



Investor emotions and market bubbles

Vineet Agarwal¹ · Richard J. Taffler² · Chenyang Wang³

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Abstract

Asset pricing bubbles are highly emotional market episodes. Despite this, investor emotions are not part of traditional bubble models. We measure the powerful affects influencing investor decisions during speculative market bubbles directly employing textual analysis of media narratives and domain-specific emotion keyword dictionaries and show how understanding investor emotional dynamics helps explain market behavior. Specifically, we focus on the two Chinese stock market bubbles of 2005–2008 and 2014–2016; there is no evidence of investor learning from experience. Despite Chinese media being censored we show it still has strong explanatory power although the independent English language media can provide an additional perspective. Deeper emotions dominate more superficial feelings in information content.

Keywords Asset pricing bubbles · Chinese stock market · Economic narratives · Investor emotions · Textual analysis

JEL Classification G12 · G15 · G41

1 Introduction

Extant financial and economic theories find great difficulty in understanding asset pricing bubbles (for summaries of attempts see e.g., the surveys of (Brunnermeier and Oehmke 2013; Scherbina and Schlusche 2014; Jarrow 2015), and are very difficult to test empirically using field data (e.g., Brunnermeier and Oehmke 2013). Even the definition of a bubble is contentious and there is a continuing debate as to whether they actually exist, and are “rational” or “irrational” (O’Hara 2008; Engsted 2016). Conventional characterizations of bubbles variously revolve around ideas of herding, informational cascades and the “greater fool” theory (see Hirshleifer and Hong Teoh, 2003 for an accessible overview). The part played by investor emotions and social and group processes in bubbles is effectively ignored (but *contra* see Shiller 2014; Hirshleifer 2015). In fact, as Hirshleifer (2015)

✉ Vineet Agarwal
Vineet.Agarwal@cranfield.ac.uk

¹ Cranfield School of Management, Cranfield University, Bedford MK43 0AL, UK

² Warwick Business School, University of Warwick, Coventry CV47AL, UK

³ University of Manchester, Oxford Road, Manchester M13 9PL, UK

argues, were this to be formally acknowledged it would “offer a deeper basis for understanding the causes and consequences of financial bubbles and crises”. In this paper, we suggest that complex mathematical models of stylized bubble processes as are prevalent in the literature (e.g., Hirshleifer 2020) can only go some way in explaining speculative bubbles as they do not take into account the highly-charged emotions driving investor behavior which are an integral part of all such market episodes.

Accounts of what actually happens in financial crises and asset pricing bubbles (e.g., Mackay 1852; Galbraith 1993; Cassidy 2002; Tuckett and Taffler 2008; Aliber and Kindleberger 2015; Quinn and Turner 2020; Taffler et al. 2022; Ryan et al. 2023) 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 measure the emotions salient during an asset price bubble and their empirical relationship with the market by examining how the financial media reports on a bubble as it inflates and bursts.

Textual analysis of investment narratives is conducted employing novel keyword dictionaries to measure the wide range of emotions experienced by market participants during a bubble, and their interactions (Loughran and McDonald 2020). Our analysis confirms how investors’ affects¹ are directly associated with market returns and measures of uncertainty.

We work with the Chinese stock market, both because it was subject to two dramatic repeated bubbles only a few years apart, and also because it is retail investor dominated, and thus arguably more influenced by emotions than western capital markets, with individual investors accounting for around 85% of the trading volume during our study period.²

It is also an intrinsically interesting market to study. As Allen et al. (2024) point out despite Chinese GDP growing almost five times between 2000 and 2018 with its economy 23% larger in PPP terms than that of the US, the Chinese stock market has been one of the very worst performers among large equity markets. Importantly, they show conventional rational expectations asset pricing factors cannot explain this market underperformance. Although they suggest several explanations for the paradox, they make no reference to the stock market bubbles during this period we study, and how Chinese investors were caught up in these, as another potential explanatory factor.

This paper explicitly focuses on the two Chinese stock market bubbles of 2005–2008 and 2014–2016. In the first period, the Shanghai Stock Exchange Composite Index (SSECI) increased from 1081 on July 1, 2005 to 6092 on October 16, 2007, a rise of over 460%! It then rapidly collapsed ending 2008 at 1821, a loss of 70% from its high. The second period is also quite dramatic as from January 1, 2014 to June 12, 2015, when the SSECI again peaked, the Chinese market went up by over 140% (with the SSECI rising from 2050 to 5166). It then fell 40% over the following 3½ months to September 28, 2015 (when the SSECI stood at 3083) despite strenuous attempts by the Chinese government to stem the rout. After a small reversal over the following three months, the SSECI fell back to 2929 by the end of June 2016. Figure 1 illustrates the SSECI trajectory between 2005 and 2016. Interestingly, this shows how the second bubble closely resembles the first only a few years later consistent with little learning from the traumatic collapse of the first bubble as investor rationality might have predicted.

¹ In line with standard psychology, we employ the terms affects and emotions synonymously.

² Source: Shanghai Stock Exchange Statistical Yearbook, 2018.

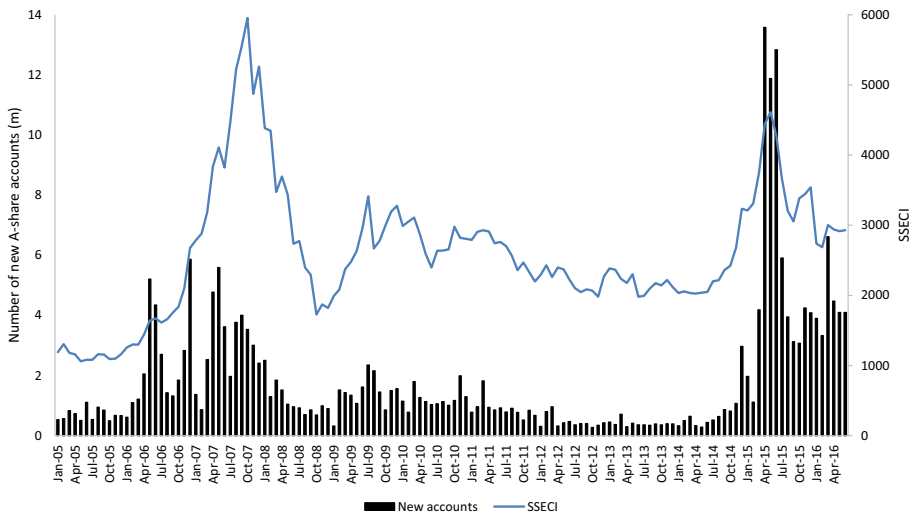


Fig. 1 Shanghai stock exchange composite index (SSECI) and new A-share account openings (January 2005 to June 2016). The number of new accounts opened was replaced by the number of new investors from May 2015 onwards. We scale the data on new investors from July 2015 to June 2016 by the ratio of new accounts to new investors in May and June 2015.

The first contribution of our paper is to demonstrate how it is possible to measure empirically investor emotional states dynamically during asset pricing bubbles. In fact, we find investor emotions are an integral part of market behavior during both our Chinese stock market bubbles being able to explain no less than 68% of market returns, 68% of market volatility, and 66% of trading volume. In addition, deeper emotions, such as excitement and anxiety (e.g., Andrade et al. 2016; Breaban and Noussir 2018; Lim and Kim 2019), subsume the information content of weaker emotions such as feelings of happiness and worry which are arguably more sentient.

Next, following the work of Hillert et al. (2018) on the impact of journalist disagreement on market pricing, and Ding et al. (2018) on the role of censorship in explaining the Chinese foreign share discount puzzle, we show that despite government censorship of Chinese media it still has high explanatory power. There is no evidence such news management can control investor behavior. Chinese and independent western media bubble reports also convey incremental information to each other.

Finally, we explore whether the emotional dynamics of the two Chinese bubbles differ and whether there is any evidence of investor learning from the 2005–2008 bubble in the later period and consequently investors behaving more ‘rationally’. In fact, although, not surprisingly, the relationship between investor emotions and market uncertainty is much stronger in the second bubble, in the case of that between investor emotions and market returns the two bubbles do not differ save for an increase in denial during the later bubble. Investors seemingly ‘did not want to know’ with the emotional characteristics of the two bubbles largely indistinguishable.

Shiller (2019) points out how it is very difficult to disentangle causality between investor emotional states and market movements directly as they are effectively synchronous. This is because affects, which are a characteristic of System 1 thinking, are processed almost instantaneously (Kahneman 2011). Therefore, we would expect investor emotions to be

incorporated very quickly in market prices with no lag. Consequently, this paper focuses on how investor emotions *explain* contemporaneous market behavior. Such understanding is important if we want to enhance our ability to anticipate and manage major economic and market events.

We proceed as follows. The next section lays out our underlying theory and motivation, and in the following one we establish our propositions. Section 4 describes our content analysis emotion keyword dictionary construction, data corpus, and variables, and section 5 our research method. Our results and empirical tests of our main thesis follow in section 6. Our final section discusses the implications of our findings, and the associated conclusions we draw.

2 Theory and motivation

2.1 Bubble psychology

Asset pricing bubbles 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 are inherently emotional in nature (Aliber and Kindleberger 2015; Quinn and Turner 2020). In each case, as Aliber and Kindleberger (2015) point out, initial displacement triggered by a new speculative opportunity leads to euphoria (or mania), denial of the underlying reality (or manic defense) and then, when the bubble bursts, panic followed finally by shame and blame. Throughout this path-dependent trajectory, as Tuckett and Taffler (2008) show in the context of dot.com mania, it is not a question of lack of information about the true nature of the underlying investments, but the way this is collectively ignored. These authors view asset pricing bubbles as due to a disturbance in investors' sense of reality brought about by an exciting new idea that captures the financial imagination. Associated emotional processes allow the exciting bubble asset, Chinese share prices in our case, to be pursued as if 'real' with any associated anxiety repressed. However, eventually reality must intrude, panic takes over and the previously 'loved' bubble asset is now 'hated'.

