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Sentiment Trend and Lottery-Related Anomalies

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Abstract

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Motivated by existing theories on investor sentiment, I study how sentiment trend affects the cross-section of lottery-related anomaly returns. I predict that overpricing should be prevalent after an uptrend is observed because investors extrapolate past trends to predict whether the market will remain bullish. Moreover, I expect that the uptrend effect will manifest only when the overall sentiment is optimistic due to short-sale impediment. Long–short strategies exploiting anomalies exhibit profits consistent with this prediction.

Keywords: Sentiment Trend, Investor Sentiment, Lottery

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1. Introduction

How do investors form their expectations of future returns? Barberis, Shleifer, and Vishny (1998) argued that beliefs of investors reflect consensus forecasts or market-wide sentiment. The aforementioned researchers' model of investor sentiment states that investors become overly optimistic that future news announcements will also be good after a series of good news. In this Bayesian setting, investors shape their future prospect not by what the latest news presents but by where the trend of recent news proceeds.

In this study, I propose the concept of sentiment trend to add theoretical basis on the current empirically motivated approach (Baker and Wurgler (2006, 2007)), and examine the effect of sentiment trend on the cross-section of stock prices. I begin with the definition of sentiment trend and theoretical predictions. Sentiment trend is a series of consecutive movements of market-wide sentiment in the same direction. Investors believe they can predict overall market condition by extrapolating past trends (Barberis, Shleifer, and Vishny (1998)). Therefore, upward (downward) trend fortifies investors' beliefs that the market will remain bullish (bearish) until the next period.

To test this prediction, I define sentiment uptrend as a dummy variable that equals 1 if the index increases for two consecutive months. I utilize monthly changes in the Baker–Wurgler investor sentiment index orthogonalized to macro factors. On the basis of the asymmetric sentiment

effect suggested by Stambaugh, Yu, and Yuan (2012), I focus more on the upward sentiment trend than on the downward trend.

I explore two hypotheses resulting from these theoretical predictions. The first hypothesis is that investors form optimistic beliefs after they observe a sentiment uptrend. Consequently, anomaly returns increase following the uptrend period. The second hypothesis is that the uptrend affects investors' beliefs only when market-wide sentiment is optimistic. The effect during the pessimistic period is difficult to anticipate because underreaction naturally disappears because of the arbitrage.

Through this study, I investigate uptrend-related overpricing for five lottery-related anomalies that survived exposure to the Fama–French (1993) three factors. Preference for lottery stocks reflects irrational optimism in the investors' mind (Barberis and Huang (2008), Brunnermeier, Gollier, and Parker (2007)); thus, such preference is likely to be affected by optimism formed by a sentiment trend. Anomalies reflect sorts through measures that include the Tversky–Kahneman value, maximum daily return, jackpot probability, idiosyncratic volatility, and idiosyncratic skewness. For each anomaly, I examine the strategy that goes long on the stocks in the highest-performing decile and short on those in the lowest-performing decile.

Prior to testing the hypotheses, I check whether each of the five anomalies is considerably strong following high levels of sentiment; among them, three anomaly returns turn substantially high. I then briefly

investigate whether the returns rise as the uptrend period is prolonged. I find that two out of the five anomalies exhibit significantly enhanced profitability as the period extends from one to four months. I conjecture this case happens because only the two anomalies are constructed from directly observable information.

Thereafter, I test the first hypothesis by sorting. Consistent with previous results, sorts suggest that the aforementioned two anomalies turn substantially strong during the months following an uptrend. Time series regressions confirm that for the two trend-subject anomalies, the sentiment index considerably explains the anomaly returns when an uptrend exists. These results confirm that investors react significantly to the rise in market-wide sentiment when an uptrend occurs.

Next, I investigate the second hypothesis. By sorting, I determine that the return difference between uptrend and non-uptrend periods only exists when the general sentiment is optimistic. Uptrend effect becomes substantially large and significant during the months following the high sentiment. The results from predictive regressions also establish that the additional predictive power of sentiment index when uptrend exists is valid only during the optimistic period.

As a robustness check, I extend my exploration of sentiment trend by assessing five anomalies using the index not orthogonalized to macro variables. The result here confirms that the uptrend effect is caused by purely sentimental reasons rather than economic ones. Furthermore, using

a highly rigorous definition of uptrend, I exercise another predictive regression and obtain consistent results.

