to some extent. As such our evidence is reasonably consistent with hypothesis 5.

In its search for scapegoats the Chinese government prosecuted and punished fund managers blamed for contributing to the slump in the stock market with a journalist accused of reporting rumours which were considered to result in causing panic in the market was arrested and required to apologise to the public on television. Even the assistant to the chairman of the CSRC was arrested for suspected corruption in the search for those to blame.<sup>10</sup> Although many government officials and agencies sought to encourage support for the stock market Chinese investors continued to stay away and were reluctant to re-enter with the SSECI continuing to fall.

### **5.7 "Dead cat bounce" phase (October 2015 to 25<sup>th</sup> December 2015)**

*H6: the standardised frequency of excitement words should increase again while the frequency of negative emotion words (anxiety, panic and revulsion) will decrease as the market appears to be rebounding.*

However, following the Chinese government's attempts to strengthen the market and "good news" announcements such as reduced interest rates and the restarting of IPOs on a more favourable basis to investors, which were interpreted by the media as a sign of "back to the bull", between October and December 2015 the market increased by no less than 20%.<sup>11</sup> Official government sources were now very optimistic with, for example, the Shanghai

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<sup>10</sup> Sources to be added with more detail provided.

<sup>11</sup> Sources to be provided.

Securities News on December 3 reassuring that “The disaster will not come back”. Nonetheless, as figures 4 and 5 highlight there was only a weak recovery in both our excitement and mania variables, nothing like in the earlier bubble inflation phases. The relative absence of mentions of anxiety, panic and revulsion key words in figures 6, 7 and 8 could well reflect censorship of negative news by the authorities as inconsistent with the feelings of investors who have been “badly burnt”.

### **5.8 "Second panic" phase (28th December to end January 2016)**

*H7: the standardised frequency of excitement emotion words will fall while that of bubble and negative emotion words anxiety and panic will all rise, reaching again their local maxima, but start to decrease as the standardised frequency of government intervention mentions reaches its local maxima.*

However nothing seemed to have really changed in terms of underlying investor sentiment with the market falling again by no less than 25% again in the month of January 2016 to its lowest level in 14 months. As figures shows excitement was absent with anxiety (figure 6) and panic (figure 7) dominating as in the earlier panic phase. Fundamentals may superficially be viewed as somewhat consistent with a rational explanation for this further market collapse (although by a quarter in a month?) with the Chinese economy continuing to slow down and concerns that the rescue measures implemented by the Chinese government to prevent the market declining further would expire. However, probably more salient was the fall in investor trust in the market associated with the implementation of circuit breaker trading restrictions on the 3rd January, although cancelled five days later, leading to the concern that investors would be locked in if the market dropped below one of pre-set threshold values. Also, the inevitable lack of belief now in the Chinese government’s ability to engineer any market rebound given how investors had been burnt twice! Both our revulsion measure (figure 8) and mentions of further government intervention (figure 10) equally increase during this period also consistent with our hypothesis H7.

### **5.9 "Second revulsion and blame" phase (since February 2016)**

*H8: the standardised frequency of revulsion emotion words will increase.*

Finally, we predict a rerun of revulsion and blame after the market collapsed the second time. As is illustrated in figure 8 our revulsion, and in figure 6 our anxiety variables increase somewhat after February 2016. Excitement and mania emotions are absent in their mention. Again we have support for our hypothesis 8.

### **5.10 “Weak emotion words v. strong emotion words”**

*H9: the relationship between standardized frequency of “weak” happy and worry emotion words as the bubble evolves will be similar to that between “strong” emotion words*

In this the final hypothesis in this section we test whether weak emotion words such as happy and worry have the same power as our strong emotion words: excitement and anxiety and mania, panic and revulsion. Figure 12 plots the ratio of our happy to worry variables against the SSECI. As can be seen this measure seems largely insensitive to changes in the Shanghai Stock Exchange Index in contrast to our general media tone measure (the ratio of [excitement – anxiety]/[excitement + anxiety]) and overall investment environment measure (mania/panic) plotted in figures 12 and 13 respectively which closely reflect market movements.

As such, we are forced to reject our hypothesis 9 that more powerful emotion words do not dominate weaker emotion ones in measuring investor emotional states and their relationship with asset pricing bubbles.

## **6. The predictive ability of investor emotions**

In this penultimate section of the paper we explore empirically the two-way causality issue using out-of sample data: do investors’ fantasies and associated emotions drive prices in asset pricing bubbles, is it the other way around, or is any relationship mainly endogenous? *Inter alia*, we show how it is possible to build an empirical model to measure the dynamic interplay of powerful investor emotions and their causal relationship with market prices and then use this to forecast the SSECI in an out-of-sample period.

## **6.1 The nature of any potential causality**

This paper develops a dynamic five-phase emotional trajectory theory of asset pricing bubbles which revolves around the idea that investors are caught up emotionally, and that it is these powerful emotions that drive market prices. However, the nature of the relationship between investor emotions and market behaviour is a subtle one in that in a stock market bubble the financial media will be reporting both the dramatic market movements, and also the associated behaviour of investors. In addition, financial journalists themselves are likely to be caught up in the high levels of excitement as the bubble inflates and subsequent panic when it bursts. Such processes are clearly reflexive in nature. Similarly, investors will be observing movements in the market and also reacting to its coverage in the media and this, we hypothesise, will lead to them being sucked into the underlying fantasy even more deeply. How can we disentangle all these different interrelated relationships?

An alternative perspective to our investor fantasy-driven theory is taken by Shiller (2015, chapter 10) who argues bubbles are not driven by investor “craziness” but by social contagion and that it is news of price increases that drives investors to invest more and more leading to the bubble (Shiller’s theory does not address the bursting of bubbles and subsequent dramatic collapse in prices). In this section, we specifically test these two alternative theories of investor behaviour. To what extent was the 2014-2016 Chinese stock market bubble driven by investor emotions as reflected in the media, and to what extent were investor emotions driven by the bubble itself? What is the underlying nature of any potential endogeneity?

To distinguish between these two alternative explanations for the recent Chinese stock market bubble statistically, we need to choose a proper model. First, it has to consider potential two-way causality, i.e., dramatic movements in the SSECI can drive the tenor and emotional nature of journalist reporting while powerful investor emotions, as reflected in media market coverage, can affect the SSECI through the actions of investors. Second, the model needs to have some ability to forecast the SSECI in bubble market conditions.

To test whether investor emotions predict market returns or whether it is the extreme market movements that generate powerful investor emotions we employ a vector autoregressive (VAR) model approach. Specifically, since all variables in the VAR are dependent variables, this allows us to explore the direction of causality between different investor emotions and movements in the SSECI. In addition, as we will see, since all

variables on the right hand side of our VAR regression function are lagged, the model can be used for forecasting as well. Our model is used to test the following three hypotheses:

*H10: investor emotions predict changes in the SSECI*

*H11: changes in the SSECI predict investor emotions*

*H12: in the case of any endogeneity, investor emotions and the power of investor fantasy in driving subsequent market movements will dominate the impact of movements in the SSECI on investor emotions.*

## 6.2 Building our model

To construct our predictive VAR model we first content analyse media coverage of the earlier 2005 to 2008 Chinese stock market bubble in the same way as we did in section 4 for 2014 to 2016 using identical emotion word dictionaries and then use the derived variables to fit our emotion-driven model for the parallel period. Finally we test its out-of-sample predictive power in terms of its ability to forecast SSECI monthly returns during the 2014 to 2016 bubble. To determine the optimal lag for our data we examine the AIC, HQIC and SBIC measures and find a one-period lag to be most appropriate. We also examine the stability of our model using the Lagrange-multiplier test and the roots of the companion matrix and find our one-period lag model to be stable. Our VAR model takes the following form with independent variables consisting of log of prior month return, and five log-transformed emotions lagged one month: mania, excitement, anxiety, panic and denial and is used to predict log of next month's return:

$$r_t = \beta_0 + \beta_1 r_{t-1} + \beta_2 lma_{t-1} + \beta_3 lex_{t-1} + \beta_4 lan_{t-1} + \beta_5 lpa_{t-1} + \beta_6 lde_{t-1} + \varepsilon \quad (1)$$

where:

$$r_t = \ln(SSECI_t) - \ln(SSECI_{t-1}), lma_t = \ln(mania_t), lex_t = \ln(excitement_t), lan_t = \ln(anxiety_t), lpa_t = \ln(panic_t) \text{ and } lde_t = \ln(denial_t)$$

## 6.3 Results

Table 2 presents our results. Column (1), our main VAR model, shows that the SSECI

monthly return is driven by investor emotions in the previous month with level of excitement significant at the 1% level, and level of anxiety, with a negative sign, significant at the 5% level, as well as prior month return (significant at the 1% level) but with a negative sign, i.e., indicating high volatility. Importantly, however, in column (2), we see that when we remove the emotion measures there is no relationship between sequential monthly returns in the index. On the other hand, in column (3), we observe how the emotions we are measuring remain significant predictors of the SSECI even alone. In the case of the VAR model, adjusted-R<sup>2</sup> is no less than 47%, and for the OLS model in column (3) it is 32%, whereas the OLS model in column (2) is not significant at conventional levels. On this basis we have evidence consistent with investor emotions driving the market in during the 2005 to 2008 stock market bubble.