As the bubble rises to its peak, market participants unconsciously collude in a fight against the impossible valuations including recourse to the superficially plausible cover story that "this time it is different" (Aliber and Kindleberger 2015). Sceptical commentators felt to be denying the value of the transformational investment 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). Importantly, observation of actual bubbles demonstrates how only when it is no longer possible to avoid underlying reality does the bubble eventually burst. The whole process then goes into reverse with investors in a head-long panic to rid themselves of the now tainted asset. Anger and blame of others rather than feelings of personal guilt erupt allowing investors to avoid the distressing realisation of how they have been caught up willingly in what turns out only to be exciting and ultimately very expensive wishful thinking. Psychologically, anxiety changes into even more painful feelings of loss, humiliation, and guilt, even if not directly acknowledged. Strong emotions, often unconscious and shared, are integral components of bubbles.

2.2 The role of the media

The role played by the media in asset pricing bubbles is key. It disseminates value-relevant information to market participants, and as Gamson et al. (1992) point out, provides at least superficially plausible explanations for market behavior. Investors, as readers/audiences, understand financial markets through the lens of the media; hence their emotions are influenced by the media (e.g., Kury 2014) and media stories help drive their investment decisions in the way they report on market events (Engelberg and Parsons 2011; Tetlock 2011; Dougal et al. 2012; Peress 2014; Hillert et al. 2018; Adämmer and Schüssler 2020; Call et al. 2022). Therefore, in this paper we utilize news reports, comments, opinions and press releases published in the media about the Chinese stock market to provide the popular investment narratives we work with. These allow a lens into the different emotions of investors and their associated investment decisions as the dynamic of a bubble evolves through its different stages.

Chinese media is mainly state owned and tightly controlled by the government ensuring only news and opinions favorable to it are disseminated.³ However, as most Chinese investors do not have access to independent news sources their investment decisions will depend on local media stories. Thus, we mainly work with censored Chinese language media in this paper although also exploring whether the independent non-Chinese English-language media reports in different ways. Specifically, we conduct formal content analysis of Chinese and western media reports on the Chinese stock market using eight emotion key word dictionaries in both Chinese and English to measure the emotional state of investors in the Chinese market over time, and its relationship with market returns, volatility, and trading volume.

2.3 Bubble narratives

It is always difficult to identify the start of an asset pricing bubble and what changes investors' feelings about a market. In the case of the 2005–2008 Chinese stock market bubble, after a period of stagnation following the collapse in prices post the internet bubble, government policy changes towards the market rekindled the interest of investors. The Shanghai Composite Index (SSECI) gained 7% in the second half of 2005, and then shot up 44% in the first half of 2006, and a further 60% in the second half to finish the year 130% higher than in 2005. This was accompanied by several large high profile initial public offerings of state-owned enterprises that were heavily oversubscribed. The market continued its inexorable rise with another 43% increase in the first half of 2007 even though concerns about unsustainable prices began to be raised. By the time it reached its peak on 16 October 2007, the SSECI stood 463% higher than its level on 30 June 2005. This bull run seemingly associated with open market reforms was sustained by the belief in strong economic fundamentals underpinning the continuing growth in GDP. However, as concerns about the sub-prime crisis in the US and its impact on the Chinese economy started to increase, prices began to collapse. In just over 6 weeks to the end of November 2007, the SSECI fell by over 20%. By the end of June 2008, it was down 55%, finishing 2008 70% below its peak. The trajectory and emotions during this

³ See Ding et al. (2018) for a full discussion of these issues and how such censorship of Chinese media can help explain the Chinese A-B share discount puzzle.

period were very similar to those in the US during the internet bubble (Tuckett and Taffler 2008). Taffler et al. (2022) provide a detailed description of what happened during the 2005–2008 Chinese stock market bubble.

However, investors did not seem to learn from this previous bubble only a very few years earlier. Optimism was back with perceptions changing significantly beginning in July 2014. In an exact replay of the previous bubble, the SSECI was up no less than 40% in the second half of the year, there was a fivefold increase in market activity, and new investment accounts opened rose from only 450,000 in June to over three million in December as Fig. 1 illustrates.

A wide range of stories in the media appeared to be associated with the dramatic change in investor emotional attitude towards the market. These included such things as: the change in Chinese government policy connected with an ambitious reform agenda to give market forces a “decisive role” in the Chinese economy, the mooted opening of the Shanghai-Hong Kong Stock Connect link which would open the Shanghai market to an influx of Hong Kong and foreign investors, speculation about the likelihood of MSCI introducing Chinese stocks into its emerging markets index in 2015, President Xi’s new Belt and Road initiative to construct a modern “Silk Road” by funding infrastructure worldwide designed, *inter alia*, to turn China into a high-income economic powerhouse, the Chinese government’s intention to end its low interest rate regime, and the fall in the Chinese housing market making it relatively more attractive to speculate in the stock market. Alibaba also floated on the NYSE in September 2014, the largest US IPO in history, with its price increasing over a third in its first day of trading. In addition, the official Chinese media stimulated activity by talking about a bull run and the Shanghai A-share market making history in terms of a turnover world record. It is clearly not possible to disentangle all these different stories regarding their potential relative contribution, however they all seemed to coalesce during the second half of 2014 in an “epidemic of narratives” (Shiller 2019) that reflected and were reflected in Chinese investor perceptions and behavior.

Nonetheless, some media stories by early 2015 were already expressing concerns about the rapid increase in prices and the high levels of margin lending, as well as potential liquidity problems due to the large number of IPOs dampening the market. However, most popular narratives, particularly from March onwards, were all about the bull market and how it was driven by the government’s economic reforms which would ensure the rally kept going. The Communist party’s official mouthpiece *The People’s Daily*, for example, ran a story in March 2015 quoting the chairman of the Chinese Securities Exchange Commission who described the bull market as inevitable and rational. There was even an article in *The People’s Daily* on 21st April headed “4000 only means the start of the bull market” just as the market hit that level, double where it was standing nine months previously. The media was also full of reports about dramatic increases in the prices of individual stocks and human-interest stories about the profits particular investors had made for readers to identify with, and how others had sold their houses to invest in the stock market. Media consensus was that the boom would continue, and the Chinese government was there to support it.

On the other hand, particularly as the SSECI was moving towards its peak, other articles argued the bull market was not sustainable, that it was driven by emotion rather than fundamentals, and would inevitably slump as in 2007. Investors were urged not to succumb to

mania and act more rationally. However, these popular narratives were largely ignored as shown by the continuing dramatic rise in the market index and, for example, the 14 million new A-share accounts opened in April 2015 compared with less than half a million at the start of the bubble (see Fig. 1).

The market rapidly rose to its peak on 12 June 2015 standing 2.5 times where it was only 10 months earlier, and then burst dramatically. It is difficult to identify the reasons for the pricking of an asset pricing bubble at a particular point in time when investors realize they are caught up in a frenzy and reality starts to enter, leading to reversal in the market. Narratives in the media reflecting investor panic tended to attribute the stock market collapse to such things as: government action to rein in margin trading to prevent the use of borrowed money to buy shares, the decision by MSCI not to add Chinese stocks to its global benchmarks, China's economic growth rate slowing, currency devaluation, and the easing of regulations on home purchases rekindling a recovery in prices of apartments, the main alternative to investing in stocks. In addition, much was made in hindsight of the fact the market was so high that a drop was inevitable. However, what comes across in all these stories are the emotions of anger, panic and blame.

As the stock market collapsed, popular narratives were about the government's attempts to stabilise the market. These 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.⁴ However, not surprisingly, all these strategies proved to be of no avail in the face of investor hysteria. The government then took action against high profile investors and analysts blaming them for subverting the market leading to public confessions on television.

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. After a brief recovery, the market fell again by no less than 25% again in the month of January 2016 to its lowest level in 14 months. Despite media stories that the actions taken by the government would prevent the market declining further these did not seem to have much impact on investors' continuing state of panic. This was not helped by 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 the pre-set threshold values. The inevitable lack of trust in the Chinese government's ability to engineer any market rebound given how investors had been burnt twice could not be assuaged by any government-engineered popular narrative!

Based on this initial analysis, our general theme that there is a clear empirical relationship between investor emotions and market behavior, at least during asset pricing bubbles, has some potential support. This evidence is also consistent with the idea that investors appear to believe they have been given licence to search for and invest in a unique opportunity to earn exceptional returns during such speculative bubbles. On this basis we suggest that the associated visceral investor passions and antipathies unleashed in this process are a key factor in asset pricing in bubble markets. Our specific hypotheses are tested using our data in the following sections.

⁴ (Chi and Li 2019) describe the market implications and unintended consequences of the Chinese government's bailout policy.

3 Propositions

We set up the following propositions to measure empirically the role played by investor emotions in the two recent Chinese stock market bubbles. We draw on our eight Chinese and English language content analysis keyword dictionaries constructed to measure the following different investor emotions: excitement, mania, anxiety, panic, revulsion & blame, denial, happiness, and worry as motivated and described below.

Our underlying contention is that powerful investor emotions as reflected in popular financial media narratives are an integral part of asset pricing bubbles. Since asset pricing bubbles are usually characterized in terms of returns and uncertainty (volatility, and trading volume) we construct our first two propositions:

P1 Investor emotions are closely associated with stock market returns and uncertainty during asset pricing bubbles.

P2 Strong investor emotions dominate weaker emotions in explaining market returns and uncertainty during stock market bubbles.

We would expect popular narratives in the Chinese media during asset pricing bubbles to differ to those in the English-language press as the Chinese government-controlled and non-censored western media will likely vary in their reporting. In addition, western journalists are less likely to be emotionally involved in Chinese stock market bubbles than local Chinese journalists. This leads to our next proposition:

P3 Local censored media and uncensored western media provide incremental information during Chinese stock market bubbles.

Finally, if investors behave rationally, we expect them to learn from their past errors. If they do, then the relationship between investor emotions and market pricing and volatility will be weaker in the later bubble period than in the earlier one. Specifically:

P4 The relationship between emotions and market dynamics will be weaker in the second bubble as compared to the first bubble.

4 Dictionary construction, data and variables

This section describes our content analysis approach, source data and our main and control variables.

4.1 Selection of emotion word categories

Taffler et al. (2022) explore the salience of various investor emotional states and their dynamic inter-relationships at different stages of the 2005–2008 Chinese stock market bubble by content analyzing contemporary Chinese media reports using emotion keyword dictionaries measuring levels of investor excitement, mania, anxiety, panic, revulsion &

blame, and denial. We work with the same empirically derived set of powerful emotions, and to explore the relative strengths of the different emotions unleashed during stock market bubbles we supplement these with feelings of happiness and worry which are less highly emotionally charged.