The prevalence of the Baker–Wurgler investor sentiment index in recent studies can be attributed to its empirical success.[1] However, several concerns were raised regarding the validity of their approach. Akhtar et al. (2012) emphasized that the change rather than the level of index must be considered. Novy-Marx (2014) argued that the empirical robustness of the index cannot justify its lack of theory because several superstitious variables, including celestial phenomena, predict anomaly returns as well. The current study contributes to remedy such shortfalls in several methods. First, I complement the methodology as consistent with existing theories, that is, the methodology that Baker and Wurgler use to specify when optimism is formed. Furthermore, I provide robust criteria when optimism is formed that does not alter depending on the sample period. Finally, I expand known relationships between sentiment and lottery-related anomalies by investigating two variables in the sentiment literature.

The rest of this paper is organized as follows. Section 2 discusses various definitions and theoretical predictions. Section 3 describes the empirical approaches and data used in this study. Section 4 reports the main empirical results. Section 5 investigates the robustness of the results. Section 5 concludes.

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[1] Studies that investigate the role of market-wide sentiment using the Baker–Wurgler investor sentiment index include Antoniou, Doukas, and Subrahmanyam (2013); Chung, Fung, and Yeh (2010); Fong (2013), Fong, and Toh (2014); Livnat and Petrovits (2009); Stamubugh, Yu, and Yuan (2012, 2015); and Yu and Yuan (2011).

2. Sentiment Trend and Theoretical Effect

The established method to classify sentiment state in a specific month, as suggested by Baker and Wurgler (2006, 2007), has several potential drawbacks.2 Motivated by the model of investor sentiment proposed by Barberis, Shleifer, and Vishny (1998), I propose a complementary concept of sentiment trend as an attempt to address these concerns. Thereafter, I introduce two hypotheses regarding the theoretical effect of sentiment trend on the cross-section of anomaly returns.

2.1. Definition

Sentiment trend is a series of consecutive movements of overall market sentiment in the same direction (either upward or downward). I assume that investors perceive sentiment as a series of news similar to the concept presented by Akhtar, Faff, Oliver, and Subramanyam (2013). Although investors cannot predict the direction of the sentiment movement in an upcoming period, they believe that sentiment behavior is predictable by extrapolating previous trends. Therefore, sentiment trend either strengthens or weakens the investors' acceptance of the current state. If investors observe an upward trend (uptrend) during the optimistic period, then such trend fortifies their belief that the market will remain bullish until the next period. Conversely, if investors observe a downward trend

[2] Studies that investigate the role of sentiment using proxies other than the Baker–Wurgler investor sentiment index (after Baker and Wurgler (2006)) include Edmans, Garcia, and Norli (2007); Frazzini and Lamont (2008); Hwang (2011); Kaplanski and Levy (2010); and Liu (2015).

(downtrend) during the pessimistic period, then such trend intensifies the belief that the market will remain bearish.

Although not precisely identical, the model proposed by Barberis, Shleifer, and Vishny (1998) provides a theoretical background for the sentiment trend concept. In their model, investors believe that the behavior of a given firm's earnings moves between two states; earnings are mean-reverting in the pessimistic state, whereas optimistic state earnings are likely to increase further after an increase. Investors observe earnings during each period and use this knowledge to update their beliefs regarding which state they are in. Consequentially, the process of updating their beliefs follows Bayesian. When a positive surprise is followed by another positive surprise, investors raise the likelihood that they are in the trending regime. By contrast, when the direction of surprise does not coincide, investors raises the likelihood that they are in a pessimistic state.

The concept of sentiment trend, as well as the aforementioned model, is based on two important psychological concepts, namely, representative heuristic and conservatism. Individuals who are subject to the representative heuristic believe they perceive patterns in genuinely random sequences, thereby concluding that the past history is representative of an underlying pattern. Individuals subject to conservatism sustain their prior beliefs of the sentiment state. Consequently, they are likely to update their prospect of the market only after a series of news when the same directions are observed.