However, to what extent are investor emotions also driven by the market? The remaining columns of table 2 explore this. For illustrative purposes we focus on columns (4) to (6) which measure the extent to which changes in the SSECI predict investor mania as reflected in media coverage and comment. Whereas the VAR model in column (4) shows that mania is inversely related to prior month return (significant at the 1% level), as well as prior period levels of mania and excitement, when we explore the relationship between mania and prior month return in column (5) alone, our OLS model is not significant. Column (6) shows the degree of autocorrelation in mania over time which is not surprising. Only in the case of excitement in column (8) is there some evidence of the SSECI driving investor emotions, however, when other emotions are included in the full VAR model in column (7) the relationship is no longer present.

In summary, table 2 suggests that investor emotions are far more powerful in driving the SSECI during the 2005-2008 Chinese stock market bubble than the other way around and provide support for our emotional trajectory theory of asset pricing bubbles. To explore these results further we also conduct Granger causality tests (not reported) which show that whereas prior period excitement and anxiety predict the SSECI in the next period (and to some extent mania as well), the SSECI only seems to be able to predict the level of investor mania. Our empirical results suggest that it is investor fantasy and associated emotional states that appear to be driving next month SSECI returns during the 2005 to 2008 Chinese stock market bubble but we have only weak, if any, evidence that investor fantasy is driven by the SSECI itself. As such we have clear evidence consistent with hypothesis H1, weak evidence supportive of H2 and quite strong evidence for H3, i.e., the direction of causality is much stronger in the case of emotions driving prices rather than the other way around.

However, to test our theory more directly the key question is how well our model predicts out of sample. To this end we use model 1 to predict monthly movements in the SSECI during the 2014 to 2016 Chinese stock market bubble. Figure 14 shows the forecast versus actual monthly movements in the SSECI and our model fitted to the earlier bubble clearly has strong predictive ability. In fact the correlation between predicted monthly return and actual monthly return over the 30 month period is a highly impressive 66%. One of the most interesting results is the model's ability to predict the bursting of the bubble in June 2015 as will be observed! To summarise, our out-of-sample prediction results provide further support for our main thesis built on the power of investor fantasy as a key driver of asset pricing bubbles and are not necessarily consistent with Shiller's social contagion arguments.

## **7. Discussion and conclusion**

This paper sets out to explain the recent Chinese stock market bubble of 2014 – 2016 in terms of the underlying emotional processes at work. Traditional explanations of financial bubbles tend to focus on theoretical and analytical models that may or may not actually fit the real-world experience of investors in real world markets. However, by considering the emotional drivers of investor behaviour in such highly charged situations and formally recognising the powerful and potentially debilitating fantasies and emotions unleashed in speculative bubbles, we argue we can increase our understanding of such major destructive economic events. In this paper we adopt a formal content analysis approach. Using emotion key word dictionaries which we develop specifically for our particular purpose we demonstrate how Chinese market participants' emotional fantasies, anxieties and drives, fanned by the Chinese government and media, led asset prices to depart dramatically from underlying fundamental value in a very compressed timeframe. Adopting a well-established path-dependent model of investor emotions based on the original Minsky taxonomy of bubble activity, we show that the search by investors for what we term a phantastic object can help explain the morphology of the Chinese stock market bubble as it played out. In this process warning voices are ignored as investors become carried away in their wish fulfilling fantasy of a market that only moves in one direction which is rapidly up, and the wealth they believe will result. Mania and euphoria reign until eventually it is no longer possible for investors to continue to deny the siren voices and reality intrudes. The bubble bursts and panic ensues with investors trying to dump their now devalued stocks as quickly as possible before prices fall further. Revulsion and blame follow together with the search for scapegoats, and in the bubble which is the

focus of this paper, the Chinese government's very expensive but ultimately fruitless attempts prevent the stock market from imploding further.

In contrast to many economists who view bubbles as an underlying fact of life which cannot be explained, based on our detailed empirical analysis we argue that, in fact, asset pricing bubbles are perfectly explicable. This follows if, instead of looking for patterns of rational economic activity, we recognise that most financial decisions, as with most other decisions we make, are predominantly emotional in nature. Only in this way are economists and policymakers going to be able to understand the nature and morphology of financial bubbles in the future and be in a better position to take appropriate action.

In our content analysis we show how the Chinese media directly mirrors investor emotions in the speculative situation we explore. Ultimately we are dealing with a highly dynamic process with our empirical VAR analysis and Granger causality tests showing how the SSECI was being largely driven by investor fantasy rather more than the powerful investor emotions being reported on simply reflecting or being driven by dramatic movements in market prices. Interestingly, we find that our emotion-driven VAR model was able to predict the peak of the 2014 – 2016 Chinese stock market bubble on an out-of-sample basis as well as a number of our emotion variables already warning of the likelihood of this in advance. Future work can perhaps look in more detail at potential emotion variable warning signs of sudden reversal in the market trajectory in bubble environments and subsequent sharp deflation in prices.

The market bubble we explore here is very similar to the 2005 – 2008 Chinese stock market bubble of only a few years earlier, and which we employ in constructing our VAR statistical model save that this time the process was much more truncated. Not reported here are the results of our parallel analysis of the earlier bubble which are very similar and thus provide an independent test of the robustness of our research approach. It seems that Chinese investors, at least, have short memories and are unable to learn from experience so emotionally seductive and exciting speculative bubbles are. In addition, we repeat both sets of analyses using non-Chinese media in English and parallel domain-specific emotion key word dictionaries, and again we find similar emotional processes being picked up although a little attenuated in comparison which is what we would expect. This is because Western financial journalists were not caught up directly in the stock market bubble in the same way as Chinese financial journalists would be and, as such, any emotional engagement would less

charged. This is indeed, in fact, what we find in our content analysis and empirical results. Further work needs to test our 5-stage path-dependent emotional model of bubbles in other cases such as dot.com mania adopting a similar research approach.

We conclude by arguing the need explicitly to take investor fantasy and associated emotions into account not just in the case of speculative bubbles but also potentially in seeking to explain investor behaviour in non-bubble situations more generally.

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## Appendix 1 - Chinese emotion dictionary (both in Chinese and in English by translation)

### 疯狂(Mania):

牛市(Bull market) 贷款(loan) 巨大(enormous) 暴涨(boom) 爆发(outburst) 疯狂(Crazy) 天量(eye-popping amount of transaction volume) 火爆(Hot) 涨停板(rise to daily limit) 抵押(guaranty) 重仓(heavy holdings) 急升(steep rise) 狂热( fever) 火热(hit) 巨量(jillion) 冠全球(Global Crown) 烧(Burn) 狂飙(madly increase) 暴增(explode) 牛气冲天(full of bull) 神话(myth) 狂欢(carnival) 政策牛(policy bull) 暴利(excessive profit) 火箭(rocket) 超级牛(super bull) 气势如虹(unstoppable) 如火如荼(in full swing) 奇迹(miracle) 狂牛(Mad cow) 傲视全球(the envy of the world) 升停板(up limit) 沸腾(ebullition) (33) (frequency ≥10)

### 激动(Excitement):

新高(new high) 大涨(surge) 红(red) 涨停(limit-up) 高点(high point) 强势(mighty) 火(fire) 领涨(some stocks lead the upside) 冲高(sharp increase) 赚钱效应(money effect) 繁荣(prosperity) 强烈(strong) 最佳(optimal) 续升(continue to increase) 庞大(tremendous) 激发(motivate) 连阳(continues Yang) 崛起(rising) 红盘(red plate) 走牛(bullish) 收红(closed in red) 高速增长(rapid growth) 热潮(upsurge) 政策红利(bonuses from the policy) 翻倍(doubling) 热炒(popular

speculation) 壮大(expand) 翻番(doubling) 前所未有(unprecedented) 蜂拥(Swarm) 高歌猛进(rapid development) 强势反弹(strong rebound) 水涨船高(When the river rises, the boat floats high) 兴奋(exciting) 高档(top grade) 屡创新高(record highs) 激情(passion) 领头羊(bellwether) 迅猛(rapid) 跃升(jumped) 重大利好(major benefits) 领军(leader) 劲扬(powerful increase) 踊跃(energetic) 热捧(hot hands) 热烈(fervency) 猛增(surge) 振奋(cheer up) 蓬勃发展(flourish) 异军突起(sudden rise) (50) (frequency ≥30)

