Investor Attention and Macroeconomic News Announcements: Evidence from Stock Index Futures

Jing Chen, Yu-Jane Liu*, Lei Lu and Ya Tang

This version: July 29, 2014

Chen is a doctoral student at the Guanghua School of Management, Peking University, Beijing, China. Liu is a Professor of Finance at the Guanghua School of Management, Peking University, Beijing, China. Lu is an Assistant professor of Finance at the Guanghua School of Management, Peking University, Beijing, China. Tang is an Assistant Professor of Finance at the Guanghua School of Management, Peking University, Beijing, China. Liu acknowledges financial support from the National Nature Science Foundation of China (#71172026), Lu acknowledges financial support from the National Nature Science Foundation of China (#71271008), and Tang acknowledges financial support from the National Nature Science Foundation of China (#71102022). All errors are our own.

*Corresponding author: Guanghua School of Management, Peking University, 5 Summer Palace Road, Beijing, China 100871. Tel: +86-10-6275-7699, Fax: +86-10-6275-3590, e-mail: yjliu@gsm.pku.edu.cn

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Abstract

This paper examines the role that investor attention plays on scheduled macroeconomic news announcements by using intraday data from the Chinese Stock Index (CSI) futures market. We find that investor attention, proxied by the Baidu Search Index, is significantly higher in Consumer Price Index (CPI) than in other macroeconomic news and, in particular, bad CPI news attracts more attention. Consistently, we document that only the CPI news announcement has a substantial short-term impact on the price, liquidity, and volatility of the CSI 300 index futures and that these effects are stronger during bad CPI news announcements. In addition, we find that the reactions of futures price changes to CPI announcements are more sensitive in high-inflation periods and less pronounced on Fridays, consistent with the findings of high Baidu Search Index in high-inflation periods and low Baidu Search Index on Fridays.

Keywords: Macroeconomic news; Index futures; Investor attention

JEL Classification: G10, G14

1. INTRODUCTION

Studies have shown that as a scarce cognitive resource, investor attention could affect trading activities and asset prices (e.g., Merton, 1987; Hirshleifer and Teoh, 2003; Peng and Xiong, 2006; Huang and Liu, 2007). Recent empirical findings document that firm announcements attract investors' attention and could thus affect both price levels and market efficiency (e.g., Barber and Odean, 2008; Hou et al., 2009; Drake et al., 2012). One caveat of existing studies is that attention-grabbing firm events normally coincide with the release of firm-specific information. However, it is unclear whether the price movements and abnormal trading around firm announcements are caused by investor attention or reflect private information in the market.

We investigate whether investor attention impacts the intraday futures market behavior around major scheduled macroeconomic announcements in the Chinese market. Macroeconomic announcements could act as good representative events to empirically examine the impact of investor attention on financial markets as announced macroeconomic variables are public information and thus we can remove the potential explanation related to private information.

This paper uses the Baidu Search Index (BSI)[1] to directly measure investor attention in contrast to most previous literature, which relies on indirect proxies for investor attention such as extreme returns, volumes, news and headlines, advertising expenses, and price limits (e.g., Gervais et al., 2001; Grullon et al., 2004; Seasholes and Wu, 2007; Barber and Odean, 2008; Yuan, 2008; Chemmanur and Yan, 2009; Hou et al., 2009). These proxies have come under criticism that they can be driven by factors unrelated to investor attention (e.g., Da et al., 2011). Direct measures such as Internet search frequency are believed to be more objective methods to capture the aggregate interest of investors (e.g., Mondria et al., 2010; Da et al., 2011; Bae and

[1] Baidu is the largest search engine in China. According to China Internet Network Information Center, 99.1% of Internet users are aware of the Baidu search engine and 86.7% of Internet users choose the Baidu search engine as their first priority. Similar to Google Search Volume, Baidu Search Index is the aggregate search frequency in Baidu.

Wang, 2012; Drake, et al., 2012; Vozlyublennaia, 2014).

We use the futures market as our sample to alleviate confounding concerns on the opening effect. The Chinese stock market opens at 9:30 a.m., which is the same time most macroeconomic announcements are scheduled to be announced. Thus, market reactions to announcements are likely to be affected by the opening effect of the stock market. The stock index futures market, in contrast, opens at 9:15 a.m. Therefore, futures price movements and trading activities around announcements can be extricated from the market opening effect.

Our main findings are illustrated as follows. First, we examine the impact of major macroeconomic announcements on the Chinese Stock Index (CSI) 300 index futures market based on intraday transaction data.[2] We find that among five macroeconomic news releases, only the Consumer Price Index (CPI) announcement has substantial effects on the short-term return, realized volatility, and trading volume of the CSI 300 index futures market.

Second, we examine whether investor attention can help explain the differences in the futures market reaction to different macroeconomic announcements. We find that the Baidu Search Index is significantly higher for CPI announcements than for other macroeconomic announcements. The search frequency of the CPI news by Internet users is about 2.5 times higher than that of the Producer Price Index (PPI) news and almost 10 times higher than the three other types of news, which indicates that Chinese investors are much more sensitive to the CPI than to other macroeconomic variables. We also find that the Baidu Search Index is significantly higher when bad CPI news occurs, which is consistent with psychological evidence that negative

[2] The five macroeconomic announcements include the Consumer Price Index (CPI), the Producer Price Index (PPI), the Total Retail Sales of Consumer Goods (RSCG), the Industrial Production (INP), and the Investment in Fixed Assets (IFA). Section 3 provides a detailed description of the macroeconomic events. The CSI 300 index futures contract is a financial derivative that was launched on April 16, 2010 on the China Financial Futures Exchange. The underlying asset, the CSI 300, consists of the 300 largest market capitalization and actively traded stocks listed on the Shanghai or Shenzhen Stock Exchanges, representing about 70% of total market capitalization of the two stock exchanges.

information receives more attention than positive information (e.g., Skowronsky and Carlston, 1989; Baumeister et al., 2001). Correspondingly, we find asymmetric price movements for positive and negative CPI news surprises—a sharp decrease in futures prices occurs when the realized value of inflation is higher than expected (e.g., a positive CPI new surprise or a bad CPI news), while no significant price movement occurs when the realized value of inflation is lower than expected (e.g., a negative CPI news surprise or a good CPI news).

We provide two other pieces of evidence to support our findings. Our results show that the Baidu Search Index of CPI news is much lower on Fridays and that the abnormal return of the CSI 300 index futures caused by CPI announcements on Fridays is also significantly lower than that of non-Fridays, indicating that investors exhibit slower responses to Friday announcements (e.g., Damodaran, 1989; Bagnoli et al., 2005; Dellavigna and Pollet, 2009). Shiller (1997) and Sims (2010) show that investors may pay more attention to inflation during a high and unstable period of inflation.[3] By splitting the sample into high- and normal-inflation periods, we find a higher investor attention level and a stronger price adjustment around CPI announcements in a high-inflation period, which supports the intuitive argument that investor attention reinforces the influence of CPI news announcements on short-term futures price.

Our paper contributes to the literature by linking investor attention and macroeconomic announcements. We fill the gap between the two research lines by using investor attention to explain why the short-term futures market has different reactions to macroeconomic announcements in the Chinese market. Most existing studies on investor attention examine the returns and trading behavior at individual stock level based on firm events such as earnings announcements. However, the documented effects of attention around firm announcements are

[3] People are more concerned about the rising standard of living in high-inflation periods. For example, headlines in the Wall Street Journal such as "High Inflation Deepens India's Stagflation Fears" and "High Inflation and Low Rates Squeeze Retirees" amplify the fear of high inflation.

likely to be confounded with private information. We complement the literature by using the macroeconomic announcements as alternative scenarios to test the investor attention theory.

This paper also extends the empirical literature of macroeconomic announcements in two aspects. First, most studies analyzing the impact of macroeconomic news releases fail to identify the reason why certain macroeconomic announcements move the market in different ways (e.g., Ederington and Lee, 1993; Balduzzi et al., 2001; Elder et al., 2012; Miao et al., 2013). By documenting a CPI attention-grabbing effect, we emphasize the role of investor attention on price dynamics and trading activities around macroeconomic announcements. Second, we add to the literature by providing new empirical evidence on asymmetric price movements in response to bad and good news, week-of-day announcement effect, and the impact of inflation on investor attention. In this aspect, our results confirm previous anecdotal evidence and complement the existing literature.

Last but not least, this study contributes to the understanding of the Chinese financial market. One of the important features of this market is the dominance of uninformed individual traders (e.g., Bailey et al., 2009; Choi et al., 2013; Liu et al., 2014). Empirical evidence suggests that individual-behavioral bias is prevalent in the Chinese market and that individual investors are vulnerable to the influence of attention-grabbing events (e.g., Seasholes and Wu, 2007; Xiong and Yu, 2011; and Liu e al., 2014). Therefore, as a highly speculative market, the Chinese financial market provides an ideal venue through which to examine the importance of investor attention.

The rest of this paper proceeds as follows. Section 2 discusses the related literature. Section 3 describes the data and sample construction. Section 4 presents the empirical results and Section 5 concludes.