4.2 Research corpus

We analyze two sets of articles sourced from the Factiva database. The first consists of those published in Chinese, and hence directly accessible to Chinese investors. These media reports are potentially liable to censorship by the Chinese government. The second set of articles we use are published in English in the western (non-Chinese) media and are hence free from the risk of censorship. The corpus of news stories we work with are those published during our two bubble periods: the 42 months from July 2005 to December 2008, and 30 months from January 2014 to June 2016.

The initial list of articles downloaded 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, to guarantee their relevance we checked all these news reports for appropriateness by looking at their headlines and, if these were not clear enough, by inspection of actual article content. Our goal was to work with up to 200 articles meeting our selection criteria each month in the first period, and 300 in the second. Where the total number of relevant articles for a specific month was less than the target, all were chosen to work with; otherwise, the required number of articles were selected spread equally by date across the whole month. In total, we ended up with an average of 190 (180) articles per month in the first period and 225 (165) per month in the second period for the Chinese (English) language media.⁵

4.3 Construction of keyword emotion dictionaries

Henry and Leone (2016) show that domain-specific wordlists in content analysis perform better than general wordlists, also equal weighting of words is just as successful as more complex weighting procedures. Drawing on the six emotional keyword dictionaries in Taffler et al. (2022) derived from Chinese media reports during the 2005–2008 Chinese stock market bubble, we augment these with a small number of additional words from parallel analysis of 2014–2016 Chinese media reports. In addition, we compile similar dictionaries of words conveying happiness and worry using the same dictionary construction method. Appendix 1 provides the Chinese keyword dictionaries we employ in this paper by emotion keyword category together with English translation.

For our comparative analysis of Chinese media and independent English language media reports on the two Chinese stock market bubbles, we also need to generate parallel English language dictionaries. We construct these drawing on the Harvard IV and Laswell value dictionaries supplemented with the excitement and anxiety words from Strauss (2013). Appendix 2 provides the English language keyword dictionaries we employ for this purpose. In total we work with over 450 Chinese words and over 1,400 English words (including derivatives).

⁵ Average article lengths were respectively 971 (286) Chinese (English) words with material information content for 2005–2008 and 1,228 (416) for 2014–2016.

In our analysis we categorize our eight investor emotion variables into strong emotions (excitement, mania, anxiety, panic, revulsion & blame, and denial), and weak emotions (happiness and worry). In addition, we synthesize two compound variables. These are investor Emotional Utility (EU), measured in terms of the difference between the numbers of excitement and anxiety keywords divided by the total number of excitement and anxiety words, to summarize the tension between the two key conflicting emotions (Kuhnen and Knutson 2011; Andrade et al. 2016; Breaban and Noussair 2018), and HW which represents the equivalent tension between happiness and worry.

4.4 Data analysis and standardization

Wordscount,⁶ a Chinese software package, is used to count the frequency of occurrence of words in each of our eight emotion keyword dictionaries. There are many benefits in using this software. First, it can count the frequency of words in both the Chinese and English languages. Second, 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.

The number of articles and their lengths vary considerably by month making a comparison between word frequencies inappropriate. We therefore scale the word count for each emotion (i) in each month (t) by the total number of words in that month (t).

$$(\text{Standardized } emotion)_{i,t} = \frac{(\text{Total count of all words of emotion})_{i,t}}{\sum (\text{All words in all stories})_t} \quad (1)$$

4.5 Other variables

We test our propositions by exploring the role emotions play during the bubble periods in terms of both market return and market uncertainty. We measure market uncertainty using two proxies, market volatility, and trading volume. Although trading volume is conventionally viewed as a measure of trading activity (e.g., Chordia et al. 2001), or liquidity (e.g., Avramov and Chordia 2006), Banerjee and Kremer (2010) show how disagreement between investors leads to higher volatility as well as increased trading volume. Similarly, Barinov (2014) shows trading volume actually proxies for uncertainty, and Carlin et al. (2014) show how asset pricing disagreements lead to increased return volatility and greater trading volume, although volatility, itself, does not result in higher trading activity save in the case of increased levels of uncertainty/disagreement.

We also control for potential macroeconomic drivers of stock market dynamics – short-term risk-free rate (proxied by one-month repo rate), aggregate dividend yield, term premium (the difference between yield on 10-year and 2-year Chinese government bonds), inflation (% change in the consumer prices index), and real GDP growth rate (see e.g., Boons et al. 2020; Mbanga et al. 2019; Petkova 2006) that have been shown to influence market returns. All the variables are downloaded from LSEG Datastream.

⁶ Available at <http://www.yuneach.com/soft/WordsCount.asp>.

5 Method

In this section we describe our empirical approach.

5.1 The nature of any potential causality

The nature of the relationship between investor emotions and market behavior 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 behavior 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 and synchronous in nature. Similarly, investors will be observing movements in the market, and also responding emotionally to its coverage in the media and this, we hypothesize, will lead to them being sucked into the underlying fantasy even more deeply. In this paper we are interested in the way in which investor emotions reflecting their likely often unconscious assimilation of popular market narratives leads to their trading behavior.

5.2 Regression models

To test our first proposition that market emotional states are closely associated with market returns, and volatility, we run the following OLS regressions:⁷

$$\text{Return}_t = \alpha + \beta_1 \text{Emotion}_t + \beta_2 \text{StDev}_t + \beta_3 \text{Volume}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \quad (2)$$

$$\text{StDev}_t = \alpha + \beta_1 \text{Emotion}_t + \beta_2 \text{Return}_t + \beta_3 \text{Volume}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \quad (3)$$

$$\text{Volume}_t = \alpha + \beta_1 \text{Emotion}_t + \beta_2 \text{Return}_t + \beta_3 \text{StDev}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \quad (4)$$

where: Return_t = return on the SSECi in month t , StDev_t = standard deviation of daily SSECi returns during month t , Volume_t = average daily total value of shares traded divided by end of day market capitalization of the SSECi during month t ,⁸ and Emotion_t = standardized emotions (one of excitement, mania, anxiety, panic, revulsion & blame, denial, happiness, and worry, or one of the two composite variables (EU and HW)) measured during month t .

The composite variable Emotional Utility (EU) represents strong emotions and is constructed using the powerful emotions of excitement and anxiety as $(\text{Excitement} - \text{Anxiety}) / (\text{Excitement} + \text{Anxiety})$, while the composite variable HW capturing weak emotions and is derived as $(\text{Happiness} - \text{Worry}) / (\text{Happiness} + \text{Worry})$.

The control variables are:

Risk-free rate = China 1-month repo rate, Inflation = year-on-year % change in CPI, GDP growth rate = % change in year-on-year real GDP, Dividend yield = aggregate 12-month

⁷ Because of the high correlations between different emotions, we use only one emotion at a time in our regressions.

⁸ We scale dollar trading volume by total market capitalization to control for the impact of price increases or decreases.

dividends divided by the market value of SSECI, and Term premium = the difference between 10-years and 2-year government bond rates.

To test our second proposition that powerful emotions dominate weak emotions, we run regressions using our individual emotions as well as the two composite variables.

We then run different specifications of the following OLS regressions:

$$\text{Return}_t = \alpha + \beta_1 \text{Emotion}_{\text{Strong},t} + \beta_2 \text{Emotion}_{\text{Weak},t} + \beta_3 \text{StDev}_t + \beta_4 \text{Volume}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \quad (5)$$

$$\text{StDev}_t = \alpha + \beta_1 \text{Emotion}_{\text{Strong},t} + \beta_2 \text{Emotion}_{\text{Weak},t} + \beta_3 \text{Return}_t + \beta_4 \text{Volume}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \quad (6)$$

$$\text{Volume}_t = \alpha + \beta_1 \text{Emotion}_{\text{Strong},t} + \beta_2 \text{Emotion}_{\text{Weak},t} + \beta_3 \text{Return}_t + \beta_4 \text{StDev}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \quad (7)$$

where $\text{Emotion}_{\text{Strong}}$ = Excitement, Anxiety or EU, $\text{Emotion}_{\text{Weak}}$ = Happy, Worry or HW, and the other variables are as defined previously.

We test our third proposition that the Chinese and independent (western) media report differently by running the following regressions with our emotions measured using both Chinese language media and English language media together:

$$\begin{aligned} \text{Panel A : } \text{Return}_t = & \alpha + \beta_1 \text{Emotion}_{\text{Ch},t} + \beta_2 \text{Emotion}_{\text{Eng},t} \\ & + \beta_3 \text{StDev}_t + \beta_4 \text{Volume}_t + \sum (\gamma_i \text{Control}_{i,t}) + \varepsilon_t \end{aligned} \quad (8)$$

$$\begin{aligned} \text{Panel B : } \text{StDev}_t = & \alpha + \beta_1 \text{Emotion}_{\text{Ch},t} + \beta_2 \text{Emotion}_{\text{Eng},t} \\ & + \beta_3 \text{Return}_t + \beta_4 \text{Volume}_t + \sum (\gamma_i \text{Control}_{i,t}) + \varepsilon_t \end{aligned} \quad (9)$$

$$\text{Volume}_t = \alpha + \beta_1 \text{Emotion}_{\text{Ch},t} + \beta_2 \text{Emotion}_{\text{Eng},t} + \beta_3 \text{Return}_t + \beta_4 \text{StDev}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \quad (10)$$

where $\text{Emotion}_{\text{Ch}}$ = One of the eight emotions or the composite variables measured using Chinese media, $\text{Emotion}_{\text{En}}$ = One of the eight emotions or the composite variables measured using English media, and all other variables are as defined previously.