### **高兴(Happy):**

改革(evolution) 稳定(stabilized) 机会(opportunity) 关注(focus) 推动(promote) 信心(confidence) 刺激(stimulate) 支持(support) 回升(rally) 有望(hopeful) 积极(active) 盈利(gain) 提升(improve) 支撑(support) 改善(improve) 看好(optimistic) 实现(achieve) 突破(break through) 带动(drive) 有利(beneficial) 买入(buy) 参与(participate) 加大(increase) 乐观(optimism) 提高(improve) 救市(bailout) 吸引(attracting) 持有(possess) 动力(power) 提振(boost) 春(spring) 获利(profitable) 偏好(preference) 热点(hot spot) 企稳(Stabilized) 恢复(recover) 合理(reasonable) 健康(healthy) 复苏(resuscitate) 希望(hope) 相信(believe) 回报(return) 完善(complete) 显著(outstanding) 符合(conform) 居前(top ranking) 平稳(steady) 放大(enlarge) 开户(open account) 低估(underrate) 走强(going strong) 增持(increase holdings) 人气(popularity) 增强(enhance) 期待(wish) 溢价(premium) 缓解(relieve) 高开(opened high) 赚钱(make money) 成功(success) 干预(intervene) 利多(beneficial) 向好(positive) 放量(increased volume) 规范(norm) 鼓励(encourage) 冲高(sharp increase) 稳健(steady) 热情(enthusiasm) 较好(preferably) 旺(vigorous) 良好(fine) 激励(encourage) 憧憬(looking forward) 站上(stand up) 温和(warm) 促使(urge) 止跌(Stabilized) 扭转(turn around) 更好(better) 推升(push up) 充裕(sufficient) 机遇(opportunity) 可期(optimistic) 便利(Convenience) 变革(revolution) (86) (frequency ≥100)

### **担忧(Worry):**

风险(risk) 压力(stress) 震荡(fluctuate) 问题(problems) 担忧(worry) 减持(reduce holding-shares) 放缓(slacken) 拖累(encumber) 加息(raising the interest rate) 限制(limitations) 谨慎(adjust back) 回调(caution) 不足(shortage) 软(soft) 暂停(pause) 下挫(drop) 震汤(vibrate) 振荡(fluctuate) 疲弱(weak) 弱势(weak) 担心(worry) 炒作(make story for stocks) 利空(bearish) 负面(negative) 不确定(uncertain) 低点(low point) 缺乏(lack) 做空(short) 萎缩(atrophy) 回吐(profit taking) 过度(excessive) 观望(wait and see) 违规(violate) 收窄(narrowing) 不利(detrimental) 阻力(resistance) 操纵(manipulate) 疲软(sluggish) 解禁(unlock) 挑战(challenge) 抑制(suppress) 反复(repeatedly) 异常(abnormal) 沽空(short selling) 降温(cooling) 违法(break the law) 阴(Yin) 防范(precaution) 缓慢(slow) 分歧(disagree) 过高(excessively high) 动荡(volatile) 沽(sell) 走弱(become weak) 敏感(sensitive) 高估(overvalue) 偏低(low) 空头(short position) 套利(interest arbitrage) 逊(inferior) 压制(suppress) 不稳(unstable) 打压(crack down) 乏力 feeble) 偏弱(weak) 被动(passivity) 困难(difficulty) 套现(interest arbitrage) 收低(close with lower price) 偏高(priced high) 审慎(prudent) 内幕交易(insider trading) 升息(rise the interest rate) 脆弱(weak) 矛盾(contradict) 差距(gap) 疑虑(doubt) 卖压(the pressure of selling) 看空(bearish) 失望(upset) 抛压(undersell) 下探(drifted down) 困扰(perplex) 过热(overheat) 规避(avoid) 减仓(underweight) 缩小(shrink) 保守(conservative) 跳空(plunge) 威胁(threat) 怀疑(doubt) 不明朗(unclear) (92) (frequency ≥100)

### **焦虑(Anxiety):**

大跌(a large drop) 差(inferior) 跌停(limit down) 低迷(downturn) 加剧(aggravate) 重挫(losing ground) 剧烈(drastic) 打击(strike) 遭遇(suffer) 避险(hedge) 忧虑(anxiety) 跳水(dive) 绿(green) 大幅下跌(dramatic drop) 领跌(some stocks leading the downside) 杀跌(sell the falling stock) 急跌(drop quickly) 警惕(cautious) 恶化(deteriorate) 缩水(shrink) 警告(warning) 质疑(query) 警示(caution) 黑色(black) 不安(uneasy) 跌市(down market) 变数(variation) 困境(dilemma) 套牢(entangle) 偏离(deviate) 普跌(drop pervasively) 大幅震荡(sharp fluctuation) 颓势(declining tendency) 黑天鹅(black swan) 恶意做空(short maliciously) 贪婪(greed) 严峻(severe) 重创(hard

hit) 大減(a large decrease) 不看好(bad expectation) 过度投机(over-speculation) 信心不足  
(unconfident) 爆破(explosion) 被套(trap) 不景(recession) 失灵(be out of order) 顾虑(scruple) 退  
潮(ebb tide) 窘境(awkward situation) 倒退(reverse) (51) (frequency ≥40)

### **恐慌(Panic):**

严重(terrible) 冲击(shock) 亏损(loss) 熊市(bear market) 跌破(drop below) 新低(new low) 抛售  
(dump) 损失(damage) 坏(bad) 恐慌(panic) 股灾(market disaster) 陷入(sink into) 熊(bear) 亏  
(loss) 损(harm) 失守(fall) 惨(miserable) 跌穿(drop below) 崩盘(market collapse) 蒸发(evaporate)  
代价(at the cost of) 恐惧(fear) 损害(damage) 撤离(evacuate) 受损(be/been damaged) 丧失(lose)  
急挫(slump quickly) 冲破(break through) 击穿(breakdown) 伤害(hurt) 损失惨重(suffer great  
losses) 混乱(chaos) 糟糕(terrible) 狂泻(slump drastically) 强制平仓(mandatory unwind) 泡沫  
(bubble) 危机(crisis) 金融危机(financial crisis) 风暴(storm) 破灭(disillusion) 破裂(rupture) 终结  
(end) 泡沫破裂(the rupture of the bubble) (43) (frequency ≥40)

### **厌恶(Revulsion):**

冷(cold) 悲观(pessimistic) 离场(leave the market) 退出(exist) 沉重(a heavy heart) 冰(ice) 冷却  
(cooling down) 阴影(shadow) 离开(leave) 清淡(insipid) 无奈(can do nothing to help) 阴霾(haze)  
痛苦(pain) 沉寂(quiet) 黯淡(gloom) 冷淡(coldness) 冬天(winter) 惨淡(dismal) 冷落(deserted)  
一蹶不振(unable to get up after a fall) 惨痛(painful) 疼(pain) 恶果(bad result) 失落(listless) 走人  
(walk away) 回辙(nightmare) (26) (frequency ≥10)

### **否认(Denial):**

否认(Denial) 违抗(Defy) 反对(Oppose) 对抗(resist) 不服从(Defy) 藐视(Defy) 蔑视(Defy) 拒绝  
(repudiate) 排斥(Reject) 抵制(Reject) 遗弃(Desert) 抵赖(Disavow) 抛弃(Discard) 丢弃(Discard)  
脱离(Disown) 扔掉(Ditch) 放弃(Renounce) 摈弃(Renounce) 中止(Renounce) 退出(Renounce) 否

定 (Negate) 反驳(Refute) 驳斥(Refute) 不承认(Disallow) 不接受(Disallow) 否决(Override) 凌驾(Override) 推翻(Overrule) 拒绝考虑(Dismiss) 避免(Avoid) 防止(Avoid) 躲避(Avoid) 逃避(Avoid) 抗拒(Resist) 反抗(Resist) 规避(Evade) 回避(Evade) 避开(Evade) 挑战(Challenge) 质疑(Challenge) 批驳(Refute) 怀疑(Discredit) 无效(Invalid) 作废(Invalid) 不相信(disbelieve) 争论 (Dispute) 辩论(Dispute) 争端(Dispute) 纠纷(Dispute) 分歧(Dispute) 异议(Dispute) 漠视(Rebuff) 不赞同(Disapprove) 不同意(Disapprove) 不赞成(Disapprove) 辩解(Defend) 辩白(Defend) 辩护(Defend) (58) (frequency≥10)

Total= 33+50+86+92+51+43+26+58 = 439 words

#### **Additional Categories:**

##### **泡沫(Bubble):**

泡沫(bubble) 危机(crisis) 金融危机(financial crisis) 风暴(storm) 破灭(disillusion) 破裂(rupture) 终结(end) 泡沫破裂(the rupture of the bubble) (8)