2.2. Hypothesis

In this study, I argue the presence of sentiment trend and its effect on anomaly returns. I focus on uptrend rather than downtrend because the former is closely related to the overreaction of noise investors, which is the phenomenon known to cause anomalies (De Long, Shleifer, Summers, Waldmann (1990)). By observing consequent increases in investor sentiment, investors expect further increase in the general sentiment that alters the current sentiment state to optimistic state; the latter is the state that investors believe they are in. A series of positive sentiment news weakens investor conservatism, thereby compelling investors to immediately update their previous beliefs. The faster the uptrend corrects such beliefs, the larger the return of anomalies. Thus, I propose the following hypothesis:

Hypothesis 1: Investors form optimistic beliefs after they observe a sentiment uptrend. Consequently, a return on a long-short strategy based on specific anomaly increases during the uptrend period.[3]

From the definition, the uptrend strengthens investors' acceptance of the optimistic state and weakens acceptance of the pessimistic state. Empirical studies on investor sentiment have reported robust results that

[3] The argument that overreaction of investors causes overpricing in anomalies follows Delong, Shleifer, Summers, and Waldmann (1990)

returns on anomalies tend to be substantially large during the optimistic period and disappear during the pessimistic period. Stambaugh, Yu, and Yuan (2012) explained that only overreaction, not underreaction, survives because the limit on arbitrage exists only for the short side. From the preceding explanation, measuring the effect of trend is difficult during the pessimistic period because the effect of underreaction caused by pessimistic sentiment naturally disappears before uptrend weakens it. Therefore, I propose following hypothesis:

Hypothesis 2: Only during the optimistic sentiment will investors react substantially to the overall increase in investor sentiment as the uptrend continues.

To test the two hypotheses, I focus on lottery-like anomalies among a large span of well-known anomalies. Lotteries are theoretically related to investors' optimism and supported by several studies (Bali, Cakici, and Whitelaw (2011); Barberis, Mukherjee, and Wang (2014); Conrad, Kapadia, and Xing (2014); Fong (2013); and Fong and Toh (2014)). An empirical method to measure the sentiment trend will be provided in the next section.

3. Data and Empirical Approach

The samples include all common stocks traded in the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ from June 1965 to December 2012. Data are obtained from several sources. I obtained monthly and daily stock data from the Center for Research in Security Prices (CRSP) database and accounting data from the Compustat annual database. I also downloaded a monthly Baker–Wurgler (BW) sentiment index data from Jeffery Wurgler's website, and monthly and daily benchmark returns from Ken French's website. Benchmark returns include risk-free rates (one-month Treasury bills), market excess returns (RMRF), small-minus-big (SMB) firm returns, and high-minus-low (HML) book to market returns.

To test my hypotheses, I first empirically define the sentiment trend by using the BW sentiment index constructed as proxy for market-wide sentiment. Thereafter, I computed changes in the sentiment index to measure investor sentiment movements. I then define the sentiment trend dummy using the computed data. Finally, I provide the definitions of the five lottery-related variables, as well as report the summary statistics.

3.1. Empirical Definition of Sentiment Trend

Following recent empirical studies on sentiment, I use the BW sentiment index as proxy for the general market sentiment. The BW sentiment index ranges over 45 years from July 1965 to December 2010.

Baker and Wurgler built their composite index by taking the first principal component of six measures of investor sentiment, as well as by orthogonalizing the result to a set of business cycle variables ($Sent^{\perp}$). The six measures are the closed-end fund discount (CEFD), number of initial public offerings (NIPO), first-day returns of IPOs (RIPO), NYSE turnover (TURN), equity share in the total new issues (S), and dividend premium (PDND). The resulting index is

$$Sent_t^{\perp} = -0.198CEFD_t^{\perp} + 0.225TURN_{t-1}^{\perp} + 0.234NIPO_t^{\perp} + 0.263RIPO_{t-1}^{\perp} + 0.221S_t^{\perp} - 0.243PDND_{t-1}^{\perp} \quad (1)$$

To estimate the consecutive movements of the overall market sentiment, I adopt changes in the BW sentiment index. Considering that all six measures in the index are observable, I assume that investors are able to perceive these changes as a series of sentiment news. Changes in the BW index is measured as

$$\Delta Sent_t^{\perp} = Sent_t^{\perp} - Sent_{t-1}^{\perp} \quad (2)$$

Using time series of the computed changes, I define sentiment trend as consecutive changes of the index in the same direction (either positive or negative). *Trend (n)*, which is the investor sentiment trend dummy, is 1 if the BW sentiment index changed in the same direction in over n successive prior months; and 0 otherwise. *Uptrend (n)*, which is my main

variable, is *Trend (n)* formed in an upward direction. Conversely, *Downtrend (n)* is the *Trend (n)* formed in a downward direction. Considering the extensive conservatism among investors, I expect n must be higher than at least 2.