2. RELATED LITERATURE

This paper is broadly related to three strands of literature. First, it contributes to the literature of investor attention. Existing theoretical studies find that investors have difficulty processing relevant information when attention-grabbing events compete for their attention. Hirshleifer and Teoh (2003) demonstrate that different presentations of accounting information affect market prices when investors pay limited attention. Hirshleifer et al. (2011) propose a theoretical framework that incorporates investors' negligence of information in predicting stock returns. Peng and Xiong (2006) show that limited investor attention leads to category-learning and thus generates stock return patterns that cannot be explained by rational expectation models.

This study corroborates existing empirical studies on the price impact of investor attention-grabbing behavior. For example, Gervais et al. (2001) find that investors pay attention to stocks with unusually high trading volumes, as trading shocks to one stock can affect its market visibility. Seasholes and Wu (2007) show that price-limit events attract investor attention and lead to active individual-buying behavior. Barber and Odean (2008) find that individual investors are net buyers of attention-grabbing stocks; e.g., stocks with abnormally high trading volumes and stocks with extreme returns. Brandt et al. (2010) document that the changes of idiosyncratic volatility levels are related to retail traders who have limited attention and that this effect is salient around attention-grabbing events. Liu et al. (2014) find that investors trade speculatively on the underlying stocks of warrants because the warrants market grabs their attention. Unlike the aforementioned empirical studies that analyze the pricing mechanism using indirect attention proxies, this paper uses an Internet search index to directly measure investor attention. This attention proxy is closely related to the Google Search Volume Index used in previous studies (e.g., Mondria et al., 2010; Da et al., 2011; Bae and Wang, 2012; Drake et al.,

2012; Vozlyublennaia, 2014).

Second, we use macroeconomic announcement events to extricate the mixed effects of investor attention and private information. Borrowing from the attention story, we explain why CPI announcements matter in the Chinese futures market while other macroeconomic announcements do not. A few studies emphasize that financial markets react differently to macroeconomic announcements. Ederington and Lee (1993) find that the announcements of the employment report, the PPI, the CPI and durable goods orders are important for interest rate market and their impact decreases in order, while announcements of the employment report, the merchandise trade deficit, the PPI, the Gross National Product, and retail sales are relevant to the currency market with decreasing levels of impact. Balduzzi et al. (2001) find that the bond market reaction to announcements regarding the unemployment rate and retail sales is stronger than to CPI and PPI announcements. However, none of these papers analyzes the mechanisms behind the findings.

Finally, our paper completes the literature by providing new evidence on the impact of macroeconomic announcements using high-frequency transaction data. The impact of macroeconomic news announcements has been widely documented in developed financial markets. Ederington and Lee (1993) find that prices adjust quickly to major economic announcements and volatility remains substantially high for approximately 15 minutes on the U.S. interest rate and foreign exchange futures markets. McQueen and Roley (1993) show a strong relationship between the S&P 500 Index stock prices and macroeconomic news releases. Balduzzi et al. (2001) find that public news releases have a significant impact on the price of U.S. government bonds and the magnitude of impact differs across maturities. Elder et al. (2012) find that the response of commodities to economic news surprises is swift and significant in gold,

silver, and copper metal futures traded on the Chicago Mercantile Exchange (CME). Miao et al. (2013) examine the price-jump behavior in the U.S. S&P 500 Index futures market. We extend the literature by examining the pattern of price adjustment, volatility, and liquidity of the CSI 300 index futures in the market and provide an investor attention channel to explain these results.

3. DATA AND SAMPLE

We collect the macroeconomic announcements data from the National Bureau of Statistics of China (NBSC) and obtain the consensus forecast data of macroeconomic variables from the Wind database.[4] We collect the intraday, tick-by-tick transaction data of the CSI 300 index futures from a private security company authorized by the China Financial Futures Exchange (CFFEX). We construct a daily Baidu Search Index as the direct measure of investor attention by manually collecting the searching information from the Baidu website (http://index.baidu.com). The sample period is from January 2011 to May 2014.

3.1 Macroeconomic Announcements

We include five macroeconomic news announcements on the Consumer Price Index (CPI), the Producer Price Index (PPI), the Total Retail Sales of Consumer Goods (RSCG), the Industrial Production (INP), and the Investment in Fixed Assets (IFA).[5] In our sample period, there are 41 CPI and PPI announcements and 33 RSCG, INP, and IFA announcements.[6] Panel A of Table 1 shows that out of 41 CPI announcements, 34 were announced at 9:30 a.m., 6 at 10:00 a.m., and 1

[4] The Wind Information Co. Ltd (WIND) is the largest leading financial data provider in China and the Wind database has been widely used in the past studies (e.g., Lin et al., 2009; Li et al., 2011). The database has conducted monthly surveys of security companies since December 2007 and provides the most complete forecast of economic indexes in China.

[5] The NBSC regularly release nine types of macroeconomic news on a monthly basis. Only the five included in our paper are followed by financial analysts and have recorded forecast values.

[6] The less number of observations of the RSCG, INP, and IFA is due to the one-time release of January and February records of the NBSC.

at 1:30 p.m. The release time of PPI news usually coincides with CPI news with one exception.[7] The announcements of the RSCG, INP, and IFA are made simultaneously with 16 announcements at 10:00 a.m., 16 announcements at 1:30 p.m. and 1 announcement at other time. Panel B reports the statistics summary for each macroeconomic news announcement. We find that the variation of realized value is relatively large for the CPI and PPI. This pattern can be also observed from the ratio of standard deviation to mean with 0.43 and 5.57 for the CPI and PPI respectively, and around 0.15 for the RSCG, INP, and IFA. Panel C reports the statistics summary for macroeconomic forecast data, which have similar characteristics to realized values.

Following Balduzzi et al. (2001), we measure the standardized news surprise, S_{it}, by dividing the news surprise over standard deviation across all observations for each macroeconomic variable *i* at time *t*,

$$S_{it} = \frac{R_{it} - E_{it}}{\sigma_i}, \quad (1)$$

where R_{it} is the realized value of announcement i, E_{it} is the consensus forecast value calculated as the arithmetic mean of the forecasts, and σ_i is the standard deviation of the forecast error, $R_{it} - E_{it}$. Panel D reports the summary statistics of macroeconomic news surprises. We find that the range of news surprises is very similar for CPI, PPI, RSCG, and IFA, varying from 4.14 to 4.65, while it is large for INP (= 6.13). In addition, during the sample period, the average news surprise is positive for CPI, RSCG, and IFA, while it is negative for PPI and INP.

3.2 Stock Index Futures

The China Financial Futures Exchange (CFFEX) launched the country's first stock index futures, the CSI 300 index futures, on April 16, 2010. The underlying asset is the CSI 300, which

[7] On September 9, 2011, the CPI is announced at 9:30 a.m., while the PPI is announced at 13:30 p.m. Our results are robust when we delete this observation.

consists of 300 listed stocks with the largest market capitalization and active trading on the Shanghai and Shenzhen Stock Exchanges. In order to avoid excessive speculation, the CFFEX has imposed restriction rules on investor entrance. An eligible investor trading on the CSI 300 index futures must satisfy the following three requirements. First, they must have available funds of more than RMB 500,000 (USD $80,050). Second, they need to pass the relevant test to ensure he/she has basic trading knowledge of the index futures market. Third, they must have transaction records of stock index futures simulation trading or commodity futures trading.

The intraday transaction data includes price, trading volume, direction of trading, and level-1 bid/ask quotes of CSI 300 index futures. Our sample covers 824 trading days. Following the standard procedure of continuous transaction series, we focus on the most active front contracts (e.g., Elder et al., 2012; Hu and Xiong, 2013).[8] We extract transaction information from the front-month contract and replace it by the next-month contract when the volume of next-month contracts exceeds the volume of the current front-month contract. This procedure helps avoid the impact of stale prices traded on the front-month contract when approaching expiration dates.

Out of the 824 trading days in our sample, there are 49 announcement days and 775 non-announcement days. For each trading day, we compute one-minute series of return, volume, spread, and volatility. Following Elder et al. (2012), the return is calculated as the logarithm of price change within one minute, the volume is the sum of trading volume within one minute, the spread is the volume-weighted average of effective spreads within one minute, and the volatility is the realized volatility using trading price of five-second intervals within one minute. Table 2 presents the summary statistics of one-minute return, volume, volume-weighted effective spread,

[8] On each trading day, four kinds of contracts with different delivery dates are traded on the futures market. The trading volume of the most active contract is thousands times higher than that of the most inactive contract.

and realized volatility. We find that the medians between announcement and non-announcement dates are much closer.

3.3 Baidu Search Index

The Baidu Search Index (thereafter BSI) was launched by the Baidu Company, which owns the largest search engine in China. Similar to the Google Search Volume Index used in previous literature (e.g., Mondria et al., 2010; Da et al., 2011; Bae and Wang, 2012; Drake et al., 2012; Vozlyublennaia, 2014), the BSI is calculated as the search frequency of keywords by Internet users through the Baidu search engine. For example, the daily BSI of CPI news represents the search frequency by Internet users using CPI as the keyword through the Baidu search engine.