Finally, to test our last proposition that the relationship between emotions and market dynamics will be weaker in the second bubble as compared to the first bubble because of investor learning we run the following OLS regressions:

$$\begin{aligned} \text{Return}_t = & \alpha + \beta_1 \text{Period} + \beta_2 \text{Emotion}_t + \beta_2 (\text{Emotion}_t * \text{Period}) \\ & + \beta_4 \text{StDev}_t + \beta_5 \text{Volume}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \end{aligned} \quad (11)$$

$$\begin{aligned} \text{StDev}_t = & \alpha + \beta_1 \text{Period} + \beta_2 \text{Emotion}_t + \beta_3 (\text{Emotion}_t * \text{Period}) \\ & + \beta_4 \text{Return}_t + \beta_5 \text{Volume}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \end{aligned} \quad (12)$$

$$\begin{aligned} \text{Volume}_t = & \alpha + \beta_1 \text{Period} + \beta_2 \text{Emotion}_t + \beta_2 (\text{Emotion}_t * \text{Period}) \\ & + \beta_4 \text{Return}_t + \beta_5 \text{StDev}_t + \sum \gamma_i \text{Control}_{i,t} + \varepsilon_t \end{aligned} \quad (13)$$

where: Period = a dummy variable that takes a value of 0 in the first period (July 2005 to December 2008) and 1 in the second period (January 2014 to June 2016). All other variables are as defined previously.

6 Results

This section explores how investor emotions, stock returns, volatility, and trading volume are directly linked. *Inter alia*, we show it is possible to measure empirically the dynamic interplay of powerful emotions, and their relationship with market dynamics. In the first sub-section we conduct an initial analysis to examine our underlying thesis before examining our propositions in subsequent sub-sections.

6.1 Overview

Figure 1 reports new A-share account openings on a monthly basis from January 2005 to June 2016.⁹ As can be seen, the highly excited market state during the two bubbles we explore is well illustrated with new account openings going from 0.9 million in 2005 to 3.1 million in 2006, then increasing dramatically to 37.5 million in 2007 as the market reached its peak, before falling back to 1.4 million in 2008. A similar pattern is observed in the second bubble when the number of new accounts jumps from 4.9m in 2013 to 9.4m in 2014 and then to no less than 45.6m in the first six months of 2015.¹⁰ The pattern is consistent with investors in a frenzy rushing to start trading in A-shares as the market reaches its peak, followed by a dramatic collapse in the number of new accounts opened when the bubble bursts.

The individual correlations between different emotions with each other and market dynamics help us explore our general proposition further. Table 1 shows all three ‘excitement-generating’ emotions (excitement, mania, and happiness) are positively associated with concurrent month returns ($r = 0.68, 0.30$, and 0.23 respectively). While mania is positively correlated with same month volatility ($r = 0.21$), both excitement and happiness have a negative correlation with it ($r = -0.27$ and -0.28 respectively). Mania is also positively correlated with trading volume (0.81). In parallel, the table also shows that ‘anxiety-generating’ emotions (anxiety, panic, revulsion & blame, denial, and worry) are positively correlated with each other. However, they are negatively associated with exciting emotions (except for a positive correlation between mania and denial ($r = 0.31$) reflecting how denial is an integral part of a manic state of mind (hence ‘manic denial’ in common parlance). Anxiety-generating emotions are also negatively correlated with contemporaneous returns (ranging from $r = -0.33$ for denial to -0.66 for worry), and have particularly high positive correlations with volatility ($r = 0.39$ for worry to 0.75 for anxiety). On the other hand, the association between anxiety-generating emotions and trading volume is statistically not significant. Finally, the composite variable that proxies for strong emotions (EU) is much

⁹ Source: *Annual China Securities Registration and Settlement Statistical Yearbook* published by the China Securities Depository and Clearing Ltd. Corporation.

¹⁰ The number of new accounts opened was replaced by the number of new investors from May 2015 onwards with overlapping data available for May and June 2015. For continuity in our time series of new account openings, we scale the data on new investors from July 2015 to June 2016 by the ratio of new accounts to new investors in May and June 2015.

Table 1 Correlation matrix: Chinese media emotions, returns, and uncertainty

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Excitement	1											
(2) Mania	0.09	1										
(3) Anxiety	-0.27**	-0.07	1									
(4) Panic	-0.61***	-0.07	0.65***	1								
(5) Revulsion	-0.69***	-0.05	0.53***	0.74***	1							
(6) Denial	-0.19	0.31***	0.68***	0.49***	0.44***	1						
(7) Happiness	-0.04	0.11	-0.56***	-0.11	-0.03	-0.39***	1					
(8) Worry	-0.58***	-0.27**	0.60***	0.47***	0.53***	0.30***	-0.28**	1				
(9) EU	0.81***	0.15	-0.74***	-0.82***	-0.79***	-0.49***	0.31***	-0.73***	1			
(10) HW	0.36***	0.24**	-0.73***	-0.36***	-0.36***	-0.45***	0.78***	-0.81***	0.65***	1		
(11) Return _t	0.68***	0.30**	-0.60***	-0.65***	-0.57***	-0.33***	0.23**	-0.66***	0.80***	0.57***	1	
(12) Sidev _t	-0.27**	0.21*	0.75***	0.67***	0.55***	0.69***	-0.28**	0.39***	-0.63***	-0.41***	-0.41***	1
(13) Volume _t	0.04	0.81***	0.07	0.04	0.10	0.35***	0.11	-0.15	0.02	0.16	0.24**	0.27**

The correlations are between the normalized emotions estimated over the month using Chinese language media, the monthly returns on the SSECI (Return), the monthly standard deviation of the returns on the SSECI (Sidev), and the average of the daily total value of shares traded divided by end of day market capitalization of the SSECI (Volume). EU is the emotional utility defined as (Excitement - Anxiety)/(Excitement + Anxiety), and HW is defined as (Happiness - Worry)/(Happiness + Worry). The standard deviation of returns for a month (Sidev) is estimated using the daily returns on the index during that month. The data covers the two bubble periods: July 2005 to December 2008, and January 2014 to June 2016.

*, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Table 2 Emotions during up and down phases of the bubble periods

Emotion	Up	Down	Difference	t
Excitement	0.73	0.36	0.37	(8.38)
Mania	0.25	0.20	0.05	(1.63)
Anxiety	0.38	0.50	-0.12	(-3.82)
Panic	0.27	0.51	-0.23	(-5.63)
Revulsion	0.04	0.07	-0.03	(-6.04)
Denial	0.07	0.12	-0.05	(-2.85)
Happiness	2.30	2.24	0.06	(0.76)
Worry	1.40	1.66	-0.25	(-5.44)
EU	0.29	-0.15	0.44	(8.78)
HW	0.24	0.15	0.09	(3.67)

The table reports the level of emotions in the up and down phases of the bubbles. The up-phases of the bubble periods are from July-2005 to October-2007 and from January-2014 to May-2015. The down-phases are from November-2007 to December-2008 and from June-2015 to June-2016. $Emotion_t$ is standardized value of one of the eight emotions or the two composite variables (EU and HW) estimated during month t using Chinese media. EU is the emotional utility defined as $(Excitement - Anxiety)/(Excitement + Anxiety)$, and HW is defined as $(Happiness - Worry)/(Happiness + Worry)$. The t-statistics are for the two-sample test of difference.

more highly correlated with both contemporaneous returns ($r = 0.80$) and volatility ($r = -0.63$) as compared to the composite variable that proxies for weaker emotions (HW) ($r = 0.57$ and -0.41). Neither has a significant correlation with trading volume.

Our correlation matrix in Table 1 thus shows it is possible to measure salient investor emotions empirically by textually analyzing media narratives. Table 1 also provides preliminary evidence in support of our general argument that investor emotional states are closely associated with market returns and uncertainty.

6.2 Are market emotions related to market dynamics?

Table 2 measures investor emotions in the up and down phases of our two bubbles. It shows that excitement is twice as high in the up phase of a bubble than when it collapses whereas all five anxiety-generating emotions are much more pronounced when the bubble deflates. This again is what we would expect if media stories reflect investor emotions.

Table 3 presents the results of regression models (2)–(4). Column 1 shows that excitement and happiness have a strong positive association with returns while all the anxiety-generating emotions are negatively and strongly associated with returns. The two composite variables (EU and HW) also have a strong positive relationship with contemporaneous returns. The greater the levels of investor excitement and the lower the levels of anxiety, the higher the contemporaneous returns, whereas the greater the anxiety and the weaker the excitement, the lower the returns during the month.

Column 3 shows that none of the excitement-generating emotions (excitement, mania nor happiness) have a significant relationship with volatility, while the anxiety-generating emotions (except worry) are all strongly and positively associated with it. The column also highlights the strong negative relationship between the composite variable for strong emotions (EU) and volatility, although the composite variable for weak emotions (HW) has no

Table 3 Investor emotions and market behavior

Dependent variable	Return (1)	Adj R ² (2)	StDev (3)	Adj R ² (4)	Volume (5)	Adj R ² (6)
Strong emotions						
Excitement	24.46 (5.95)	0.59	-0.82 (-0.40)	0.59	2.12 (0.86)	0.67
Mania	19.85 (1.71)	0.39	2.34 (0.61)	0.59	18.45 (6.70)	0.80
Anxiety	-52.90 (-5.90)	0.59	14.91 (4.47)	0.69	8.68 (1.68)	0.68
Panic	-35.50 (-3.46)	0.47	14.69 (5.95)	0.74	3.39 (0.72)	0.67
Revulsion	-140.80 (-2.29)	0.42	73.67 (4.77)	0.70	-24.05 (-0.95)	0.67
Denial	-48.68 (-2.82)	0.44	13.10 (2.32)	0.62	22.09 (3.50)	0.72
Weak emotions						
Happiness	11.83 (3.26)	0.46	1.37 (1.04)	0.60	0.34 (0.21)	0.66
Worry	-24.51 (-5.88)	0.59	-0.20 (-0.10)	0.59	-2.29 (-0.93)	0.67
Composite						
EU	29.51 (8.01)	0.69	-6.94 (-3.55)	0.66	1.69 (0.59)	0.67
HW	52.12 (6.16)	0.61	3.91 (0.93)	0.59	2.09 (0.40)	0.66

The table reports the results of OLS regressions using investor emotions derived from the Chinese media: $Return_t = \alpha + \beta_1 Emotion_t + \beta_2 StDev_t + \beta_3 Volume_t + \sum \gamma_i Control_{i,t} + \epsilon_t$ (2) $StDev_t = \alpha + \beta_1 Emotion_t + \beta_2 Return_t + \beta_3 Volume_t + \sum \gamma_i Control_{i,t} + \epsilon_t$ (3) $Volume_t = \alpha + \beta_1 Emotion_t + \beta_2 Return_t + \beta_3 StDev_t + \sum \gamma_i Control_{i,t} + \epsilon_t$ (4) $Return_t$ is the return on SSECI during month t , $StDev_t$ is the standard deviation of daily stock returns during month t , and $Volume_t$ is the average of the daily total value of shares traded divided by end of day market capitalization of the SSECI during month t . $Emotion_t$ is standardized value of one of the eight emotions or the two composite variables (EU and HW) estimated during month t using Chinese media. EU is the emotional utility defined as $(Excitement - Anxiety)/(Excitement + Anxiety)$, and HW is defined as $(Happiness - Worry)/(Happiness + Worry)$. Control variables are risk-free rate (China 1-month repo rate), inflation (year-on-year % change in CPI), GDP growth rate (% change in year-on-year real GDP), dividend yield on SSECI, and term premium (difference between 10-years and 2-year government bond rates). Figures in parenthesis are the t -statistics. The data covers the two bubble periods: July 2005 to December 2008, and January 2014 to June 2016. For ease of exposition, the table only reports the coefficients on the Emotion variables.

explanatory power. It seems as if anxiety-related emotions are associated with higher levels of investor disagreement and thus greater market volatility.