##### **政府干预(Government Intervention):**

救市(bailout) 干预(intervene)

**Extra low frequency words:** 国家队 (National Team) 护盘(support the market) 接盘(accept the offer) 官方资金(the official fund) 托市(when the market drop constantly, the authorities inject the fund into the market to make it rise again) (7)

Table 1 Emotion word category variables and Shanghai Stock Exchange Composite Index 2014 - 2016 Correlation matrix

	mania	excitement	happy	worry	anxiety	panic	revision	SSEC(Mid-point)	SSEC(SD)	(E-A)/(E+A)	M/(P+R)	M/P
mania	1											
excitement	0.557402734	1										
happy	0.136810716	0.54083	1									
worry	-0.389204096	-0.74796	-0.36235	1								
anxiety	-0.126498126	-0.66252	-0.54574	0.713505672	1							
panic	-0.058567021	-0.64815	-0.47113	0.577985127	0.894248	1						
revision	-0.297685779	-0.66363	-0.29289	0.616490753	0.803788	0.748666945	1					
SSEC(Mid-point)	0.567653661	-0.08153	-0.08515	0.194253682	0.385615	0.448316594	0.119353588	1				
SSEC(SD)	0.51840329	-0.06616	-0.12336	0.182439807	0.48588	0.564769895	0.32714488	0.831828936	1			
(E-A)/(E+A)	0.342857119	0.889762	0.607157	-0.793821712	-0.92265	-0.840046636	-0.812545477	-0.281805007	-0.318895375	1		
M/(P+R)	0.804561516	0.847338	0.463445	-0.571141552	-0.51419	-0.491010262	-0.550731445	0.191633366	0.177116268	0.722892	1	
M/P	0.767461801	0.856694	0.491268	-0.574356328	-0.52794	-0.51308326	-0.535551228	0.145707486	0.14273244	0.73514	0.996479	1

**Table 2: Regression analysis of the association between SSECI and different investor emotions based on Chinese sources**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)		
	r_t (VAR)	r_t (OLS)	r_t (OLS)	lma_t (VAR)	lma_t (OLS)	lma_t (OLS)	lex_t (VAR)	lex_t (OLS)	lex_t (OLS)	lan_t (VAR)	lan_t (OLS)	lan_t (OLS)	lpa_t (VAR)	lpa_t (OLS)	lpa_t (OLS)	lpa_t (OLS)	lde_t (VAR)	lde_t (OLS)	lde_t (OLS)	
r_t(t-1)	-0.539*** (0.152)	0.180 (0.148)	0	-2.035*** (0.637)	0.161 (0.601)	0	-0.785 (0.665)	1.780*** (0.591)	0	0.214 (0.455)	0.0692 (0.376)	0	0.0198 (0.746)	-0.941 (0.705)	0	0.0174 (0.455)	-0.318 (0.386)	0	0	
lma_t(t-1)	0.0489 (0.0305)	0	0.0145 (0.0349)	0.679*** (0.128)	0	0.593*** (0.141)	0.144 (0.134)	0	0.0405 (0.141)	0.156* (0.0917)	0	0.198** (0.0935)	0.112 (0.150)	0	0.159 (0.152)	0.201** (0.0917)	0	0	0.218** (0.0918)	
lex_t(t-1)	0.207*** (0.0456)	0	0.114** (0.0454)	0.441** (0.192)	0	0.0905 (0.184)	0.606*** (0.200)	0	0.468** (0.184)	0.0622 (0.0622)	0	0.100 (0.122)	0.115 (0.198)	0	0.120 (0.198)	-0.0597 (0.137)	0	0	-0.0561 (0.119)	
lan_t(t-1)	-0.144** (0.0605)	0	-0.148** (0.0750)	0.184 (0.254)	0	0.203 (0.296)	0.194 (0.265)	0	0.145 (0.295)	-0.0366 (0.182)	0	-0.0125 (0.196)	-0.190 (0.297)	0	-0.153 (0.318)	0.176 (0.181)	0	0	0.189 (0.192)	
lpa_t(t-1)	0.0544 (0.0465)	0	0.0587 (0.0553)	0.0580 (0.195)	0	0.0246 (0.224)	-0.368* (0.204)	0	-0.301 (0.224)	0.351** (0.140)	0	0.317** (0.148)	0.874*** (0.229)	0	0.823*** (0.241)	0.216 (0.139)	0	0	0.198 (0.145)	
lde_t(t-1)	-0.0592 (0.0599)	0	-0.0663 (0.0724)	-0.279 (0.251)	0	-0.277 (0.293)	0.134 (0.263)	0	0.0885 (0.293)	-0.174 (0.180)	0	-0.153 (0.194)	-0.136 (0.294)	0	-0.106 (0.315)	-0.164 (0.180)	0	0	-0.154 (0.191)	
Constant	0.491 (0.440)	0.00750 (0.0165)	-0.258 (0.478)	-0.448 (1.849)	-6.384*** (0.0670)	-2.881 (1.937)	-1.184 (1.931)	-5.140*** (0.0660)	-2.756 (1.934)	-3.559*** (1.322)	-5.434*** (0.0420)	-3.009** (1.281)	-1.418 (2.164)	-5.722*** (0.0787)	-0.982 (2.082)	-5.223*** (1.321)	-7.216*** (0.0431)	-5.062*** (1.258)	0	0
Observations	46	46	47	46	46	47	46	46	47	46	46	47	46	46	47	46	46	47	47	
R-squared	0.540	0.032	0.396	0.490	0.002	0.404	0.523	0.171	0.467	0.336	0.001	0.332	0.512	0.039	0.499	0.379	0.015	0.378	0.302	
Adjusted R-squared	0.4698	0.032	0.3221	0.49	-0.0211	0.33	0.523	0.1707	0.467	0.3356	-0.0219	0.25	0.4368	0.017	0.4375	0.2831	-0.0073	0.302	0.302	
Prob > F	0	0.23	0.0007	0.0001	0.79	0.0005	0	0.0043	0.0001	0.01	0.85	0.0043	0.0001	0.1891	0	0.0035	0.4155	0.0012	0.0012	

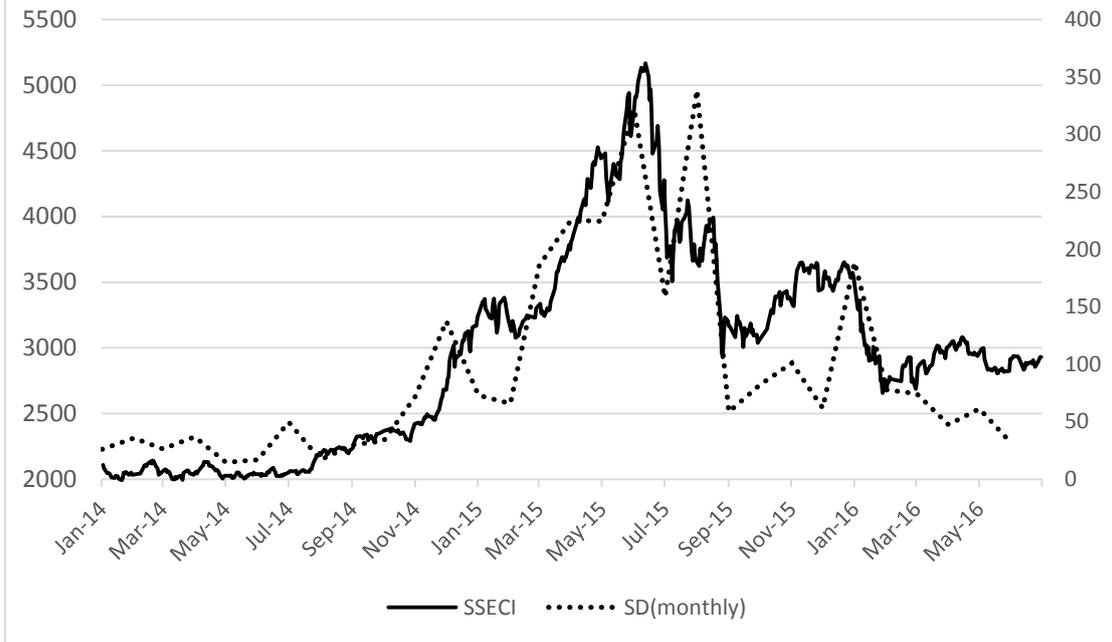
This table shows the relationship between monthly change in the SSECI and a range of investor emotion variables over the 48 month period from Jan 2005 to December 2008.

VAR denotes vector autoregression model and OLS denotes ordinary least squares.