We employ the BSI as the proxy of investor attention for two reasons. First, according to a recent report published by the China Internet Network Information Center, 99.1% of Internet users in China have been aware of the Baidu search engine and 86.7% of Internet users chose it as their top search engine in 2013. The search frequency of Baidu represents Internet users' real search record without any manipulation and thus captures investors' attention. Second, it is intuitive and objective. Searching for information means that the searcher pays attention to it. The empirical studies suggest that Internet search frequency is a good proxy for investor attention (e.g., Mondria et al., 2010; Da et al., 2011; Drake et al., 2012; Vozlyublennaia, 2014).

Panel A of Fig. 1 provides time-series plots of BSI data for the CPI, PPI, RSCG, INP, and IFA news from January 2011 to May 2014. Two interesting observations emerge from this figure. First, the BSI for CPI news is much higher than that for PPI, RSCG, INP and IFA news during the sample period, with the BSI averaging 3,561 for the CPI, 1,556 for the PPI, and around 350 for the other three macroeconomic variables. These numbers show that the searching volume of CPI news is 10 times greater than that of RSCG, INP, and IFA news, suggesting that the Chinese

people are more concerned about the CPI than other macroeconomic variables. Second, we observe spikes in the BSI of the CPI on every announcement date (see dotted points). These spikes suggest the dramatically increasing public attention on the CPI news-release dates.

Panel B of Fig. 1 plots the BSI around the announcement for all five macroeconomic variables and confirms that investors pay much more attention to the variables when they become public. For instance, the averaged BSI of the CPI on the announcement dates is 16,268, and the averaged BSI of the CPI during the period 10 days prior to the news release and 10 days after the news release (announcement day 0 is excluded) is 2,893. The surge of BSI on announcement dates is salient in CPI and PPI news releases, but not for RSCG, INP and IFA news.

4. EMPIRICAL RESULTS

4.1 Which Macroeconomic Announcements Matter?

This section examines which announcements have a significant impact on price adjustments—the process that new information is incorporated into futures prices, and on liquidity and volatility movements around announcements.

4.1.1. The Impact of Macroeconomic Announcements on Prices

We first investigate the price reactions of the CSI 300 index futures market to five macroeconomic news surprises. Specifically, we regress the price change on the news surprise of the macroeconomic variable being studied by controlling the other macroeconomic surprises announced simultaneously:

$$\frac{P_{15,it}-P_{k,it}}{P_{k,it}} = \alpha_i + \beta_i * S_{it} + \sum_{j\neq i}^{n} \beta_j * S_{jt} + \varepsilon_{it}, \quad (2)$$

where $P_{15,it}$ is the price 15 minutes after announcement i at time t, and $P_{k,it}$ is the price k

minutes before (or after) the announcement *i* at time *t* with *k* changing from -10 (10 minutes prior to the news release) to 10 (10 minutes after the news release).[9] S_{it} is the standardized news surprise for announcement *i*, and S_{jt} is the standardized news surprise for announcement *j* concurrent with announcement *i* to control the confounding effect. β_i is the sensitivity of the price change to announcement *i*, and β_j is the sensitivity of the price change to *j*-th announcement concurrent with announcement *i* at time *t*.

Table 3 presents the regression results for the five types of macroeconomic news within 20 minutes around the announcements ([-10, 10]). We have two interesting findings. First, among the five macroeconomic announcements, only the CPI news release significantly affects the price change. The estimated coefficients of the CPI news surprise are significant and negative for the interval between 10 minutes before the announcement and 3 minutes after the announcement, while none of the other four macroeconomic surprises (PPI, RSCG, INP, and IFA) significantly affect the price change. Second, our evidence demonstrates the existence of information leakage and rapid price adjustment. The price reaction is strong before the announcement, implying that CPI news flows into the market 10 minutes before the announcement and is fully incorporated into the price 3 minutes after the announcement. This is consistent with the rapid price adjustments of financial markets documented in the literature (e.g., Patell and Wolfson, 1984; Ederington and Lee, 1993; Balduzzi et al., 2001; Miao et al., 2013).

4.1.2 The Impacts of Macroeconomic Surprises on Liquidity and Volatility

In this section, we examine the impact of macroeconomic news surprises on liquidity and volatility in the CSI 300 index futures market. Following Boudt and Petitjean (2014), we use abnormal liquidity to measure the liquidity change around the announcement. The abnormal

[9] We also run the regressions using the endpoint price at 5, 10, 20, 25, 30, and 60 minutes after the announcements. We find that the price adjustments are extremely rapid and that there are no price changes 10 minutes after announcements.

liquidity at the *m*-th minute on announcement date *t* for macroeconomic news *i*, $Ab\_Liq_{i,m,t}$, is defined as:

$$Ab\_Liq_{i,m,t} = \frac{Liq_{i,m,t}}{\left(\frac{Liq_{m,t}}{Liq_t^{Med}}\right)^{Med} * Liq_{i,t}^{Med}} - 1, \quad (3)$$

where $Liq_{i,m,t}$ is the liquidity at *m*-th minute on date *t* for macroeconomic news *i*,[10] $Liq_{i,t}^{Med}$ is the median of the liquidity on announcement date *t*, and $\left(\frac{Liq_{m,t}}{Liq_t^{Med}}\right)^{Med}$ denotes the median of the ratio between the liquidity at *m*-th minute of date *t* and liquidity median of date *t* over all non-announcement dates.

We regress the abnormal liquidity on each macroeconomic news surprise controlling other concurrent news announcement surprises:

$$Ab\_Liq_{i,m,t} = \alpha_i + \beta_{liq\_i} * S_{it} + \sum_{j \neq i}^{n} \beta_{liq\_j} * S_{jt} + \varepsilon_{it}, \quad (4)$$

where β_{liq_i} is the sensitivity of abnormal liquidity to macroeconomic announcement *i* with 5-minute intervals from 15 minutes before the announcement to 30 minutes after the announcement,[11] and *n* is the number of macroeconomic announcements concurrent with announcement *i*. We consider a longer examination window because the liquidity reaction lasts for a longer time period after the announcement (e.g., Ederington and Lee, 1993; Balduzzi et al., 2001).

Panel A of Table 4 reports the regression results for abnormal liquidity. We find a similar pattern as the price change —only the CPI news surprise significantly affects abnormal liquidity,

[10] Boudt and Petitjean (2014) define liquidity at *m*-th minute on date *t*, $Liq_{i,m,t}$, as the volume-weighted proportional effective spread ($ES_{j,m}$), where $ES_{j,m} = 2 * Sign_{j,m} * (Price_{j,m} - \frac{1}{2}(Ask_{j,m} + Bid_{j,m})/\frac{1}{2}(Ask_{j,m} + Bid_{j,m})$. $ES_{j,m}$ denotes effective spread of the *j*-th tick record at *m*-th minute, $Sign_{j,m}$ denotes the direction of the *j*-th tick record at *m*-th minute (+1 and -1 denote buy and sell orders respectively), $Price_{j,m}$ is the price of the *j*-th tick record at *m*-th minute, and $Bid_{j,m}$ and $Ask_{j,m}$ stand for the bid and ask price of the *j*-th tick record on *m*-th minute.

[11] When we estimate the models for 1- and 3-minute intervals, the results are qualitatively similar.

while the impact of the other four news surprises are not statistically significant. In addition, the significance of the CPI news surprise increases monotonically as the time of announcement approaches, with a *t*-value of 1.75, 2.39, and 2.46 for 15, 10, and 5 minutes before the announcement, respectively.

Next, we investigate the impact of macroeconomic announcements on (abnormal) volatility. Following Nofsinger and Prucyk (2003), we define abnormal volatility of the *m*-th minute on date *t* for macroeconomic announcement *i*, $Ab\_Vol_{i,m,t}$, as

$$Ab\_Vol_{i,m,t} = Vol_{i,m,t} - \overline{Vol_m}, \tag{5}$$

where $Vol_{i,m,t}$ is the realized volatility at the *m*-th minute on date *t* for announcement *i*,[12] and $\overline{Vol_m}$ is the average of the *m*-th minute realized volatility over all non-announcement dates in the pre-announcement week. To examine the impact of a macroeconomic news surprise on volatility around announcements, we run the regression of abnormal volatility on each macroeconomic news surprise controlling other concurrent announcements:

$$Ab\_Vol_{i,m,t} = \alpha_i + \beta_{vol\_i} * S_{it} + \sum_{j \neq i}^{n} \beta_{vol_j} * S_{jt} + \varepsilon_{it}, \tag{6}$$

where β_{vol_i} is the sensitivity of abnormal volatility to announcement *i* with 5-minute intervals from 10 minutes before the announcement to 30 minutes after the announcement, and *n* is the number of announcements concurrent with announcement *i*.

Panel B of Table 4 presents the regression results for abnormal volatility. Similar to abnormal liquidity, the volatility effect is only pronounced for the CPI news surprise with β_{vol_i} statistically significant at the 5th minute and the 10th minute both before and after the announcements.

[12] We calculate the realized volatility using the method proposed by Barndorff-Nielsen and Shephard (2002) and choose the calculation interval following Elder et al. (2012) to avoid a biased estimation. The *m*-th minute realized volatility on date *t*, $Vol_{i,m,t}$ is calculated at 5-second intervals as follows: $Vol_{i,m,t} = \sum_{j=1}^{j=12} Ret_{i,j,m}^2$, where $Ret_{i,j,m}$ stands for the return of the *j*-th 5-second interval within *m*-th minute for announcement *i*.