Finally, column 5 provides a mixed picture for trading volume. While mania and denial both have a positive and highly significant association with trading volume, that with other emotions is statistically insignificant. As psychologists point out denial is an integral part of mania (as in 'manic denial') and, in fact, correlated with it in our data ($r=0.31$) so their joint association with trading levels is not surprising.

Table 4 Do powerful emotions dominate weak ones?

	Return (eq. 5)		SD (eq. 6)		Turnover (eq. 7)	
	(1)	(2)	(3)	(4)	(5)	(6)
α	14.05	(1.45)	4.94	(1.34)	21.45	(4.53)
β_1	24.30	(4.22)	-10.53	(-5.06)	1.56	(0.43)
β_2	13.85	(1.18)	14.31	(3.47)	0.37	(0.06)
β_3	-0.27	(-0.82)	-0.04	(-0.82)	0.08	(1.21)
β_4	0.27	(1.21)	0.25	(3.17)	0.55	(3.17)
Adj R ²	0.69		0.71		0.66	

The table reports the results of OLS regressions using composite investor emotions derived from the Chinese media. $Return_t$ is the return on SSECI during month t , $StDev_t$ is the standard deviation of returns on SSECI during month t , and $Volume_t$ is the average of the daily total value of shares traded divided by end of day market capitalization of the SSECI during month t . EU is the composite variable measuring strong emotions defined as $(Excitement - Anxiety) / (Excitement + Anxiety)$, and HW is the composite variable measuring weak emotions defined as $(Happiness - Worry) / (Happiness + Worry)$. Control variables are risk-free rate (China 1-month repo rate), inflation (year-on-year % change in CPI), GDP growth rate (% change in year-on-year real GDP), dividend yield on SSECI, and term premium (difference between 10-years and 2-year government bond rates). Figures in parenthesis are the t-statistics. The data covers the two bubble periods: July 2005 to December 2008, and January 2014 to June 2016. Coefficients on control variables are not reported for ease of exposition. $Return_t = \alpha + \beta_1 Emotion_{Strong,t} + \beta_2 Emotion_{Weak,t} + \beta_3 StDev_t + \beta_4 Volume_t + \sum \gamma_i Control_{i,t} + \varepsilon_t$ (5)

$StDev_t = \alpha + \beta_1 Emotion_{Strong,t} + \beta_2 Emotion_{Weak,t} + \beta_3 Return_t + \beta_4 Volume_t + \sum \gamma_i Control_{i,t} + \varepsilon_t$ (6)

$Volume_t = \alpha + \beta_1 Emotion_{Strong,t} + \beta_2 Emotion_{Weak,t} + \beta_3 Return_t + \beta_4 StDev_t + \sum \gamma_i Control_{i,t} + \varepsilon_t$ (7)

In summary, Table 3 shows that our investor emotions measures are directly reflected in, and reflected by, market prices: excitement-generating emotions are associated with higher returns, and anxiety-generating emotions with lower returns. Similarly, greater volatility is associated with anxiety-generating emotions. The table also shows more powerful emotions have a much stronger relationship with market behavior than weaker emotions. While the picture is less clear for trading volume perhaps, not surprisingly, both mania and denial have a very strong positive relationship with trading activity. Overall, the evidence in both Tables 2 and 3 is consistent with our first proposition: Chinese stock market dynamics and investor emotions are closely associated during the market bubbles we examine.¹¹ In fact, if we regress our return and uncertainty measures against all eight emotion variables taken together, we find they explain no less than 68% of contemporaneous market returns, 68% of its volatility and 66% of its trading volume.¹²

¹¹ For robustness purposes, we run regression models (2) to (4) with (i) natural logarithmic transforms, and (ii) first differences of all our variables. Results are very similar to those presented in Table 3 and demonstrate the underlying relationships between market emotions and market dynamics are robust. The respective tables are available from the authors.

¹² We run the following OLS regression: $Y_t = \alpha + \sum (\beta_n Emotion_{n,t}) + \varepsilon_t$ where Y_t is either $Return_t$ (return on the SSECI in month t), $Stdev_t$ (standard deviation of daily SSECI returns during month t), or $Volume_t$ (average daily total value of shares traded divided by end of day market capitalization of the SSECI during month t), and $Emotion_{n,t}$ is the standardized emotion (one of excitement, mania, anxiety, panic, revulsion & blame, denial, happiness, and worry) measured during month t .

6.3 Do strong emotions dominate weak emotions?

Next, we explore our second proposition – do weak emotion words such as happiness and worry have the same ability to explain market behavior as our strong emotion words excitement and anxiety? Columns 1 and 2 in Table 4 show that the composite variable EU, our proxy for strong emotions, subsumes the information about contemporaneous returns in HW, the composite variable proxying for weak emotions ($\beta_1 = 24.30$; $t = 4.22$; $\beta_2 = 13.85$; $t = 1.18$).

In the case of volatility, columns 3 and 4 in Table 4 show that our proxy for stronger emotions (EU) has a strong negative relationship with volatility ($\beta_1 = -10.53$; $t = -5.06$) whereas, in contrast, our weaker emotions proxy (HW) appears to have a strong positive relationship with it ($\beta_2 = 14.31$; $t = 3.47$). However, this latter which has a counterintuitive sign is likely due to the high multicollinearity between the two measures ($r=0.65$) suggesting, again, EU dominates HW. Finally, columns 5 and 6 of panel C show neither of the two proxies have a significant relationship with trading volume.

As such, we find evidence consistent with our expectation that more powerful investor emotions will dominate weaker ones in terms of their relationship with market returns during asset pricing bubbles.

6.4 Does Chinese media reporting differ to that of the independent western financial press?

When we replicate our main analysis in Tables 1, 2, 3, 4 employing the parallel English language keyword dictionaries, results are very similar and thus not reported here. Unabridged analysis also shows that investor emotions as manifest in the Chinese and western media are correlated in most cases confirming Chinese investor emotions are being reflected similarly in both Chinese and western media sources.¹³ Market participants and financial journalists seem equally to become caught up emotionally in asset pricing bubbles even when these events take place in a different market thousands of miles away, and there are no censorship issues.

However, an interesting question is whether there are differences in the way Chinese journalists, who are subject to government censorship, write about the Chinese stock market bubbles compared with non-censored English-language journalists (Ding et al. 2018). In addition, Chinese journalists are likely to be closer to events unfolding in their home stock market, and thus more emotionally engaged, compared with foreign journalists who may be less caught up, and thus potentially more dispassionate. We explore these intriguing questions by running regressions (8)–(10) which have investor emotions as measured in both the Chinese and Western media in the same specification. *Inter alia*, for the reasons given above, we would expect Chinese investor emotions to be reflected less in western media reports than in those written by Chinese financial journalists.

Results in Table 5 panel A which measures the relationship with return, suggest both Chinese and western media sources convey information incremental to each other in the case of excitement and anxiety although in the case of other emotions, such information appears to be subsumed in the Chinese media.¹⁴ Looking at our two composite variables

¹³ The respective tables are available from the authors.

¹⁴ This is confirmed in the separate analysis of the relationship between investor emotions as reflected in western English language media and returns in which case the majority of the emotion variables and the two composite measures are highly significant.

Table 5 Chinese media v English media emotions

	β_1	t	β_2	t	Adj R ²
Panel A : $\text{Return}_t = \alpha + \beta_1 \text{Emotion}_{\text{Ch},t} + \beta_2 \text{Emotion}_{\text{Eng},t} + \beta_3 \text{StDev}_t + \beta_4 \text{Volume}_t + \Sigma(\gamma_i \text{Control}_{i,t}) + \varepsilon_t$ (8)					
Excitement	15.50	(3.24)	27.32	(3.15)	0.65
Mania	18.45	(1.43)	13.84	(0.26)	0.39
Anxiety	-47.11	(-5.16)	-22.38	(-2.15)	0.61
Panic	-26.31	(-2.25)	-51.57	(-1.59)	0.48
Revulsion	-136.90	(-2.07)	-10.24	(-0.17)	0.41
Denial	-32.52	(-1.41)	-22.34	(-1.05)	0.44
Happiness	11.29	(3.11)	7.45	(1.40)	0.47
Worry	-23.24	(-4.98)	-4.64	(-0.62)	0.59
EU	20.60	(4.04)	19.76	(2.44)	0.71
HW	48.13	(4.93)	9.20	(0.82)	0.60
Panel B : $\text{StDev}_t = \alpha + \beta_1 \text{Emotion}_{\text{Ch},t} + \beta_2 \text{Emotion}_{\text{Eng},t} + \beta_3 \text{Return}_t + \beta_4 \text{Volume}_t + \Sigma(\gamma_i \text{Control}_{i,t}) + \varepsilon_t$ (9)					
Excitement	-1.90	(-0.88)	5.43	(1.41)	0.60
Mania	3.09	(0.74)	-7.61	(-0.45)	0.59
Anxiety	12.15	(3.70)	9.88	(2.94)	0.72
Panic	12.25	(4.12)	12.96	(1.44)	0.74
Revulsion	79.56	(4.92)	-19.86	(-1.18)	0.70
Denial	6.62	(0.89)	8.94	(1.32)	0.63
Happiness	1.32	(1.00)	1.43	(0.78)	0.59
Worry	-1.24	(-0.58)	4.36	(1.53)	0.60
EU	-5.69	(-2.45)	-3.57	(-1.00)	0.66
HW	5.75	(1.28)	-5.17	(-1.18)	0.60
Panel C : $\text{Volume}_t = \alpha + \beta_1 \text{Emotion}_{\text{Ch},t} + \beta_2 \text{Emotion}_{\text{Eng},t} + \beta_3 \text{Return}_t + \beta_4 \text{StDev}_t + \Sigma(\gamma_i \text{Control}_{i,t}) + \varepsilon_t$ (10)					
Excitement	4.56	(1.89)	-13.46	(-3.25)	0.71
Mania	14.70	(4.34)	28.02	(1.84)	0.81
Anxiety	9.11	(1.79)	-8.53	(-1.69)	0.69
Panic	0.41	(0.08)	19.04	(1.38)	0.67
Revulsion	-42.18	(-1.64)	53.26	(2.38)	0.69
Denial	21.05	(2.48)	1.49	(0.18)	0.71
Happiness	0.15	(0.10)	6.09	(3.04)	0.70
Worry	-0.91	(-0.35)	-5.39	(-1.55)	0.68
EU	2.90	(0.89)	-3.83	(-0.79)	0.66
HW	-3.51	(-0.66)	14.32	(2.96)	0.70