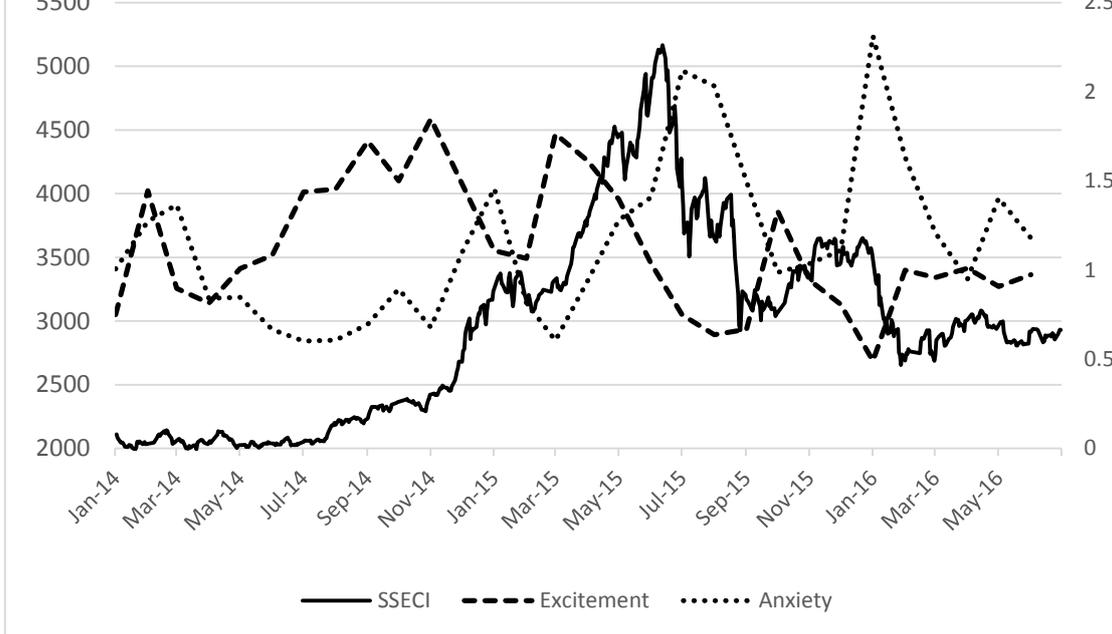
r\_t = ln[SSECI\_t] - ln[SSECI\_{t-1}]; lma\_t = ln(mania\_t); lex\_t = ln(excitement\_t); lan\_t = ln(anxiety\_t); lpa\_t = ln(panic\_t); lde\_t = ln(denial\_t)

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

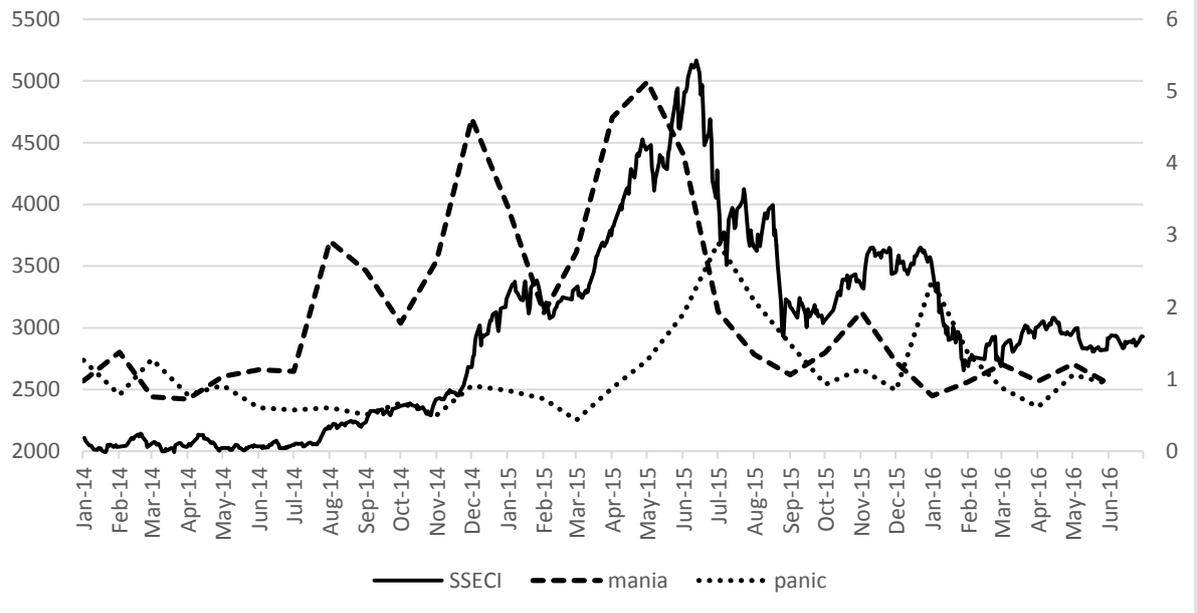
**Figure 1: SSECI (daily) vs st dev monthly 2014 – 2016**



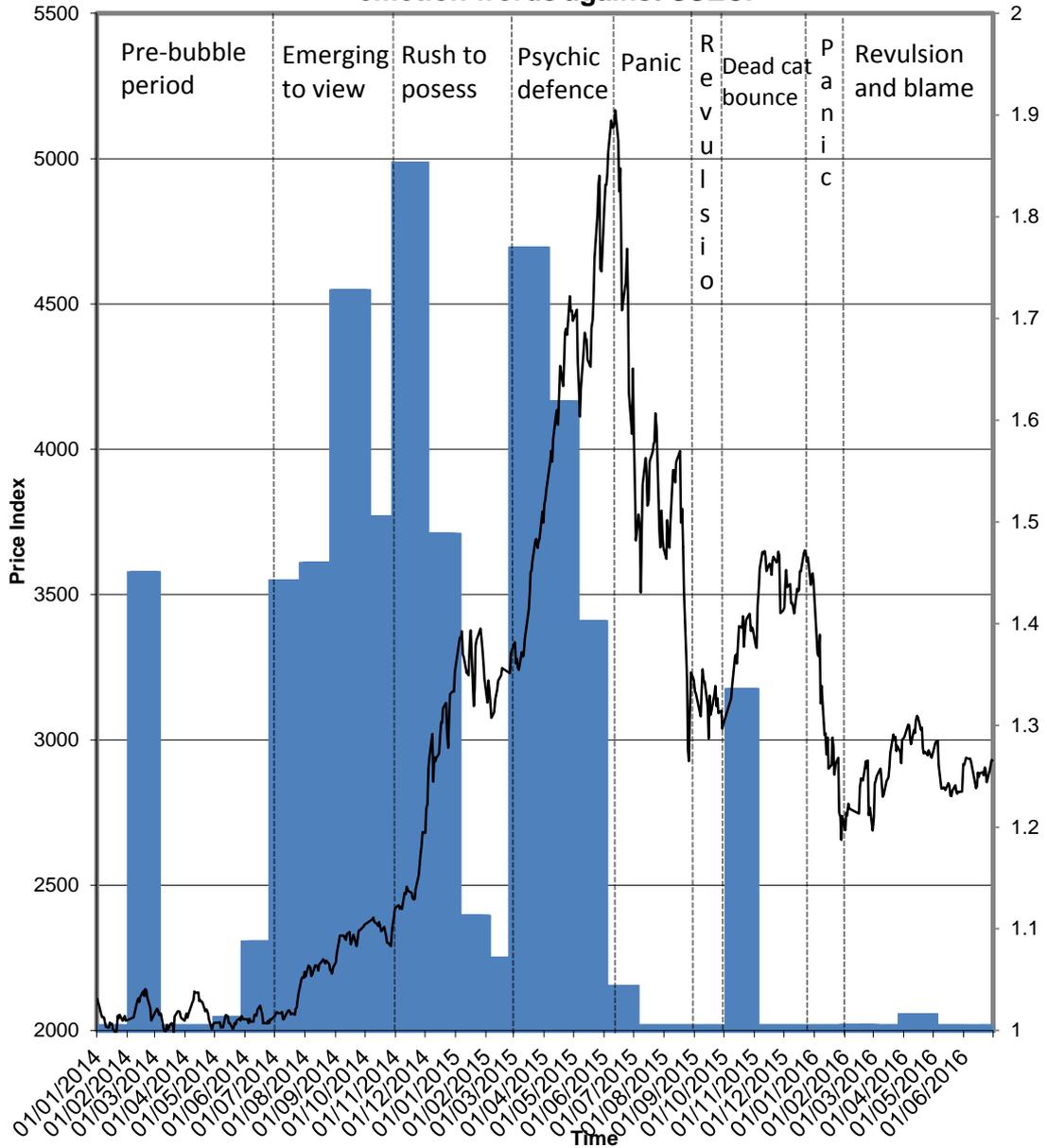
**Figure 2: SSECI vs Excitement and Anxiety**