In summary, among five macroeconomic announcements, only the CPI announcement has a substantial short-term impact on the price, liquidity, and volatility of the CSI 300 index futures market.

4.2 Investor Attention, Macroeconomic Surprises, and Market Reactions

The previous section shows an interesting pattern that only the CPI news announcement affects the Chinese stock index futures market. In this section, we explore the mechanism behind this phenomenon. One of the most important aspects of the Chinese market is the dominance of uninformed individual traders (e.g., Choi et al., 2009). Seasholes and Wu (2007) and Xiong and Yu (2011) find that Chinese individual investors are vulnerable to the influence of attention-grabbing events. In our sample, on the CSI 300 index futures markets, 77.4% of the traders are individual investors and 99.3% of them are classified as speculators who focus on making profits from the short-term price fluctuation.[13] In such a speculative market, we would expect the market reactions around macroeconomic-announcement events to be impacted by investor attention. In the following section we provide a few tests on investor attention and market reactions to macroeconomic news announcements.

4.2.1 Investor Attention and Macroeconomic News Surprise

We first investigate whether the CPI news attracts more investor attention than the other four macroeconomic variables (PPI, RSCG, INP, and IFA). Panel A of Table 5 presents the summary statistics of the BSI, the investor attention proxy, for each macroeconomic news. Panel B compares both the BSI level and ratio between the CPI news and the PPI, RSCG, INP and IFA news, respectively. The BSI level is defined as the average of BSI for each macroeconomic news during the sample period and the BSI ratio is calculated as the BSI on the announcement date

[13] Investors in the CSI 300 index futures market are classified as speculators, hedgers, or arbitragers according to their trading purpose. Institutional investors make up 22.6% of traders and 98.5% of them are speculators.

divided by the BSI average over the past three non-announcement dates, that is,

$$Ratio_{it} = \frac{Att_{i,t}}{(Att_{i,t-7}+Att_{i,t-14}+Att_{i,t-21})/3}, \quad (7)$$

where $Att_{i,t}$ is the BSI of announcement *i* on date *t*, $Att_{i,t-7}$, $Att_{i,t-14}$, and $Att_{i,t-21}$ are the BSI on the non-announcement dates for the same weekday in the past three weeks.

We find that the BSI of CPI news is much higher than that of other four macroeconomic variables. For instance, the CPI-related BSI level is 3,561 while the PPI-, RSCG-, INP-, and IFA-related BSI levels are 1,556, 310, 483, and 346, respectively. The BSI ratio for CPI news is 7.58, while it is 5.76, 1.00, 1.45 and 1.21 for the PPI, RSCG, INP, and IFA news, respectively. These results suggest that the CPI news release grabs more investor attention than the other four macroeconomic variables in the Chinese market, which is consistent with our previous finding that the Chinese futures market only reacts to CPI news announcements.

4.2.2 Investor Attention and Asymmetric Market Reactions to Good and Bad News

The existing studies document that investors may pay more attention to bad news than to good news.[14] If the pronounced futures market reaction to CPI announcements is driven by investor attention, we would expect to find asymmetric investor attention in good and bad CPI news and asymmetric responses in the futures market accordingly.[15]

To test this hypothesis, we investigate whether investor attention, proxied by the BSI, is different in good and bad CPI news. The CPI announcement is defined as good news if the CPI news surprise is negative—i.e., the realized CPI value is lower than the CPI consensus forecast,

[14] Skowronsky and Carlston (1989) find that individual-formation impression is biased in the sense that individuals pay more attention to bad news and extreme situations. Baumeister et al. (2001) argue that "…the greater power of bad events over good ones is found in everyday events. Bad information is processed more thoroughly than good." Several studies on financial markets support this argument. Booth et al. (1997) find that the price and volatility spillover is more pronounced for bad news than good news in the Scandinavian stock market. Veronesi (1999) finds that the stock market overreacts to bad news in good times.

[15] Because the other four macroeconomic announcements do not impact the Chinese futures market, we will only focus on CPI news announcements in the following tests.

and otherwise defined as bad news. Panel A of Table 6 shows that the averaged BSI is 21,944 for CPI bad news, while it is 15,150 for good CPI news, and the difference is significant at 5% level (*t*-value = 2.08).

Next, we investigate whether the futures market of the CSI 300 index reacts asymmetrically to bad and good CPI news. We regress the price change on positive and negative CPI news surprises, respectively:

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S^{+}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{+}_{jt} + \varepsilon_{CPI,t}, \quad (8)$$

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S^{-}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{-}_{jt} + \varepsilon_{CPI,t}, \quad (9)$$

where $S^{+}_{CPI,t}$ is a positive standardized surprise of CPI news (corresponding to bad CPI news) and $S^{+}_{j,t}$ is the positive standardized news surprise for announcement *j* concurrent with the CPI announcement. Similarly, $S^{-}_{CPI,t}$ is a negative standardized surprise of CPI news (corresponding to good CPI news) and $S^{-}_{j,t}$ is the negative standardized news surprise for announcement *j* concurrent with the CPI announcement.

Panel B shows that futures price responds negatively and intensely to bad CPI news. From 10 minutes before the announcement to 2 minutes after the announcement, the estimated coefficients, β_{CPI}, are significant with *t*-value varying from -1.67 to -2.47. In sharp contrast, futures prices react positively to good CPI news but the price movements are insignificant over the sample period. This helps explain the significant negative price adjustments to CPI news announcements documented in section 4.1.1. A simple and intuitive illustration of the asymmetric price reaction to good and bad CPI news is also provided in Fig. 2. The above results indicate that investors are more sensitive to bad CPI news releases than good CPI news releases and futures market prices, correspondingly, react more strongly to negative CPI news surprises.

4.2.3 Friday Inattention Effect and Market Reactions

There is evidence showing that the attention effect is likely to be less pronounced on Fridays. For example, Dellavigna & Pollet (2009) suggest that weekends distract investors' attention and lower the quality of their decision making, causing the immediate response to earnings surprise less pronounced on Fridays.[16] Following this idea, we investigate the existence of the Friday inattention effect in the CSI 300 stock index futures market and examine whether it impacts market reactions to the CPI news surprise.

Panel A of Table 7 shows that CPI news announcements that occurred on Fridays attract less attention than announcements that occurred on non-Fridays. The averaged BSI for Friday and Non-Friday CPI announcements is 15,274 and 22,583, respectively, and the difference 7,309 is statistically significant at 5% confidence level (*t*-value = 2.32). We further explore whether the Friday effect would weaken the sensitivity of price change to CPI news surprises by running the following regression:

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S_{jt} + \gamma_{CPI} * Friday + \delta_{CPI} * S_{CPI,t} * Friday + \varepsilon_{CPI,t}, \quad (10)$$

where $S_{CPI,t}$ is the standardized CPI news surprise on announcement date *t*, S_{jt} is the standardized news surprise for announcement *j* concurrent with the CPI announcement, *Friday* is a dummy variable which equals 1 if the announcement occurs on Friday and 0 otherwise, and $S_{CPI,t} * Friday$ is the interaction term of the CPI news surprise and *Friday*. The estimated coefficient of the interaction term, δ_{CPI}, is expected to be positive—that is, the negative price changes to CPI news surprises should be attenuated when the news is released on Friday.

Panel B of Table 7 reports the regression results for the interval from 10 minutes before the CPI news announcement to 9 minutes after the CPI news announcement. Consistent with

[16] This issue is also addressed by Damodaran (1989) and Bagnoli et al. (2005).

evidence documented in previous sections, the coefficients on CPI news surprises, β_{CPI}, are negatively significant. As we expected, the estimated coefficients on the interaction term, δ_{CPI}, are 0.32, 0.27, 0.18, and 0.17 (with *t*-values of 2.71, 2.79, 1.88, and 2.47) at -10, -5 , 5 , and 10-minute intervals, respectively. These observations support our conjecture that the negative impacts of CPI news releases on short-term futures prices are alleviated by the Friday inattention effect.

4.2.4 Investor Attention, Inflation, and Market Reactions

Sims (2010) claims that people may pay more attention to tracking economic signals when inflation is high. Following this argument, we investigate whether people pay more attention to price level during a period of high inflation and examine the implications for futures market reactions to CPI announcements. As one of the most important macroeconomic policies, the Chinese government targets moderate inflation levels and usually controls inflation under 5.0%.[17] With this cutoff value, a month in our sample is defined as a high-inflation period if the realized CPI value is above 5.0% and otherwise as a normal-inflation period.

Panel A of Table 8 shows that the averaged BSI for CPI news in a high-inflation period is 29,051 while in a normal inflation period the averaged BSI for CPI news is 15,997, and the difference 13,054 is statistically significant at 1% level (*t*-value = 3.87). This huge difference of Baidu search volume on CPI news confirms that investors are more sensitive to CPI news when inflation is high. Next, we examine the implications of the high-inflation effect on the price-change sensitivity to CPI news surprises by running the following regression:

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S_{jt} + \gamma_{CPI} * HI_t + \delta_{CPI} * S_{CPI,t} * HI_t + \varepsilon_{CPI,t}, \quad (11)$$

where $S_{CPI,t}$ is the standardized CPI news surprise on announcement date *t*, S_{jt} is the

[17] See government report http://www.ce.cn/macro/more/201110/25/t20111025_22787040.shtml.

standardized news surprise for announcement *j* concurrent with the CPI announcement, HI_t is a dummy variable, which equals 1 if inflation exceeds 5.0% and 0 otherwise, and $S_{CPI,t} * HI_t$ is the interaction term of the CPI news surprise and high-inflation dummy variable. The estimated coefficient of the interaction term, δ_{CPI}, is expected to be negative—that is, the negative price changes to the CPI news surprise becomes stronger when the CPI news is released during a high-inflation period.