Figure 1 plots the BW sentiment index and sentiment trend; the bold lines are the periods following *Uptrend (2)*, *Downtrend (2)*, and no such trends. Sentiment trend tends to be cyclic. For example, after the long period of sentiment uptrend in the 1960s, downtrend generally persisted from 1970 to 1975. Thereafter, an uptrend appeared later in the late 1970s. This up–down pattern of sentiment index reveals that the sentiment trend effect, other than level effect, may also exist.

3.2. Lottery-Related Variables

On the basis of cumulative prospect theory, Barberis and Huang (2008) theoretically proved that preference for lottery-like stocks, the payoff structure of which has high idiosyncratic skewness, exists among investors. Optimal belief theory proposed by Brunnermeier, Gollier, and Parker (2007) provides another theoretical basis for such preference. Optimism in investors' mind plays a key role in forming such preference. Furthermore, the literature suggests that market-wide sentiment affects such individual investors' prospect. Therefore, I conjecture that market-wide sentiment can immensely affect such preference for lotteries.

I explore the use of five well-documented lottery-related anomalies

with sufficient sample periods and frequent rebalancing rules for analysis using the BW sentiment index. In this section, I briefly describe how these variables are constructed. Considerably detailed explanations are provided in the Appendix section.4

Anomaly 1: TK. Prospect theory value for each stock, as constructed by Barberis, Mukherjee, and Wang (2014), represents the utility that prospect theory-subject investors gain by holding the stock. When the TK value of a certain stock becomes high, the more it appeals to such investors, thereby resulting in overvaluation and subsequently lowering the stock's return. I construct this variable using excess returns the stock posted over the previous 60 months, as well as estimate the model parameters from Tversky and Kahneman (1992).

Anomaly 2: MAX. Motivated by prospect theory, Bali, Cakici, and Whithlaw (2011) documented a significant and negative relationship between the maximum daily return during the previous month and the monthly return. Fong and Toh (2014) determined that the max effect is considerably strong when sentiment is high, thereby suggesting consistent result with the theoretical effect of sentiment on preference for lotteries.

Anomaly 3: JKPOTP. Conrad, Kapadia, and Xing (2014) demonstrated that stocks with highly predicted probability of extremely

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[4] Studies that introduce lottery variables used in the current study include An, Wang, Wang, and Yu (2015); Ang, Hodrick, Xing, and Zhang (2006); Bali, Cakici, and Whitelaw (2011); Barberis, Mukherjee, and Wang (2014); Boyer, Mitton, and Vorkink (2009); and Conrad, Kapadia, and Xing (2014).

large payoffs, that is, substantially over 100% log return, earn atypically low consequential returns. They argued that investor preference for skewed payoffs causes such anomalous result (Conrad, Kapadia, and Xing (2014). Thus, I use their baseline model to calculate the predicted jackpot probability. By its construction, a series of out-of-sample predicted jackpot probability begins from January 1972.

Anomalies 4 and 5: IVOL and ISKEW. Ang et al. (2006) discovered that idiosyncratic volatility negatively predicts future returns. In an attempt to explain the negative relationship between IVOL and the expected return, Stambaugh, Yu, and Yuan (2015) determined that the higher the sentiment, the stronger the negative IVOL effect; thus, the result that implies the IVOL effect is mainly caused by arbitrage asymmetry. Boyer, Mitton, and Vorkink (2010) documented that the expected idiosyncratic skewness, which is constructed from lagged idiosyncratic skewness and other firm characteristics, exhibits a strong negative relationship with average returns. Although historical idiosyncratic skewness lacks any pricing implication, Fong (2013) reported that triple-sorting on price level, idiosyncratic volatility, and idiosyncratic skewness creates uncharacteristic benchmark-adjusted returns.

4. Results

To investigate my hypotheses, I first briefly analyze the relationship

between investor sentiment and the five lottery-related anomalies. Thereafter, I test the first hypothesis, that is, the positive relationship between sentiment trend and anomaly returns, through sorting and predictive regressions. Finally, I examine the second hypothesis, that is, the relationship between sentiment trend and sentiment state, also through sorting and predictive regression. All results are adjusted for the Fama–French 3 benchmark returns.