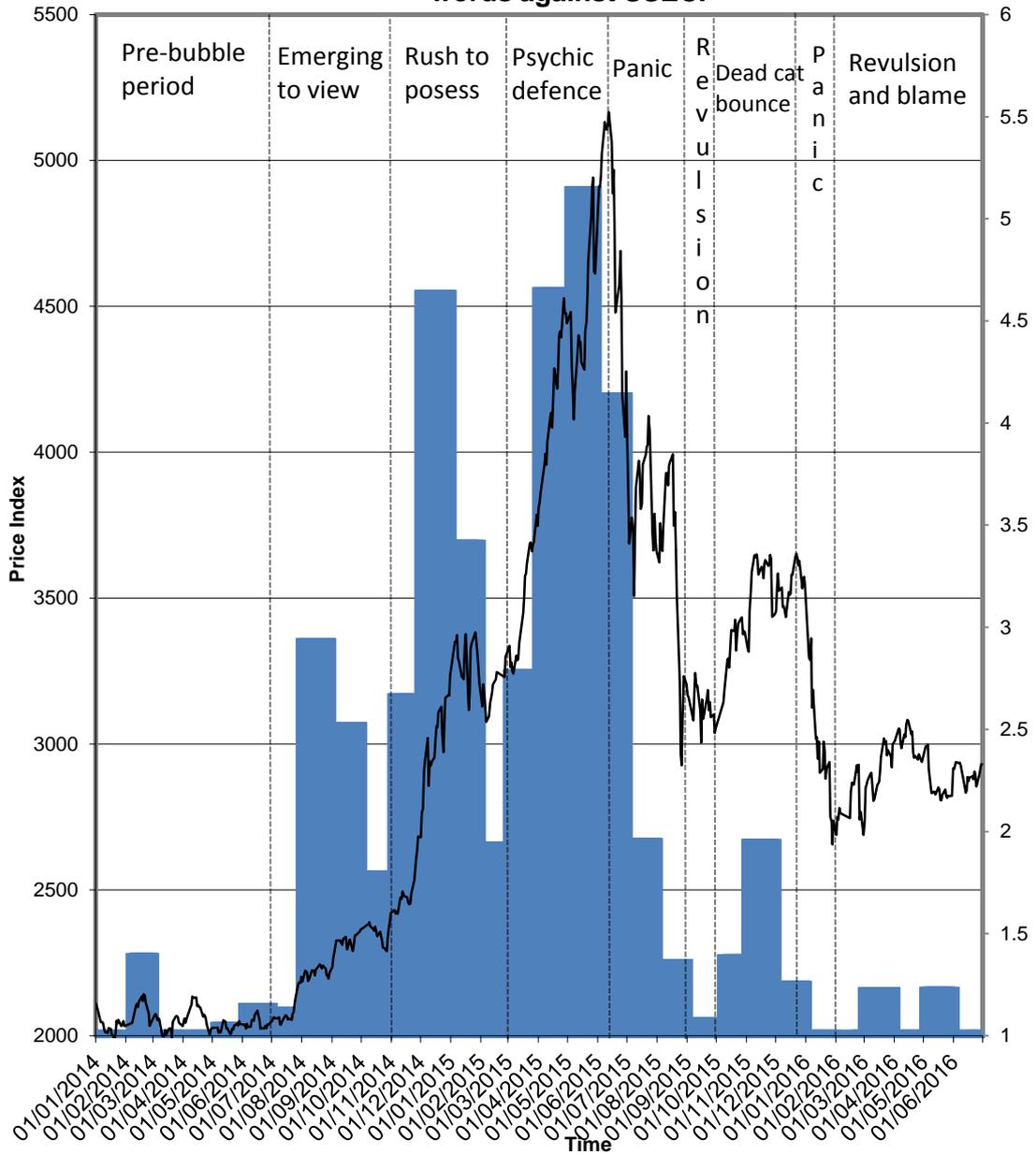
**Figure 3: SSECI vs Mania and Panic**



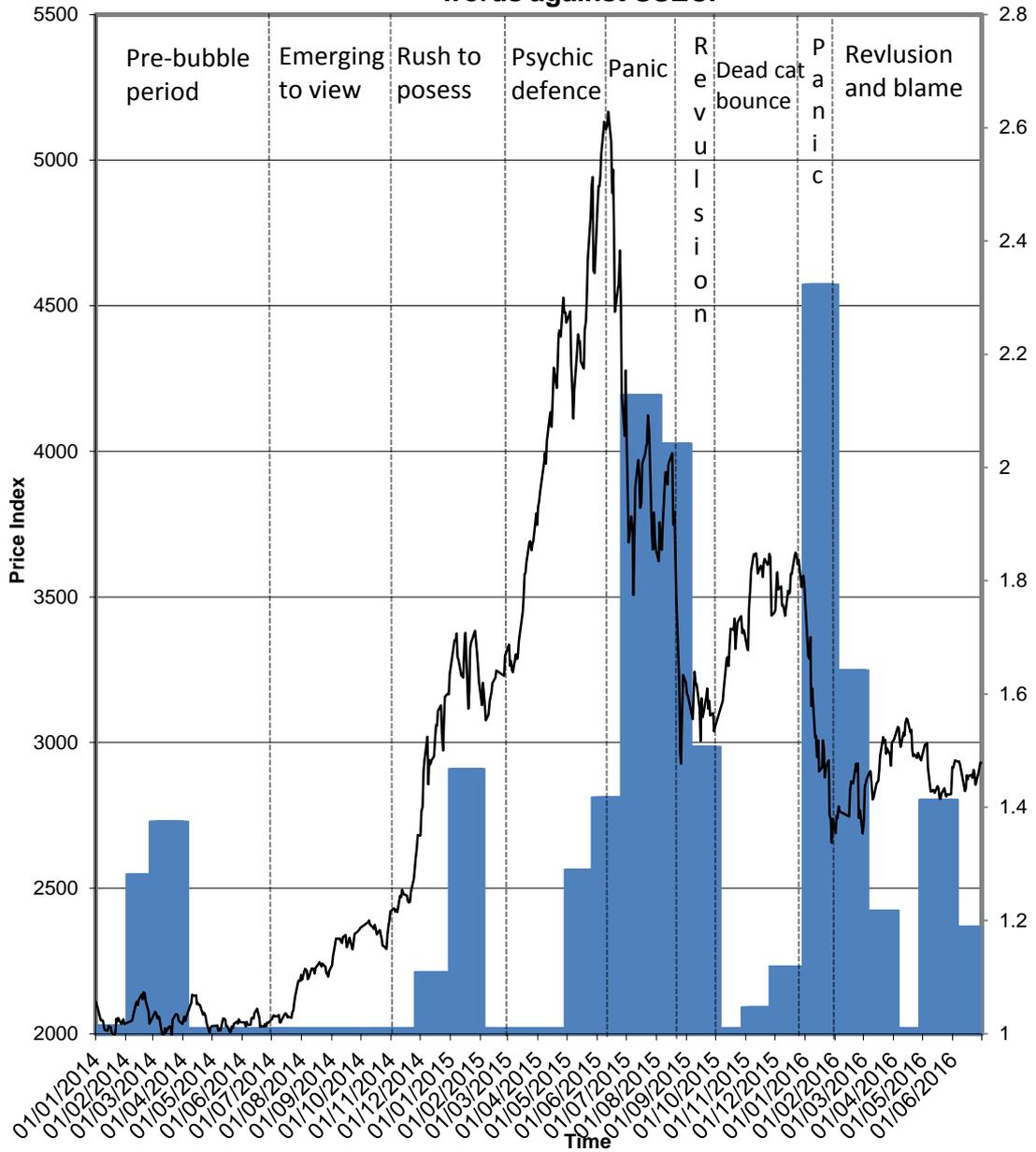
**Figure 4: Standardized frequency of "Excitement" type of emotion words against SSECI**