Panel B reports the regression results from 10 minutes before the CPI news announcement to 9 minutes after the CPI news announcement. The coefficients of the interaction term, δ_{CPI},, as expected, are negative and statistically significant from 3 minutes before the announcement to 3 minutes after the announcement. The coefficients of CPI news surprises, β_{CPI}, on the other hand, turn out to be weakly significant from 8 to 3 minutes before the announcement and become insignificant afterwards. These results suggest that the impact of CPI news surprises on short-term futures price changes is reinforced during high-inflation periods because investors pay more attention to CPI announcements.

4.3 Robustness Check

It is worth noting that not all CPI announcements are publicly made at 9:30 a.m. Out of 41 CPI news releases, 34 were announced at 9:30 a.m., 6 at 10:00 a.m. and 1 at 1:30 p.m. To solve the potential problem caused by these different release times, we only keep the announcements that occurred at 9:30 a.m. and re-do the tests in Sections 4.1 and 4.3.2. Table 9 presents the regression results. We find qualitatively similar results that futures prices react significantly to CPI news surprises before the announcement and this effect is stronger for bad CPI news.

5. CONCLUSION

We use intraday data from the Chinese stock index futures market to investigate whether investor attention helps explain market reactions to scheduled macroeconomic announcements. Macroeconomic announcements are good representative events to empirically examine the impact of investor attention on financial markets as macroeconomic variables are made publicly, thus alleviating a potential explanation related to private information.

Using a direct measure of investor attention—the Baidu Search Index—we document that investor attention is significantly higher for CPI news than for the other four types of macroeconomic news and that a CPI news surprise has a substantial short-term impact on price, liquidity, and volatility of the CSI 300 index futures. In addition, we find that investor attention makes the reaction of price changes to CPI announcements more vulnerable to bad news, more sensitive during a high-inflation period, and less pronounced on Fridays.

Our empirical findings provide supporting evidence for the growing behavior finance by using the Baidu Search Index. Individual investors may not efficiently process abundant information circulated in the market and thus are more attentive to attention-grabbing information such as CPI announcements. This paper offers important implications for emerging financial markets dominated by individual investors.

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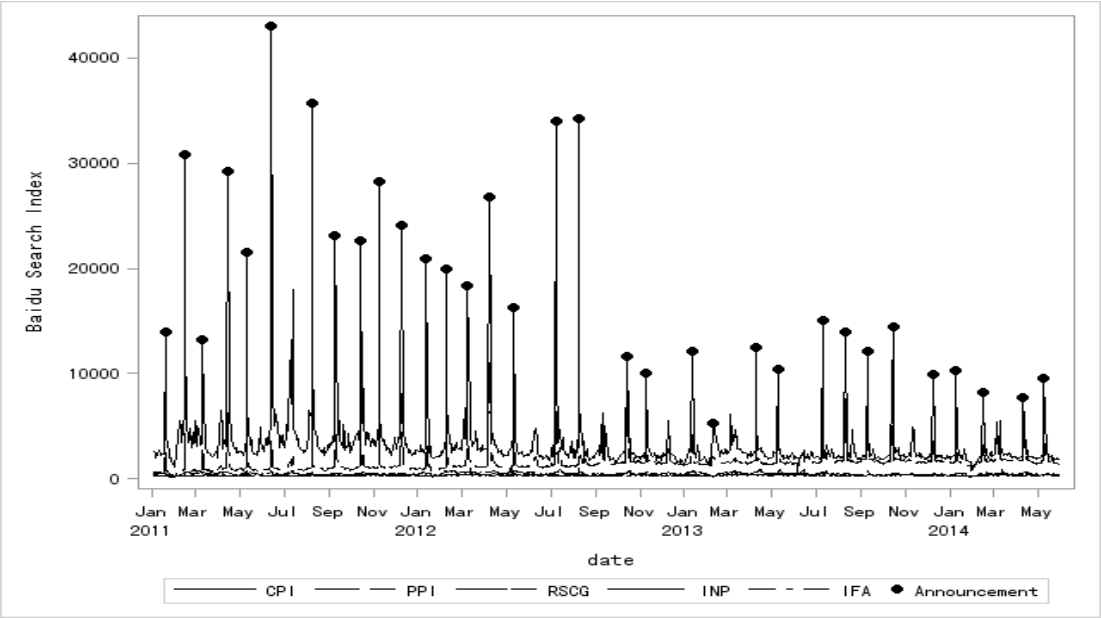
Panel A. Time-series BSI for macroeconomic variables



Panel B. Averaged BSI around announcements

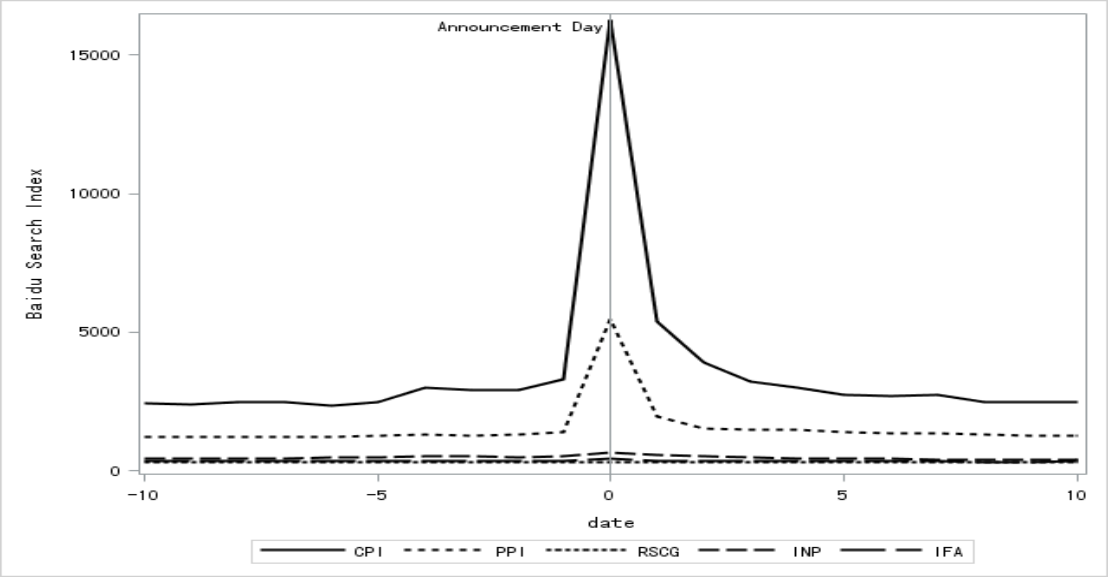


Fig. 1. The BSI for macroeconomic variables

Figure 1 plots the Baidu Search Index (BSI) for five macroeconomic variables, including CPI, PPI, RSCG, INP, and IFA. Panel A shows the time-series BSI for each variable and Panel B plots the averaged BSI around announcement dates for each macroeconomic variable.