The table reports the results of OLS regressions. Return_t is the return on SSECI during month t , StDev_t is the standard deviation of daily stock returns during month t , and Volume_t is the average of the daily total value of shares traded divided by end of day market capitalization of the SSECI during month t . $\text{Emotion}_{\text{Ch},t}$ is standardized value of one of the eight emotions or the two composite variables estimated during month t using Chinese media and $\text{Emotion}_{\text{Eng},t}$ are emotions based on English media. Composite variable EU measures strong emotions and is defined as $(\text{Excitement} - \text{Anxiety}) / (\text{Excitement} + \text{Anxiety})$, and composite variable HW measures weak emotions and is defined as $(\text{Happiness} - \text{Worry}) / (\text{Happiness} + \text{Worry})$. Control variables are risk-free rate (China 1-month repo rate), inflation (year-on-year % change in CPI), GDP growth rate (% change in year-on-year real GDP), dividend yield on SSECI, and term premium (difference between 10-years and 2-year government bond rates). Figures in parenthesis are the t-statistics. The intercept, β_4 , β_5 and coefficients on control variables are not reported for ease of exposition. The data covers the two bubble periods: July 2005 to December 2008, and January 2014 to June 2016.

both the Chinese as well as the English language media have significant incremental content for EU ($\beta_1 = 20.60$; $t = 4.04$, and $\beta_2 = 19.76$; $t = 2.44$) though not for HW ($\beta_1 = 48.13$; $t = 4.93$, and $\beta_2 = 9.20$; $t = 0.82$). However, in the case of volatility, Panel B demonstrates that much of the emotion information content of the uncensored English language media is subsumed in the censored Chinese media reports.¹⁵ In addition, it shows our composite Chinese media variable proxying for strong emotions (EU) subsumes the information about volatility in the corresponding English-language media sources which coefficient is insignificant.

Finally, in the case of trading volume, panel C of Table 5 shows that the only Chinese language media emotion variables with a significant relationship with trading volume are mania and denial which subsume the equivalent information present in English language media. On the other hand, a number of the other investor emotions measured using the English language media have a strong relationship with trading volume.

Overall, just under 40% (18) of the coefficients on the 8 individual emotion variables in Table 5 are significant. This is consistent with our third proposition that the Chinese language and independent English-language media report on the 2005–2008 and 2014–2016 Chinese market bubbles in some cases in similar ways and in other cases in different ways.¹⁶ Both carry some information about market returns and uncertainty that is distinct.

6.5 Do market participants learn from previous bubbles?

In this final sub-section we explore our last proposition that the relationship between emotions and market dynamics is weaker in the second bubble because investors should have learned from the first bubble only a few years before in the same market? Table 6 presents the results of running regression models (11)–(13). The parameter of primary interest in all the panels is the coefficient on the interaction term (β_3). In fact, in the case of panel A, the table shows β_3 is only statistically significant in the case of denial and happiness; the two bubbles do not differ across the other 6 emotions, evidence consistent with little investor learning from the first bubble. In fact, this conclusion is even emphasized by recognizing how the negative relationship between denial and returns is much stronger in the second bubble—investors are not just denying the existence of the bubble itself but also rejecting the lessons of the first bubble. Although happiness is weaker in the second bubble, the level of excitement is unabated.¹⁷ On this basis, the relationship between investor emotions and market returns (panel A) does not differ materially across the two bubbles.

However, in the case of market uncertainty measured both by standard deviation in panel B and trading volume in panel C, most of the β_3 coefficients are significant. The impact of our excitement-generating emotions (excitement, mania, and happiness) on the standard deviation of returns in panel B is much lower, and that of our anxiety-generating emotions (anxiety, panic, revulsion, and worry) much greater than in the case of the earlier bubble consistent with greater disagreement between investors. In parallel, panel C shows

¹⁵ This is also confirmed in a parallel analysis to Table 3 using English language media.

¹⁶ If we add interaction terms between Chinese media and western media investor emotions in equations (8), (9) and (10) in Table 5, most of these are insignificant. This, once again, confirms Chinese media and English-language media are not direct substitutes in terms of their information content.

¹⁷ Interestingly, in the case of the English-language media, β_3 for denial is now negative and highly significant and β_3 for worry positive and significant both consistent with such independent news sources able to draw parallels with the first bubble and warn against its reoccurrence. These results are available from the authors.

Table 6 Chinese media emotions in the two periods

	β_1	t	β_2	t	β_3	t	Adj R ²
Panel A: $\text{Return}_t = \alpha + \beta_1 \text{Period}_t + \beta_2 \text{Emotion}_t + \beta_3 (\text{Period}_t * \text{Emotion}_t) + \beta_4 \text{StDev}_t + \beta_5 \text{Volume}_t + \Sigma(\gamma_i \text{Control}_{i,t}) + \varepsilon_t$ (11)							
Excitement	-6.48	(-1.16)	23.14	(5.42)	9.50	(0.78)	0.59
Mania	-3.34	(-0.48)	37.68	(2.03)	-32.37	(-1.70)	0.41
Anxiety	1.74	(0.19)	-55.62	(-5.09)	1.95	(0.14)	0.58
Panic	-4.66	(-0.48)	-31.12	(-2.60)	-7.54	(-0.47)	0.47
Revulsion	-16.92	(-1.64)	-171.90	(-2.27)	105.60	(1.09)	0.42
Denial	-1.04	(-0.16)	-45.41	(-2.83)	-102.00	(-2.94)	0.52
Happiness	44.06	(2.23)	23.79	(3.73)	-19.30	(-2.51)	0.50
Worry	-16.54	(-0.96)	-26.43	(-5.19)	8.50	(0.91)	0.58
EU	0.26	(0.05)	33.88	(7.53)	-9.66	(-1.54)	0.69
HW	8.49	(1.45)	67.73	(6.02)	-34.44	(-1.99)	0.62
Panel B: $\text{StDev}_t = \alpha + \beta_1 \text{Period}_t + \beta_2 \text{Emotion}_t + \beta_3 (\text{Period}_t * \text{Emotion}_t) + \beta_4 \text{Return}_t + \beta_5 \text{Volume}_t + \Sigma(\gamma_i \text{Control}_{i,t}) + \varepsilon_t$ (12)							
Excitement	-2.08	(-1.16)	-0.44	(-0.27)	-14.25	(-4.09)	0.73
Mania	-3.97	(-2.10)	9.00	(1.70)	-15.25	(-2.96)	0.70
Anxiety	-11.73	(-5.77)	10.68	(3.30)	10.87	(3.10)	0.80
Panic	-8.42	(-3.85)	8.41	(2.83)	9.35	(2.46)	0.78
Revulsion	-9.37	(-3.97)	40.32	(2.10)	50.21	(2.11)	0.76
Denial	-6.65	(-3.52)	9.02	(1.67)	16.91	(1.44)	0.68
Happiness	8.35	(1.32)	3.82	(1.78)	-5.76	(-2.39)	0.68
Worry	-24.02	(-5.21)	-2.35	(-1.22)	10.81	(4.08)	0.73
EU	-7.68	(-5.49)	-3.73	(-1.83)	-6.31	(-3.18)	0.77
HW	-2.38	(-1.19)	7.57	(1.60)	-20.16	(-3.67)	0.71
Panel C: $\text{Volume}_t = \alpha + \beta_1 \text{Period}_t + \beta_2 \text{Emotion}_t + \beta_3 (\text{Period}_t * \text{Emotion}_t) + \beta_4 \text{Return}_t + \beta_5 \text{StDev}_t + \Sigma(\gamma_i \text{Control}_{i,t}) + \varepsilon_t$ (13)							
Excitement	2.86	(1.51)	0.96	(0.54)	17.92	(5.08)	0.83
Mania	6.61	(4.58)	10.56	(2.39)	7.64	(1.66)	0.88
Anxiety	15.21	(4.94)	3.02	(0.60)	-12.98	(-2.51)	0.78
Panic	14.47	(5.18)	6.75	(1.59)	-13.22	(-2.54)	0.78
Revulsion	13.85	(4.59)	-0.48	(-0.02)	-61.11	(-1.93)	0.78
Denial	3.31	(1.68)	15.85	(3.19)	39.42	(3.76)	0.83
Happiness	2.45	(0.33)	0.41	(0.16)	2.96	(1.03)	0.77
Worry	29.24	(6.13)	1.10	(0.52)	-12.57	(-4.42)	0.82
EU	10.62	(6.56)	-0.19	(-0.07)	8.96	(3.74)	0.81
HW	5.42	(2.53)	-1.53	(-0.29)	21.27	(3.46)	0.81

The table reports the results of OLS regressions. Period is a dummy variable that takes a value of 0 for the first period (July 2005 to December 2008), and 1 for the second period (January 2014 to June 2016). Return_t is the return on SSECI during month t , StDev_t is the standard deviation of daily stock returns during month t , and Volume_t is the average daily value of shares traded divided by the end-of-the-day market value of SSECI during month t . Emotion_t is standardized value of one of the eight emotions or the two composite variables estimated during month t using Chinese media. Composite variable EU measures strong emotions and is defined as $(\text{Excitement} - \text{Anxiety}) / (\text{Excitement} + \text{Anxiety})$, and composite variable HW measures weak emotions and is defined as $(\text{Happiness} - \text{Worry}) / (\text{Happiness} + \text{Worry})$. Control variables are risk-free rate (China 1-month repo rate), inflation (year-on-year % change in CPI), GDP growth rate (% change in year-on-year real GDP), dividend yield on SSECI, and term premium (difference between 10-years and 2-year government bond rates). Figures in parenthesis are the t -statistics. The intercept, β_4 , β_5 and coefficients on control variables are not reported for ease of exposition.

excitement is associated with much higher trading volumes while anxiety-generating emotions are associated with lower trading volumes in the second bubble save denial where β_3 is positive and highly significant again consistent with investors ‘turning a blind eye’.