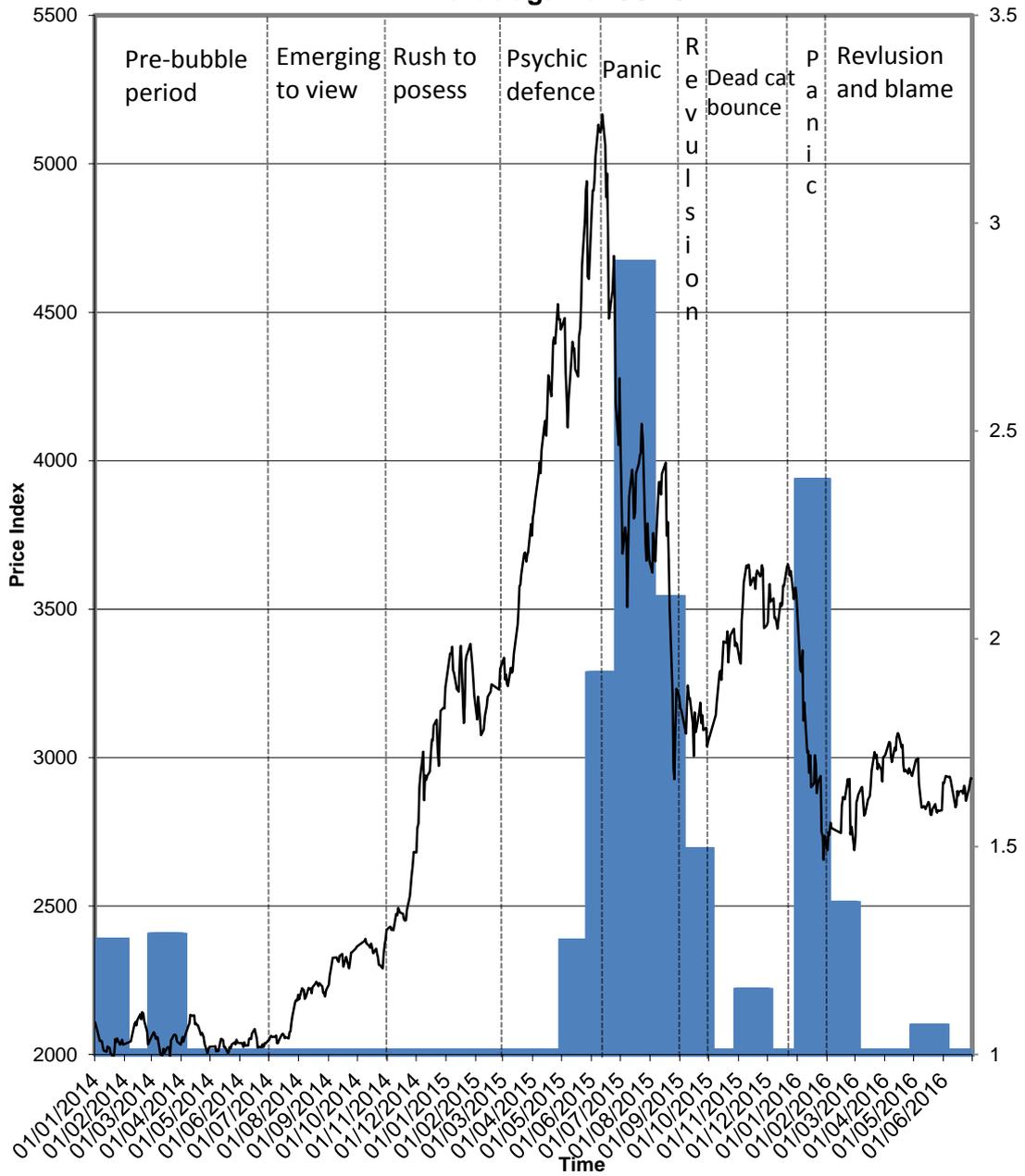
**Figure 5: Standardized frequency of "Mania" type of emotion words against SSECI**



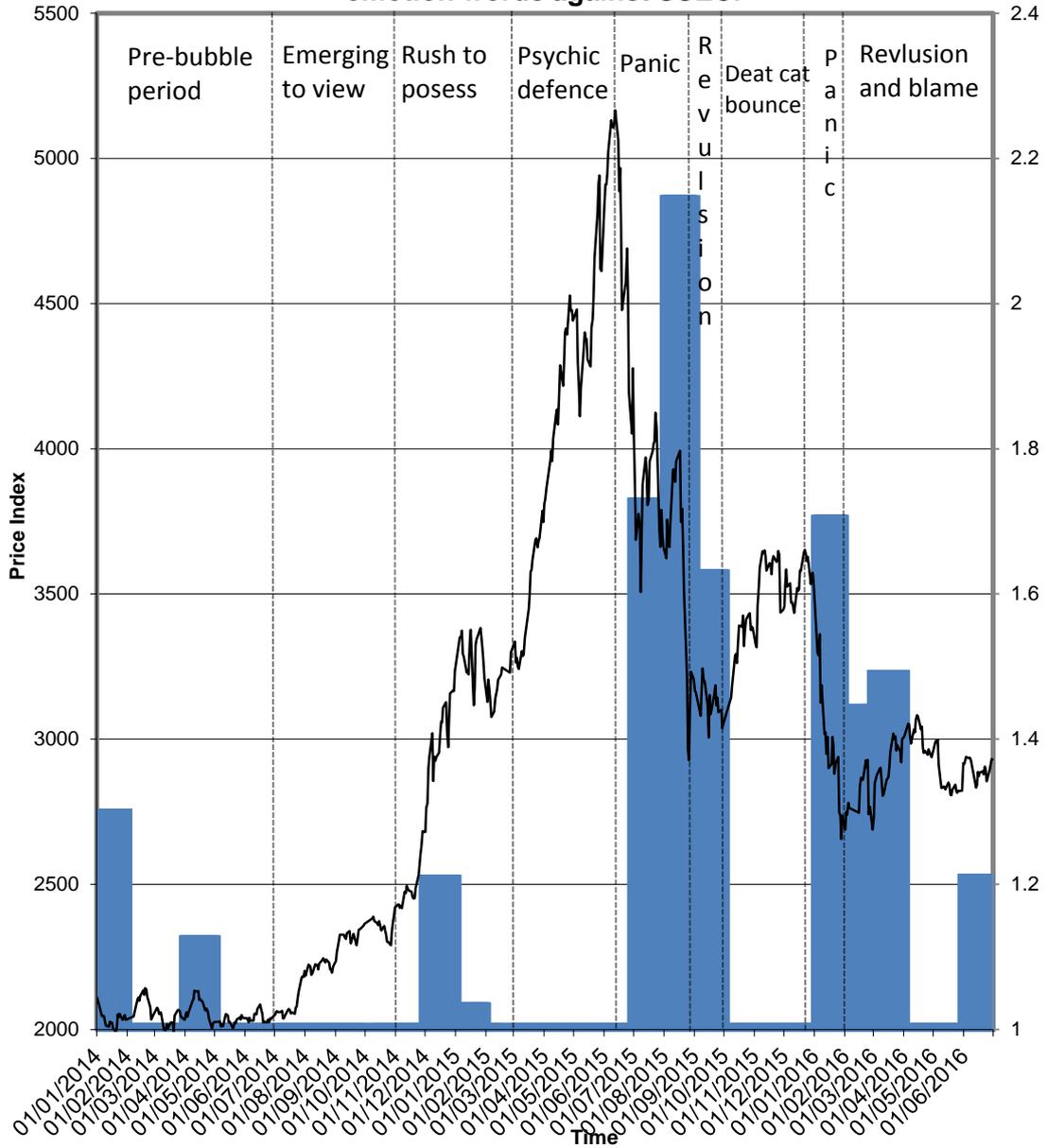
**Figure 6: Standardized frequency of "Anxiety" type of emotion words against SSECI**