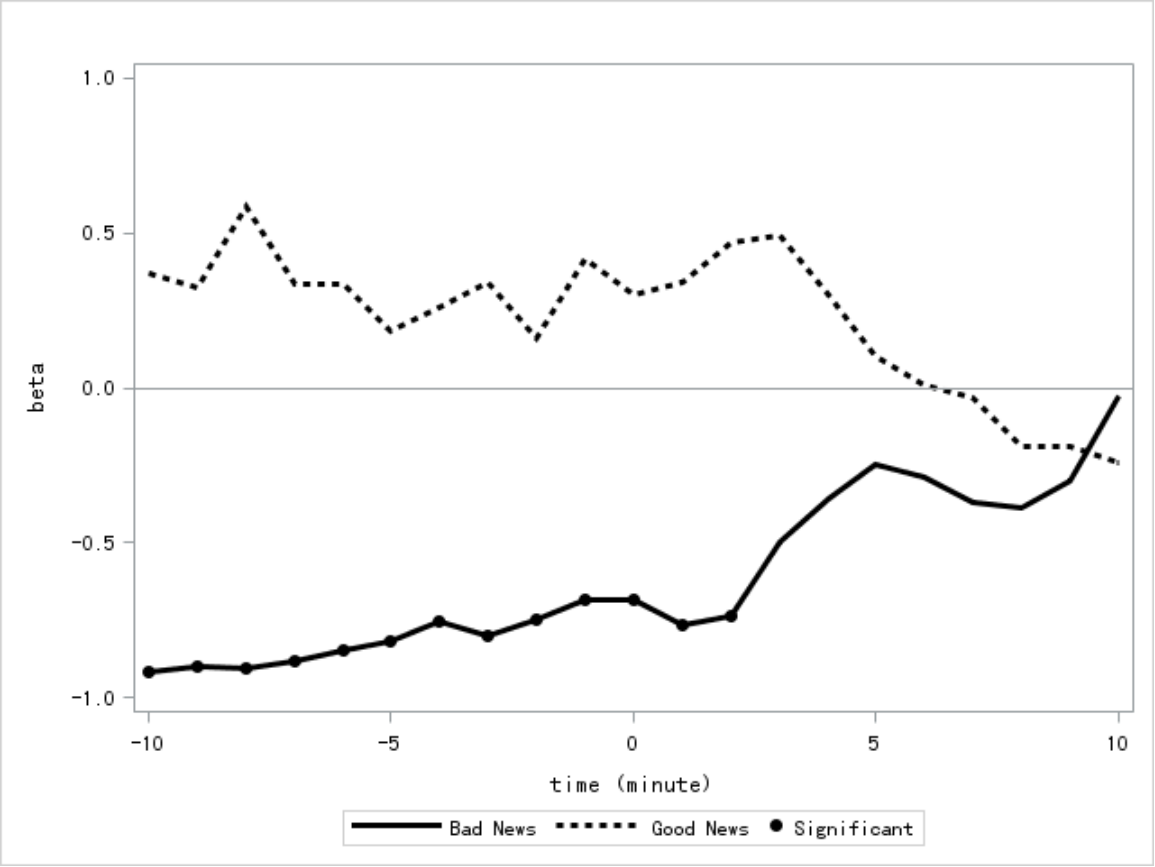


Fig. 2. Asymmetric price reactions to positive and negative CPI news surprises

Figure 2 plots asymmetric price reactions to positive and negative CPI news surprises by running the following two regressions respectively,

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI,t} + \beta_{CPI} * S^{+}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{+}_{jt} + \varepsilon_{CPI,t},$$

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI,t} + \beta_{CPI} * S^{-}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{-}_{CPI,t} + \varepsilon_{CPI,t},$$

where S^{+}_{it} and S^{-}_{it} are standardized positive and negative surprises of CPI news, respectively (corresponding to bad and good CPI news, respectively), and S^{+}_{jt} and S^{-}_{jt} are standardized positive and negative news surprises for announcement *j* concurrent with the CPI announcement, respectively.

Table 1. Macroeconomic News Announcements (January 2011–May 2014)

Panel A. Announcement Time					
	CPI	PPI	RSCG	INP	IFA
9:30 AM	34	33	0	0	0
10:00 AM	6	6	16	16	16
1:30 PM	1	2	16	16	16
Other times	0	0	1	1	1
Panel B. Summary Statistics of Realized Values of Macroeconomic News Announcements					
	CPI	PPI	RSCG	INP	IFA
Min (%)	1.70	-3.60	11.90	8.70	17.30
25% percentile	2.20	-2.10	13.30	9.30	20.20
Median (%)	3.00	-1.40	14.10	10.10	20.60
75% percentile	4.60	5.00	17.10	13.20	24.50
Max (%)	6.50	7.50	19.10	15.10	25.80
Mean (%)	3.50	0.70	14.90	11.00	21.70
Stdev (%)	1.50	3.90	2.10	2.10	2.50
Obs. Number	41	41	33	33	33
Panel C. Summary Statistics of Forecast Values of Macroeconomic News Announcements					
	CPI	PPI	RSCG	INP	IFA
Min (%)	1.70	-3.50	12.20	8.90	17.70
25% percentile	2.40	-1.90	13.30	9.60	20.20
Median (%)	2.90	-1.40	13.90	10.00	20.50
75% percentile	4.40	5.70	16.90	13.20	24.30
Max (%)	6.30	7.30	18.80	14.60	25.70
Mean (%)	3.40	0.70	14.80	11.00	21.60
Stdev (%)	1.40	3.80	1.90	1.90	2.30
Obs. Number	41	41	33	33	33
Panel D. Summary Statistics of Macroeconomic News Surprises					
	CPI	PPI	RSCG	INP	IFA
Min (%)	-1.90	-2.94	-2.28	-3.73	-1.64
25% percentile	-0.48	-0.74	-0.62	-0.27	-0.27
Median (%)	0.00	-0.37	0.00	0.00	-0.27
75% percentile	0.95	0.37	0.83	0.40	0.27
Max (%)	2.38	1.47	1.86	2.40	3.01
Mean (%)	0.10	-0.28	0.12	-0.02	0.13
Stdev (%)	1.00	0.95	1.00	1.00	1.00
Obs. Number	41	41	33	33	33

Table 2. Summary Statistics of CSI 300 Index Futures (January 2011–May 2014)

Table 2 reports the summary statistics of one-minute return, volume, spread, and volatility on announcement and non-announcement dates, respectively. The return is calculated as the logarithm of price change within one minute, the volume is the sum of trading volume within one minute, the spread is the average effective spread weighted by trading volume within one minute, and the volatility is the realized volatility using the trading price of five-second intervals within one minute.

	Return (%)	Volume	Spread (0.1‰)	Volatility (0.1‰)
Announcement Day (49 days)				
Min	-0.569	16	-2.260	0.000
25% Percentile	-0.015	644	0.225	0.001
Median	0.000	1,219	0.367	0.002
75% Percentile	0.015	2,099	0.508	0.005
Max	0.623	14,518	2.380	4.990
Average	0.000	1,594	0.365	0.006
Stdev.	0.052	1,394	0.239	0.051
Non-Announcement Day (775 days)				
Min	-1.125	15	-2.350	0.000
25% Percentile	-0.015	613	0.231	0.001
Median	0.000	1,136	0.372	0.002
75% Percentile	0.014	2,039	0.510	0.005
Max	2.171	30,314	2.390	8.840
Average	-0.000	1,570	0.370	0.006
Stdev.	0.052	1,450	0.234	0.039

Table 3. Price-Adjustment Speed to Macroeconomic News Surprises (January 2011–May 2014)

Table 3 reports the estimation results for the following regression:

$$\frac{P_{15,it} - P_{k,it}}{P_{k,it}} = \alpha_i + \beta_i * S_{it} + \sum_{j \neq i}^{n} \beta_j * S_{jt} + \varepsilon_{it},$$

where $P_{15,it}$ is the price 15 minutes after announcement *i* at time *t*, $P_{k,it}$ is the price *k* minutes before (or after) the announcement *i* at time *t* with *k* changing from -10 to 10, S_{it} is the standardized news surprise for announcement *i*, and S_{jt} is the standardized news surprise for announcement *j* concurrent with announcement *i*. *t*-value is reported in the brackets. ***, ** and * denotes that the coefficient is significant at 1%, 5%, and 10% level, respectively.

k	CPI	PPI	RSCG	INP	IFA
-10	-0.14**	0.02	-0.08	0.08	0.10
	(-2.00)	(0.22)	(-1.04)	(0.96)	(1.43)
-9	-0.13**	0.01	-0.06	0.03	0.07
	(-2.09)	(0.21)	(-1.01)	(0.59)	(1.19)
-8	-0.16**	0.05	-0.05	0.03	0.06
	(-2.33)	(0.65)	(-0.76)	(0.71)	(1.00)
-7	-0.13**	0.01	-0.06	0.03	0.04
	(-2.14)	(0.15)	(-1.00)	(0.56)	(0.65)
-6	-0.15**	0.02	-0.05	0.02	0.06
	(-2.40)	(0.30)	(-0.83)	(0.49)	(0.96)
-5	-0.12**	0.02	-0.04	0.02	0.09
	(-2.11)	(0.31)	(-0.70)	(0.45)	(1.50)
-4	-0.11**	0.00	-0.02	0.05	0.06
	(-2.15)	(0.06)	(-0.37)	(0.90)	(1.03)
-3	-0.12**	-0.01	-0.01	0.05	0.06
	(-2.43)	(-0.27)	(-0.21)	(0.91)	(1.13)
-2	-0.10*	-0.01	-0.01	0.04	0.04
	(-1.84)	(-0.12)	(-0.20)	(0.77)	(0.74)
-1	-0.10*	-0.01	-0.01	0.05	0.05
	(-1.74)	(-0.21)	(-0.11)	(0.84)	(0.81)
0	-0.10*	0.00	0.01	0.06	0.06
	(-1.70)	(-0.08)	(0.23)	(1.11)	(1.08)
1	-0.10	0.00	0.01	0.03	0.04
	(-1.62)	(-0.04)	(0.26)	(0.67)	(0.73)
2	-0.11*	-0.03	0.00	0.02	0.06
	(-1.83)	(-0.50)	(-0.04)	(0.41)	(1.34)
3	-0.1*	0.00	0.00	0.00	0.04
	(-1.66)	(0.07)	(0.01)	(0.08)	(0.90)

(Cont.)