The evidence in Table 6 is thus consistent with Chinese investors not learning (not wanting to learn) from the earlier bubble in the case of their return expectations and trading activity although there is greater emotional uncertainty in the case of market volatility. There is thus little evidence consistent with our fourth proposition; relationships between investor emotions and market behavior in the second bubble are not weaker and, in many cases, particularly denial, actually stronger. There is little evidence of learning from the events of the first bubble and this may help to explain the occurrence of the 2014–2016 bubble only a few years later.

7 Discussion and conclusion

This paper sets out to test whether it is possible to explain stock market bubbles by measuring the emotions investors experience during such market episodes. Our empirical analysis is conducted on the repeated Chinese stock market bubbles of 2005–2008 and 2014–2016. Employing standard textual analysis approaches, we construct context-specific emotion keyword dictionaries to measure the investor emotions (excitement, mania, anxiety, panic, revulsion & blame, denial, happiness, and worry) reflected in both Chinese and English language media. We show how properly acknowledging the powerful affects released during speculative bubbles can increase our understanding of such major destructive economic events. In particular, we find investor emotions and market dynamics (proxied by returns, volatility and trading volume) are closely related, with investor emotions explaining around two-thirds of Chinese market behavior in these two periods. In addition, we demonstrate how our strong emotions (excitement and anxiety) have much greater information content than weaker more consciously accessible feelings (happiness and worry).

Similar emotional processes are reflected in independent English-language western media employing our parallel domain-specific emotion keyword dictionaries, as in Chinese media. This is despite the impact of Chinese government censorship on local journalists, and the likelihood of them being personally more emotionally engaged with the Chinese market. Interestingly, while there is a significant overlap between the two sets of media, they are not substitutes for each other. Importantly, we find no evidence that the censorship of financial news had much impact on Chinese investor emotions and consequently their actual trading behavior.

An important finding of this paper is that the nature of the two bubbles we analyze are very similar empirically. It is as if investors have short memories and are unable to learn from experience and behave rationally so emotionally charged are asset pricing bubbles. Conventional financial ‘common sense’ is seemingly being swamped (e.g., Loewenstein 2000) *inter alia* possibly because of the seductive appeal of stories that “this time it’s different”. In fact, rather we demonstrate empirically actually that “this time it’s (still) the same”.

In contrast to many economists who view bubbles as an underlying fact of life which cannot be explained, we argue that these can be understood. This follows if, instead of looking for economic rationality, we recognise that many financial decisions can be predominantly emotional in nature. As Lerner et al. (2015) point out “[E]motions constitute potent, pervasive, and predictable drivers of decision making...[and] are for better or worse, the dominant driver of most meaningful decisions in life”. Only by recognising how

investors' emotions often determine their judgements and decision making will we 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 line with Shiller (2017), we conclude from our results that popular narratives can help provide a direct route into explaining what is going on, at least in economic crisis situations. This is by measuring empirically the emotional resonance of different and often conflicting contemporaneous stories in the media. We speculate on whether media stories can be analyzed in the same way to explain investor behavior in non-bubble situations more generally. Future work can also explore, for example, the emotional drivers of other asset pricing bubbles, including most recently those relating to cryptocurrencies, meme stocks and SPACs, as well as the pricing of individual equities, and the investment decisions of different types of investors, both retail and professional.

Appendix 1: Chinese emotion keyword dictionaries (with English translation)

激动 (Excitement)

大涨 (surge) 热潮 (upsurge) 翻番 (Doubling) 连阳 (continues Yang) 强烈 (strong) 领涨 (leading up) 涨停 (limit-up) 热烈 (fervency) 强势 (mighty) 新高 (new high) 走牛 (bullish) 重大利好 (major benefits) 兴奋 (exciting) 领军 (leader) 获利丰厚 (largely profitable) 红 (red) 壮大 (expand) 振奋 (cheer up) 飞涨 (sharp increase) 全线上涨 (entirely increased) 蜂拥 (swarm) 高歌猛进 (rapid development) 高涨 (upsurge) 盛行 (prevail) 翻倍 (doubling) 繁荣 (prosperity) 劲扬 (powerful increase) 踊跃 (energetic) 非常好 (super) 崛起 (rising) 强劲增长 (strong growth) 强势反弹 (strong rebound) 异军突起 (sudden rise) 冲高 (sharp increase) 激发 (motivate) 红盘 (red plate) 最佳 (optimal) 高点 (high point) 高档 (top grade) 热炒 (popular speculation) 收红 (closed in red) 高速增长 (rapid growth) 跃升 (jumped) 续升 (continues increase) 前所未有的 (unprecedented) 迅猛 (rapid) 猛增 (surge) 激情 (passion) 火 (fire) 庞大 (tremendous) 蓬勃发展 (flourish) 热捧 (hot hands) 领头羊 (bellwether) 借机发挥 (opportunity to play) 屡创新高 (record highs) 潜力无穷 (great potential) 水涨船高 (when the river rises, the boat floats high) 赚钱效应 (money effect)

疯狂 (Mania)

烧 (burn) 牛市 (bull market) 火爆 (hot) 狂热 (fever) 升停板 (up limit) 疯狂 (crazy) 强悍涨停 (strongly surged limit) 全面飘红 (all in the red) 重仓 (heavy holdings) 翻天覆地 (earth-shaking) 急速扩大 (rapid enhancement) 飚升 (soared) 暴增 (explode) 天量 (eye-popping) 爆发 (outburst) 火热 (hit) 人满为患 (packed) 奇迹 (miracle) 沸腾 (ebullition) 贷款 (loan) 抵押 (guaranty) 暴涨 (boom) 急升 (steep rise) 牛气冲天 (full of bull) 沸点 (boiling point) 狂飙 (madly increase) 暴红 (sharp red) 暴利 (excessive profit) 无可限量 (limitless) 气势如虹 (unstoppable) 满盘红 (plateful red) 全线暴涨 (soared across the board) 涨停板 (daily limit board) 神话 (myth) 巨大 (enormous) 嫉妒 (envy) 如火如荼 (in full swing) 急速上升 (rise extreme rapidly) 扶摇直上 (skyrocket) 狂欢 (carnival) 政策牛 (policy bull) 傲视全球 (the envy of the world) 冠全球 (global crown) 狂牛 (mad cow) 疯炒 (crazy speculation) 超级牛 (super bull) 巨量 (jillion) 火箭 (rocket)

焦虑 (Anxiety)

大跌 (a large drop) 差 (bad) 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 lead 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) 跌市 (down market) 不安 (uneasy) 变数 (variation) 困境 (dilemma) 套牢 (entangle) 偏离 (deviate) 普跌 (drop pervasively) 大幅震荡 (sharp fluctuation) 大幅震荡 (sharp fluctuation) 大幅振荡 (sharp fluctuation) 颓势 (declining tendency) 黑天鹅 (black swan) 恶意做空 (short maliciously) 贪婪 (greed) 重创 (hard hit) 大减 (a large decrease) 严峻 (severe) 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) 蹉跌 (slip down) 背道而驰 (run in opposite direction) 离场观望 (on the side-lines) 得而复失 (lose after having got it) 严重不足 (serious shortage)

恐慌 (Panic)

严重 (terrible) 冲击 (shock) 亏损 (loss) 熊市 (bear market) 跌破 (drop below) 新 (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) 灾难 (disaster)

厌恶与责怪 (Revulsion and Blame)

冷 (cold) 悲观 (pessimistic) 离场 (leave the market) 退出 (exit) 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) 奢望 (extravagant hopes) 沮丧 (dispirited) 望而却步 (shrink back at the sight of something dangerous or difficult) 疼 (pain) 冷遇 (a cold reception) 厄运 (misfortune) 恶果 (bad result) 失落 (listless) 走人 (walk away) 噩梦 (nightmare) 失宠 (be out of favour) 淡漠 (indifferent) 回撤 (retacement)

泡沫 (Denial)

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)

高兴 (Happiness)

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) 震荡(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(slugish) 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)

Appendix 2: English emotion keyword dictionaries

Excitement

Affectionate affection affectional affectionately affectionateness almighty almightiness attitude attitudinal desire desires desired desiring desirability desirous eager eagerly eagerness elate elates elated elating elatedly emotionally emotion emotional enthusiastic enthusiasm enthusiastically excite excites excited excitement exciting excitedly flirt flirts flirted flirting flirtation flirtatious flirty gaities gaiety gaily jubilant jubilantly long motivated motivate motivates motivation motivating passion passionate passionately pride prided priding prideful religious religiously religion sanguine sanguineous loved loving

loves love sentimental sentiment sentiments sentimentally cupid cupidity determine determined determines determinedly sustainable sustain sustains sustaining sustainability sustainably sustained outperform outperforms outperforming outperformance outperformed superb superbly spectacular spectacularly enhance enhances enhanced enhancing enhance enhancement excel excels excelled excelling excellent excellently tremendous tremendously perfection perfect powerful powerfully win won extremely extreme extremeness fantastic fantasy fantasticality fantastically brilliant brilliantly superior superiors superiority gain gains gained gaining bonuses bonus successful success succeed succeeded succeeding succeeds successfully incredible incredibly surpass surpassed surpasses surpassing surpassingly strong stronger strongest strongly boost boosted boosts boosting opportunity opportunistic opportunities opportunist opportunists opportunism amazement amaze amazes amazed amazing amazingly galvanise galvanize galvanizes galvanized galvanizing galvanised optimistic optimistical optimistically wonderful wonderfully electrify electrified electrifying electrifies electrification