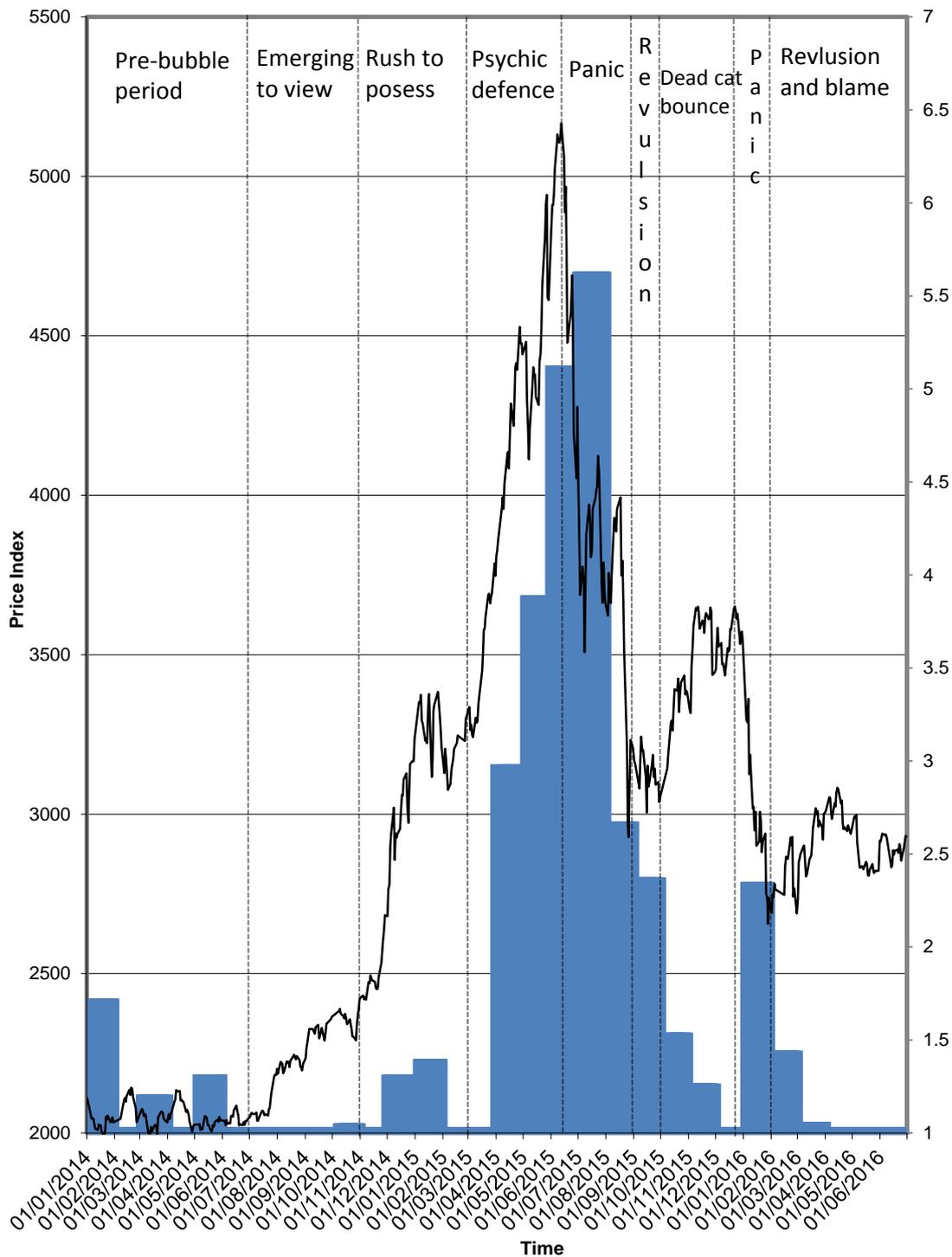
**Figure 7: Standardized frequency of "Panic" type of emotion words against SSECI**



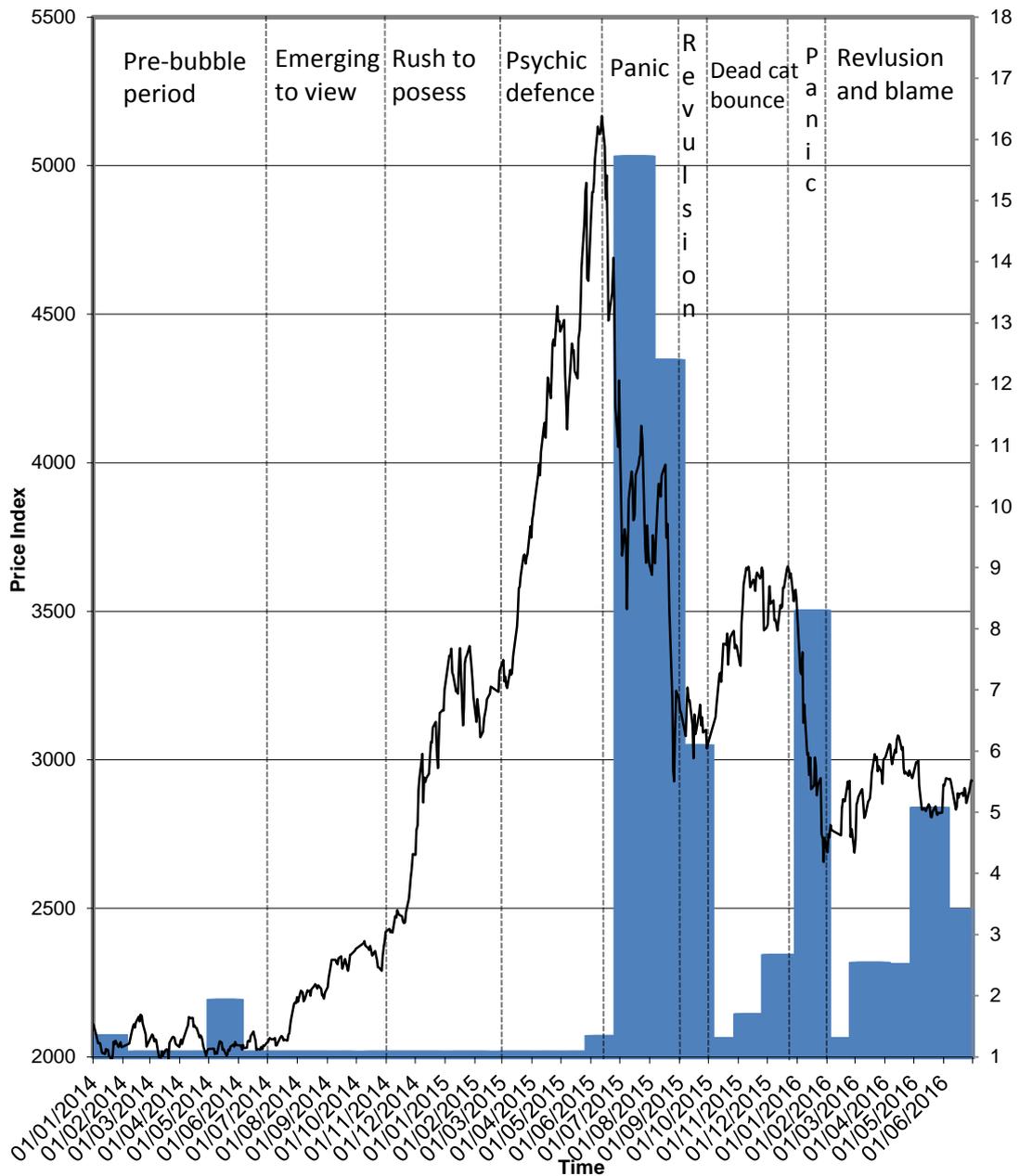
**Figure 8: Standardized frequency of "Revulsion" type of emotion words against SSECI**



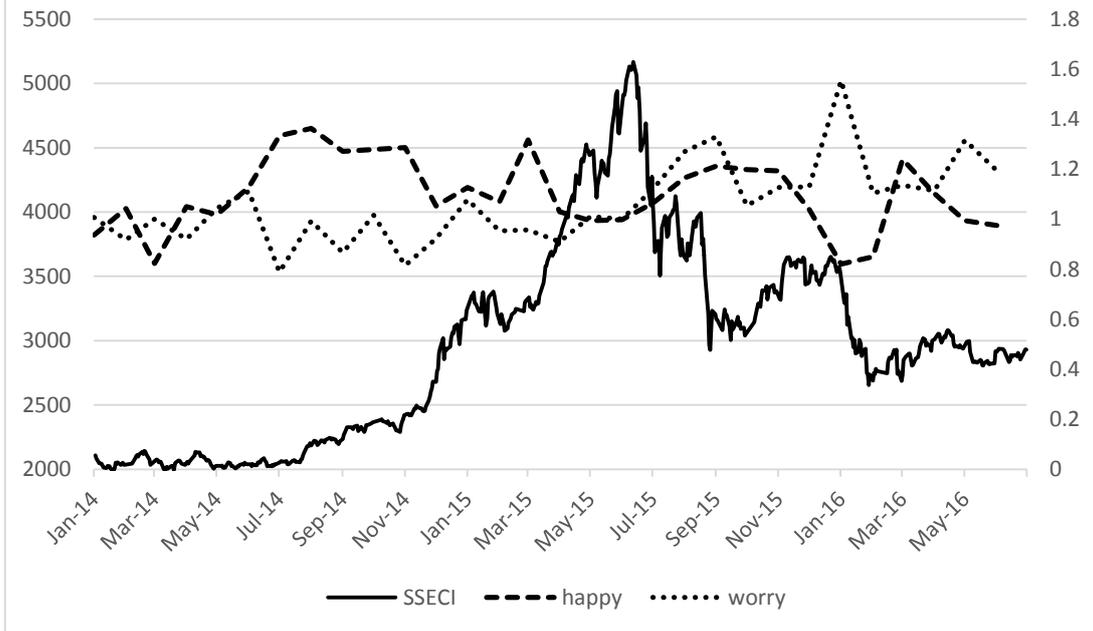
**Figure 9: Standardized frequency of "Bubble" type of emotion words against SSECI**



**Figure 10: Standardized frequency of "Government Intervention" type of emotion words against SSECI**



**Figure 11: Happy vs Worry vs SSECI**



**Figure 12 Actual SSECI Monthly Return vs Predicted SSECI Monthly Return**