k	CPI	PPI	RSCG	INP	IFA
4	-0.07	-0.01	0.01	0.00	0.01
	(-1.26)	(-0.24)	(0.15)	(0.01)	(0.40)
5	-0.05	-0.01	0.02	-0.01	0.02
	(-0.92)	(-0.31)	(0.63)	(-0.21)	(0.49)
6	-0.04	0.00	0.01	-0.02	0.02
	(-0.67)	(-0.05)	(0.33)	(-0.52)	(0.61)
7	-0.04	-0.01	0.00	-0.02	0.00
	(-0.79)	(-0.14)	(-0.07)	(-0.86)	(-0.14)
8	-0.03	0.00	0.02	-0.01	0.01
	(-0.70)	(0.09)	(0.74)	(-0.37)	(0.21)
9	-0.02	-0.01	0.01	-0.01	0.01
	(-0.50)	(-0.13)	(0.49)	(-0.41)	(0.25)
10	0.01	0.02	0.00	-0.02	-0.02
	(0.21)	(0.42)	(0.05)	(-0.86)	(-0.68)

Table 4. Liquidity and Volatility Reactions to Macroeconomic News Surprises (January 2011–May 2014)

Table 4 reports the regressions of abnormal liquidity and abnormal volatility on each macroeconomic news surprise controlling other concurrent announcements, respectively:

$$Ab\_Liq_{m,t,i} = \alpha_i + \beta_{liq\_i} * S_{it} + \sum_{j \neq i}^{n} \beta_{liq\_j} * S_{jt} + \varepsilon_{it}$$

$$Ab\_Vol_{m,t,i} = \alpha_i + \beta_{vol\_i} * S_{it} + \sum_{j \neq i}^{n} \beta_{vol_j} * S_{jt} + \varepsilon_{it},$$

where S_{it} is the standardized news surprise for announcement i and S_{jt} is the standardized news surprise for announcement j concurrent with announcement i. t-value is reported in the brackets. ***, ** and * denote that the coefficient is significant at 1%, 5%, and 10% level, respectively.

Panel A. Liquidity

k	CPI	PPI	RSCG	INP	IFA
-15	0.46*	-0.09	0.08	-0.16	0.11
	(1.75)	(-0.82)	(0.55)	(-0.97)	(1.09)
-10	0.22**	0.10	0.18	-0.10	-0.17
	(2.39)	(0.95)	(1.05)	(-0.67)	(-1.53)
-5	0.33***	0.00	0.30	0.10	0.17
	(2.46)	(0.03)	(1.65)	(0.77)	(1.61)
0	0.18	-0.01	0.08	-0.01	-0.01
	(1.58)	(-0.04)	(0.56)	(-0.05)	(-0.09)
5	0.13	0.04	-0.20	0.28	-0.22
	(1.4)	(0.52)	(-1.13)	(1.59)	(-1.53)
10	-0.13	0.11	0.02	0.01	-0.16
	(-1.2)	(1.18)	(0.16)	(0.02)	(-1.46)
15	0.13	-0.04	0.16	-0.10	0.13
	(1.45)	(-0.47)	(0.92)	(-0.69)	(0.94)
20	0.05	-0.10	0.02	-0.24	-0.09
	(0.55)	(-1.21)	(0.13)	(-1.5)	(-0.74)
25	-0.06	-0.01	0.23	0.16	-0.03
	(-0.52)	(-0.10)	(1.6)	(0.86)	(-0.27)
30	0.01	0.11	0.06	0.01	-0.01
	(0.20)	(1.59)	(0.30)	(0.08)	(-0.08)

Panel B. Volatility

k	CPI	PPI	RSCG	INP	IFA
-15	1.E-05	1.E-05	7.E-08	-2.E-07	-7.E-08
	(0.67)	(0.94)	(0.36)	(-1.21)	(-0.53)
-10	2E-07**	-1.E-08	4.E-08	7.E-08	-1.E-08
	(2.19)	(-0.27)	(0.25)	(0.47)	(-0.1)
-5	8E-08*	6.E-08	-1.E-07	9.E-09	-1.E-07
	(1.88)	(0.37)	(-0.41)	(0.03)	(-0.48)
0	-2.E-07	2.E-07	-7.E-08	-9.E-08	-1.E-07
	(-1.25)	(1.19)	(-0.74)	(-0.64)	(-1.01)
5	1.E-07	1.E-07	2.E-07	-1.E-08	6.E-08
	(1.28)	(0.7)	(0.31)	(-0.07)	(0.43)
10	4E-07**	1.E-07	6.E-08	-2.E-07	-1.E-07
	(2.36)	(0.93)	(0.45)	(-0.87)	(-1.06)
15	7.E-08	-4.E-08	7.E-08	-2.E-07	-2.E-07
	(0.35)	(-0.12)	(0.16)	(-0.7)	(-1.06)
20	-1.E-07	2.E-07	-3.E-07	1.E-07	2.E-07
	(-0.24)	(0.98)	(-1.96)	(0.92)	(1.6)
25	-7.E-08	1.E-08	-3.E-08	-9.E-08	-4.E-08
	(-0.39)	(0.07)	(-0.18)	(-0.55)	(-0.37)
30	-5.E-08	4.E-08	3.E-08	-1.E-07	-4.E-08
	(-0.27)	(0.49)	(0.24)	(-0.88)	(-0.41)

Table 5. Averaged BSI for Macroeconomic News Announcements (January 2011–May 2014)

Panel A reports the summary statistics of the Baidu Search Index (BSI) for macroeconomic news announcements. Panel B reports the level and ratio of BSI for the PPI, RSCG, INP, and IFA news compared with those of the BSI of the CPI news. For each macroeconomic variable, the level is defined as the average of the BSI during the sample period and the ratio is calculated as the BSI on announcement date divided by the average of the BSI over previous non-announcement weekdays, that is, $Ratio_{it} = \frac{Att_{it}}{(Att_{it-7}+Att_{it-14}+Att_{it-21})/3}$, where Att_{it} is the BSI of announcement *i* on date *t*, Att_{it-7}, Att_{it-14}, and Att_{it-21} are the BSI on non-announcement dates for the same weekday in the past three weeks. *t*-value is reported in the brackets. ***, ** and * denote that the coefficient is significant at 1%, 5% and 10% level, respectively.

Panel A. Summary Statistics of BSI for Macroeconomic Variables

	CPI	PPI	RSCG	INP	IFA
Min	1,003	152	150	91	74
25% Percentile	2,134	1,075	284	412	310
Median	2,523	1,406	308	470	341
75% Percentile	3,386	1,624	333	541	380
Max	43,033	10,983	642	1,101	893
Average	3,561	1,556	310	483	346
Stdev.	3,913	1,134	45	107	59

Panel B. Comparison of the BSI of CPI News to Other Macroeconomic News

	Level (CPI: 3,561)	Level Difference with CPI	Ratio (CPI: 7.58)	Ratio Difference with CPI
PPI	1,556	-2,01*** (-14.13)	5.76	-1.82** (-2.31)
RSCG	310	-3,25*** (-23.85)	1.00	-6.58*** (-10.35)
INP	483	-3,08*** (-22.57)	1.45	-6.12*** (-9.60)
IFA	346	-3,22*** (-23.58)	1.21	-6.37*** (-10.00)

Table 6. Attention and Asymmetric Price Reactions to Good and Bad CPI News (January 2011–May 2014)

Panel A shows the averaged Baidu Search Index for good and bad news. Panel B reports the regression results of price change on positive and negative CPI news surprise, respectively, by running the following regressions:

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI,t} + \beta_{CPI} * S^{+}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{+}_{jt} + \varepsilon_{CPI,t},$$

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI,t} + \beta_{CPI} * S^{-}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{-}_{jt} + \varepsilon_{CPI,t},$$

where $S^{+}_{CPI,t}$ and $S^{-}_{CPI,t}$ are standardized positive and negative surprises of CPI news, respectively (corresponding to bad and good CPI news, respectively), and S^{+}_{jt} and S^{-}_{jt} are positive and negative standardized news surprises for announcement *j* concurrent with the CPI announcement. *t*-value is reported in the brackets. ***, ** and * denote that the coefficient is significant at 1%, 5% and 10% level, respectively.

Panel A. Attention to Good and Bad CPI News

Good News	Bad News	Difference	*t*-value
15,150	21,994	6,844**	2.08

Panel B. Asymmetric Price Reaction to Good and Bad CPI News

Dependent	Price Change									
Good News	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
	0.71	0.63	1.13	0.63	1.03	0.52	0.58	0.66	0.43	0.67
	(1.11)	(1.1)	(1.56)	(1.15)	(1.56)	(1.01)	(1.21)	(1.45)	(0.87)	(1.28)
	0	1	2	3	4	5	6	7	8	9
	0.55	0.53	0.71	0.75	0.53	0.33	0.15	0.08	-0.1	-0.1
	(1.06)	(0.96)	(1.3)	(1.44)	(1.07)	(0.72)	(0.32)	(0.18)	(-0.25)	(-0.33)
Bad News	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
	-1.0**	-1.0**	-1.0**	-0.9**	-0.9**	-0.9**	-0.8**	-0.8***	-0.8**	-0.7
	(-2.09)	(-2.28)	(-2.2)	(-2.31)	(-2.28)	(-2.38)	(-2.26)	(-2.47)	(-2.07)	(-1.6)
	0	1	2	3	4	5	6	7	8	9
	-0.7*	-0.7*	-0.7*	-0.6	-0.4	-0.3	-0.3	-0.3	-0.4	-0.3
	(-1.7)	(-1.67)	(-1.68)	(-1.33)	(-1.04)	(-0.81)	(-0.76)	(-1.06)	(-1.29)	(-1.04)

Table 7. The Friday Inattention Effect on CPI Price Impact (January 2011–May 2014)

Panel A shows the averaged Baidu Search Index for Friday and non-Friday announcements. Panel B reports the results of the Friday effect by running the following regression:

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI,t} + \beta_{CPI} * S_{CPI,t} + \sum_{jCPI}^{n} \beta_j * S_{jt} + \gamma_{CPI} * Friday + \delta_{CPI} * S_{CPI,t} * Friday + \varepsilon_{CPI,t},$$

where $S_{CPI,t}$ is the standardized CPI news surprise on announcement date *t*, S_{jt} is the standardized news surprise for announcement *j* concurrent with CPI announcement, *Friday* is a dummy variable which equals 1 if the announcement occurs on Friday and 0 otherwise, and $S_{CPI,t} * Friday$ is the interaction term of CPI news surprise and *Friday*. *t*-value is reported in the brackets. ***, ** and * denote that the coefficient is significant at 1%, 5% and 10% level, respectively.