Mania

Adulate adulates adulated adulating adulatory adulator adulation awe awes awed awing bliss blisses blissed blissful blissfully crazy crazily craze crazes crazed devote devotes devoted devoting devotedly devotee devotement ecstasy ecstatic ecstatically enchant enchants enchanted enchanting enchanter enchantment hysteria hysterical hysteric hysterically hysterics lust lusted lustful lustfulness lustfull lustfully mad madness overjoy overjoys overjoyed paranoid paranoia paranoiac romance romantic romances romanced romancing smitten smite smites smote smiting triumphant triumph triumphs triumphed triumphing triumphantly exceptional exceptionally extraordinary extraordinarily rave raves raving raver raved unique uniquely uniqueness bullish bullishly bullishness bull attachment attach attaches attached attaching cockiness cocky haughty haughtiness haughtily

Anxiety

Anxiety anxieties antagonism antagonistic antagonist antagonists anxious anxiousness anxiously anxiousness brood brooded brooding broods dejected dejection dejectedly deject dejects depress depression depressed depressing depresses desolation desolated desolate desolates edge edged edging edges exhaustion exhausting exhausted fear fearful fearsome feared fears jittery jitter jittered jitters melancholy melancholic mix mixed mixing mixes mood moody moods moodily moodiness restless restlessness restlessly somber sombre somberly sombrely unnerve unnerved unnerving unnerves unsettling unsettled unsettle unsettles loss losses lose loses losing lost undermine undermined undermining undermines fragile erode eroded eroding erodes battered batter batters mistrust mistrustful mistrusted mistrusting mistrusts instability instable instabilities jeopardise jeopardised jeopardising jeopardises jeopardize jeopardizes violation violated violate violates violating violations vulnerable vulnerably vulnerability vulnerabilities unsuccessful unsuccessfulness unsuccessfully alarm alarming alarmed alarms threat threaten threatens slump slumped slumping slumps damaging damaged damage damages warning warned warn warns imperil imperilled imperilling imperilment imperils danger dangerous dangers worse worst struggling struggled struggle struggles gloomy gloomily gloominess tense tension tensions apprehension apprehensive apprehensions hurt hurtful hurting hurts frustrate frustrates frustrated frustrating frustration frustrations wary warily wariness

Panic

Broken-hearted heartbroken despair despairing despaired despairs desperate desperation desperately disillusion disillusioned disillusionment disillusionments dismay dismayingly dismayed dismays distress distressed distressingly distressful distressing distresses dread dreaded dreadful dreading dreadfully forlorn forlornly forlornness frighten frightened frightening frightens grief grieve grieved grieves panic panicked panicking panics phobia phobias scare scared scary scaring scares shock shocked shocking shocks suffer suffered suffering suffers surprise surprised surprises surprising terrify terror terrorise terrorize terrified terrifying terrors terrorizes terrorises tragedy tragedies unspeakable unspeakably weep wept weeping weeps whimper whimpering whimpers toxic toxicity toxically trepidation trepidations bankruptcy bankrupt bankrupted bankruptcies bankrupts calamity calamities peril periled periling nightmare nightmares destroy destroyed destroying destroys failure failed failures failing turmoil neurotic neurotically neuroticism horror horrors sob sobbed sobbing sobs collapse collapses collapsed collapsing crisis crises bubble bubbles crash crashed crashing crashes recession recessions downturn downturns

Revulsion & Blame

Anger angered angering angrily angrily angry angers anguish anguished anguishing anguishes annoyance annoy annoys annoying annoyingly annoyed ashamed belligerent belligerently berserk berserking bitter bitterness bitters bristle bristled bristling bristles callous callously callousness callouses contempt contemptuous contemptible cross crossly crossness crosses aggressive aggressively aggressiveness detest detestable detestation detested detests disgust disgusted disgusting disgusts dislike disliked disliking dislikes enrage enraged enraging enagement enrages exasperation exasperate exasperated exasperating exasperates fed feds ferocious ferociously ferociousness ferocity fierce fiercely fierceness frantic frantically frantiness furious fury gall galling galls guilt guilty guiltiness guiltily guiltiest hate hatred hates hated hating heartless heartlessly hostile hostility humiliation humiliate humiliating humiliated humiliations humiliates indifference indifferent indifferences indignation indignant indignations intolerable intolerably intolerability intolerabilities intolerableness irritable irritability irritabilities irritably irritableness lament lamentingly lamentable laments miserable miserably miserableness mortify mortifies mortified mortifying mortification mortifications mourner mourn mourns mourning mourned numb numbs numbly numbness oppressive oppressively oppressiveness outrage outrages outraged outraging compassion compassions compassionate compassionates compassionately pity pities pitied pitying pout pouts pouting pouty prejudice prejudices prejudiced prejudicing rage rages regret regrets regrettable remorse remorseful remorsefully resentful resentment resentments sad sadness scorn scornful shame shameful shameless sick sickness solemn solemnity solemnities solemnly sore sores soreness sorrow sorrowful sorry spite spites spiteful sympathetic sympathy sympathies thoughtless thoughtlessly thoughtlessness torturous tortured torturing touch touches touchy trauma traumas traumatic traumatize traumatized traumatise traumatised upset upsets upsetting wallow wallows wallowing wallowed weary wearies wearied wearying wearily weariness woeful woefully woefulness woe woes agony agonies punish punishes punishing punished penalty penalties abuse abuses abused abusing abusive abusively empathy pain pains painful

Denial

Collapse collapses collapsed collapsing crisis crises bubble bubbles crash crashed crashing
crashes recession recessions downturn downturns depress depression depressed depressing
depresses

Happiness

Admiration admirer admire admires admired admiring admirably admirers adore adores
adoring adoringly adored amour amuse amuses amused amusement amusing calms calmed
calming calm calmness calmly carefree cheerful cheery collect collected collects collecting
collection collective contents contented contenting content contentment coolness cool cooled
cooling cools courage courageously courageous courageousness creative creation create cre-
ates created creatively curiosity curious curiously enjoyment enjoy enjoys enjoyed enjoyable
faith faithful faithfulness faithfully fondness fond fondly friendly gay glad gladness gladly
glee gleeful gleefully grateful gratification gratifications gratefully happiness happy hope-
ful hope hopes hoped hopefully interest interests interesting interestingly interested intimacy
intimate intimately jolly jollity joys joy joyful like likes liked merrily merriment merry mirth
myself pleasurable pleasure pleasures pleased relaxation relax relaxes relaxed relaxing
relaxation relieve relieves relieved relief relieved relish relishes relished relishing satisfaction
satisfy satisfies satisfactory satisfactorily satisfied secure secured secures securing securely
serene serenely tenderness tender tenders tendered tendering tenderly tolerable tolerate tol-
erates tolerated tolerating toleration understand understands understood understanding
understandingly wonders wondered wondering wonder warmth warm progress progresses
progressed progressive progressing progressively progression reward rewards rewarded
rewarding investment invest invests invested investing effective effect effects effectively effec-
tiveness effectual effectually lucrative lucratively revenue strengthen strengthens strength-
ened strengthening strength raise raises raised raising positive positives positively inspira-
tions inspirational inspirationally inspiration cash venerate venerates venerated venerating
beneficial benefit benefits benefitted benefitting beneficiary pleased attractive attract attracts
attracted attracting attractively attraction attractions demanding demands demanded demand
beautiful beautifully ideal ideally recovery recover recovers recoveries recovered recovering
profitable profit profits profitability profitably improvement improvements improve improves
improving improved favourable favourite favourites incomes income durable durably encour-
age encourages encouraged encouragement encouraging encouragingly realistic realistically
efficient efficiency efficiently better best good safety safe safely rally rallies rallied rally-
ing yield yields yielded yielding energise energize energizes energized energizing enliven
enlivened enlivens enlivening enlivenment bargain bargains bargained bargaining meritori-
ous meritoriously stability stable stables stabled stably health healthy healthily healthier
healthiest healthful quality qualities foster fosters fostered fostering growth grow grows grew
growing grown delight delighted delightedly delightful delightfully earnings worth worthy
worthwhile animation animate animates animated animatedly valuable value values impress
impressed impresses impressing impression impressive peaceful peacefully peace peace-
able great nice influential influentially influent influence protection protect protects protected
protecting protective assure assures assured assuredly assuredness assuring confidently con-
fidence confident willing willingness wish wished wishing wishes wishful certain certainly
certainty trust trusts trusted trusting trustful trustfully trustworthy trustworthily trustworthi-
ness support supports supported supporting supportive

Worry

Alienation alienate alienates alienated ambivalent ambivalence bashful bashfully beset besetting besetment commiseration commiserate commiserates commiserated commiserating commiserative concern concerns concerned concerning controversy controversies controversial disappoint disappoints disappointed disappointedly disappointing disappointment discourage discourages discouraged discouraging discouragement discouragements dishearten disheartens disheartens disheartenment dishearteningly displeasure disturb disturbs disturbed disturbing disturbingly disturbance disturbances downhearted downheartedly feel feels felt feeling feelings fickle fickleness glum glumly glumness lonesome nervous nervousness nervously plight plights plighted plighting shy shies shied shying shyness shyly uncomfortable uncomfortableness uncomfortably uneasiness uneasy unease uneasily unhappiness unhappy unhappily sensitive sensitively sensitiveness sensitivity shun shuns shunned shunning drop drops dropped dropping disrupted disruption disruptive disrupting disrupt disrupts underperform underperforms underperformed underperforming underperformance pressure pressures rejection reject rejects rejected rejecting distrust distrusts distrusted distrusting distrustful decline declines declining declined uncertainty uncertain uncertainly weak weaken weakens weakened weakening weakly weaknesses weaker weakest weakness doubt doubts doubtful doubtfully trouble troubles troubled troublesome nervy nervily nerviness negative negatively inflation inflationary afraid downside downsides problem problems problematic difficulty difficulties difficult difficultly suspicion suspicions suspicious suspiciously conflict conflicts conflicted conflicting taint tainted tainting bad badness worse worst worsen worsens worsened worsening complicated complicatedly complicate complicates complication complications worry worries worried worrying worryingly unconfident stress stressful stressed unsure unsureness

Declarations

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