Panel A. Attention on Friday and Non-Friday

Friday Attention	Non-Friday Attention	Difference	*t*-value
15,274	22,583	7,309**	2.32

Panel B. Friday Inattention Effect on the CPI Price Impact

k	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
S	-0.22***	-0.21***	-0.29***	-0.21***	-0.27***	-0.19***	-0.17***	-0.19***	-0.17***	-0.16**
	(-3.09)	(-3.20)	(-3.96)	(-3.3)	(-3.85)	(-3.10)	(-2.91)	(-3.53)	(-2.8)	(-2.41)
Friday	-0.07	-0.05	-0.09	-0.04	-0.09	-0.01	-0.08	-0.07	-0.07	-0.03
	(-0.58)	(-0.5)	(-0.92)	(-0.36)	(-0.95)	(-0.14)	(-0.92)	(-0.8)	(-0.71)	(-0.26)
*S*Friday*	0.32***	0.29***	0.37***	0.29***	0.33***	0.27***	0.23**	0.26***	0.25**	0.20*
	(2.71)	(2.76)	(3.44)	(2.86)	(3.29)	(2.79)	(2.43)	(3.00)	(2.52)	(1.88)
k	0	1	2	3	4	5	6	7	8	9
S	-0.16***	-0.17**	-0.18***	-0.15**	-0.12*	-0.10*	-0.10*	-0.10*	-0.09*	-0.06
	(-2.53)	(-2.38)	(-2.55)	(-2.4)	(-1.95)	(-1.81)	(-1.73)	(-2.03)	(-1.86)	(-1.3)
Friday	-0.08	-0.11	-0.09	-0.08	-0.1	-0.14	-0.14	-0.11	-0.07	-0.09
	(-0.77)	(-1.04)	(-0.84)	(-0.79)	(-1.09)	(-1.59)	(-1.57)	(-1.41)	(-0.99)	(-1.37)
*S*Friday*	0.22**	0.2*	0.21*	0.2	0.18*	0.18*	0.18*	0.18**	0.17**	0.17***
	(2.10)	(1.80)	(1.89)	(1.96)	(1.81)	(1.99)	(1.97)	(2.21)	(2.18)	(2.47)

Table 8. Price Reactions in High-Inflation Periods (January 2011–May 2014)

Panel A shows the averaged Baidu Search Index for high- and normal-inflation periods. Panel B reports the results of high-inflation effect by running the following regression:

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S_{jt} + \gamma_{CPI} * HI_t + \delta_{CPI} * S_{CPI,t} * HI_t + \varepsilon_{CPI,t},$$

where $S_{CPI,t}$ is a standardized CPI news surprise on announcement date *t*, S_{jt} is the standardized news surprise for announcement *j* concurrent with CPI announcement, HI_t is a dummy variable that equals 1 if CPI exceeds 5.0% and 0 otherwise, and $S_{CPI,t} * HI_t$ is the interaction term of the CPI news surprise and a high-inflation dummy variable. *t*-value is reported in the brackets. ***, ** and * denote that the coefficient is significant at 1%, 5% and 10% level, respectively.

Panel A. Attention in High- and Normal-Inflation Periods

Normal Period	High Inflation Period	Difference	*t*-value
15,997	29,051	13,054 ***	3.87

Panel B. Price Reactions in High-Inflation Periods

k	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
S	-0.10	-0.10	-0.13*	-0.10*	-0.12*	-0.10*	-0.09*	-0.09*	-0.07	-0.07
	(-1.51)	(-1.60)	(-1.87)	(-1.68)	(-1.96)	(-1.81)	(-1.69)	(-1.91)	(-1.31)	(-1.20)
HI	0.11	0.08	0.05	0.10	0.09	0.12	0.11	0.12	0.14	0.11
	(0.67)	(0.49)	(0.26)	(0.68)	(0.61)	(0.80)	(0.81)	(1.06)	(1.11)	(0.74)
*S*HI*	-0.47*	-0.43*	-0.34	-0.38	-0.28	-0.19	-0.33	-0.42**	-0.44**	-0.48**
	(-1.76)	(-1.75)	(-1.31)	(-1.62)	(-1.22)	(-0.85)	(-1.63)	(-2.30)	(-2.18)	(-2.17)
k	0	1	2	3	4	5	6	7	8	9
S	-0.06	-0.07	-0.07	-0.08	-0.05	-0.03	-0.02	-0.02	-0.02	-0.02
	(-1.17)	(-1.16)	(-1.27)	(-1.27)	(-0.90)	(-0.62)	(-0.36)	(-0.44)	(-0.43)	(-0.36)
HI	0.12	0.11	0.01	-0.05	-0.16	-0.07	-0.13	-0.10	0.03	-0.01
	(0.82)	(0.56)	(0.06)	(-0.35)	(-0.84)	(-0.55)	(-0.93)	(-0.81)	(0.22)	(-0.12)
*S*HI*	-0.47**	-0.60*	-0.45*	-0.23	-0.18	-0.15	-0.16	-0.18	-0.15	-0.06
	(-2.1)	(-1.93)	(-1.96)	(-0.96)	(-0.62)	(-0.73)	(-0.75)	(-0.95)	(-0.83)	(-0.34)

Table 9. Robustness Check: Price-Change Reactions to CPI News Announced at 9:30 a.m. (August 2011–May 2014)

Table 9 reports the estimation results of coefficient β_{CPI} for each time horizon *k* by running the following three regressions:

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S_{jt} + \varepsilon_{CPI,t},$$

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S^{+}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{+}_{jt} + \varepsilon_{CPI,t},$$

$$\frac{P_{15,CPI,t}-P_{k,CPI,t}}{P_{k,CPI,t}} = \alpha_{CPI} + \beta_{CPI} * S^{-}_{CPI,t} + \sum_{j\neq CPI}^{n} \beta_j * S^{-}_{jt} + \varepsilon_{CPI,t},$$

where $P_{15,CPI,t}$ is the price 15 minutes after the CPI announcement, $P_{k,CPI,t}$ is the price *k* minutes before (or after) the CPI announcement ($k \in [-10, 10]$), $S_{CPI,t}$ is the standardized news surprise for CPI announcement, $S^{+}_{CPI,t}$ and $S^{-}_{CPI,t}$ are standardized positive and negative CPI news surprises, respectively, S^{+}_{jt} and S^{-}_{jt} are standardized news surprises for announcement *j* concurrent with CPI announcement. ***, ** and * denote that the coefficient is significant at 1%, 5% and 10% level, respectively.

	All		Good News		Bad News	
k	S_{CPI}	*t*-value	S^{+}_{CPI}	*t*-value	S^{-}_{CPI}	*t*-value
-10	-0.18**	-2.18	0.85	1.12	-0.90*	-1.79
-9	-0.16**	-2.19	0.64	0.95	-0.88*	-1.94
-8	-0.16**	-2.18	0.77	1.10	-0.88*	-1.87
-7	-0.16**	-2.30	0.68	1.03	-0.90**	-2.02
-6	-0.15**	-2.34	0.69	1.07	-0.86*	-1.99
-5	-0.14**	-2.19	0.39	0.61	-0.81*	-1.97
-4	-0.13**	-2.12	0.41	0.66	-0.77*	-1.86
-3	-0.13**	-2.19	0.44	0.73	-0.77*	-1.94
-2	-0.12*	-1.77	0.30	0.45	-0.75*	-1.76
-1	-0.12	-1.64	0.65	0.96	-0.69	-1.47
0	-0.10	-1.47	0.37	0.57	-0.65	-1.45
1	-0.09	-1.25	0.25	0.36	-0.72	-1.52
2	-0.12	-1.66	0.46	0.69	-0.78*	-1.73
3	-0.10	-1.40	0.39	0.65	-0.53	-1.27
4	-0.08	-1.16	0.21	0.36	-0.42	-1.05
5	-0.05	-0.84	-0.06	-0.12	-0.32	-0.85
6	-0.04	-0.61	-0.18	-0.32	-0.35	-0.91
7	-0.04	-0.70	-0.24	-0.49	-0.43	-1.26
8	-0.04	-0.83	-0.34	-0.76	-0.48	-1.57
9	-0.02	-0.40	-0.42	-0.98	-0.33	-1.08
10	0.01	0.28	-0.52	-1.27	-0.08	-0.25