4.1. Sentiment and Returns

For each of the five anomalies, I form decile portfolios and compute the value weighted returns. Thereafter, I build a long–short strategy using the extreme deciles, namely, decile 1 (with the lowest variable value) and decile 10 (with the highest variable value). I focus my analysis on long–short portfolios and on short legs (the lower performing decile) because the latter is the portfolio in which overreaction mostly occurs. Furthermore, I report benchmark-adjusted returns, that is, the Fama–French 3 factor alphas (FF3 alphas), for each anomaly. All but the jackpot probability portfolio returns cover the period from August 1965 to December 2010. Portfolio returns sorted by *JKPOTP* are available only after January 1972 because of its construction process.

Following Baker and Wurgler (2006), I allot returns each month as following either the optimistic or pessimistic month. Optimistic months have the BW index above its median in the respective previous months,

whereas pessimistic months have the BW index below its median. I separately compute the average returns of constructed portfolios for each optimistic and pessimistic month. Returns are measured in percent per month.

Table 2 shows the differences in value-weighted excess returns and benchmark-adjusted returns of each anomaly portfolios across optimistic and pessimistic sentiment states. For the entire sample period in the first row, all but *ISKEW* exhibit positive returns for the long–short strategy in terms of both excess and benchmark-adjusted returns. This result is typical because Boyer, Mitton, and Vorkink (2010) reported that historical *ISKEW* lacks any pricing implication. Among the remaining anomalies, *JKPOTP, MAX*, and *IVOL* are statistically valid at the 0.05 significance level. This result is relatively close to those of previous studies, and the relationship between *JKPOTP* and sentiment is new to the literature.

In the second and third rows, returns during the optimistic and pessimistic periods are reported, respectively. In the fourth row, I measure the differences between the returns following the optimistic and pessimistic months. On the short legs of three anomalies (except *TK* and *ISKEW*), excess returns are significantly lower during the optimistic period than during the pessimistic period. Given that long legs do not vary significantly on the basis of sentiment states, the excess returns on the long–short strategies for *MAX, JKPOTP,* and *IVOL* become substantially large during the optimistic period. In particular, *JKPOTP*, the long–short

portfolio return of which does not show statistical significance for the entire sample period, earns over one percent per month following the optimistic months (*t*-statistic: 4.37). The results for the aforementioned three anomalies are robust for benchmark adjustment. For most of the anomalies (except *ISKEW*), I determine that the long–short strategy exhibits considerably high returns during the months following the optimistic months. Overall, the evidence for lottery-related anomalies in Table 2 appears consistent with those in previous studies using the established optimism–pessimism method.

4.2. Uptrend and Returns

Before directly testing the first hypothesis, I briefly investigate whether the long–short strategy returns are correlated to the duration of sentiment. From the first hypothesis, an investor significantly responds to the overall increase in investor sentiment as the uptrend persists. The first hypothesis implies that an investor would react to the existence and the duration of the trend because the investor's response will be significantly strong as the trend effect overlaps. Figure 2 shows that the preceding conjecture holds for two out of the five lottery-related anomalies. The bold lines are the long–short portfolio returns, whereas the dotted lines are the average BW sentiment index level during the respective uptrend (n) period. As the number of months that the trend continues (*n*) to increase, the long–short returns also increase proportionally for *TK* and *MAX*. The optimistic

beliefs of investors are fortified as the uptrend period holds in an extended manner. Given the trivial difference in the overall index level, difficulty is noted in determining whether the cause of an increase in portfolio return is due to the change in index level. No observable pattern also exists for the rest of the anomalies; thus, the duration of sentiment trend lacks any predictive power in estimating long–short returns.

The following question must now be answered: Why do only two out of the five anomalies respond to the duration of sentiment trend? One explanation is that the difference in the variable construction process may have caused this result. *TK* and *MAX* are constructed from directly observable market returns, whereas the other variables are computed from unobservable market returns. Investors are likely to react more immediately to directly observable information than to unobservable ones. Given the absence of continuity during the months following sentiment trend, only variables that immediately reflect changes in investor behavior are able to react to the sentiment trend. Another possible explanation is that variables genuinely related to the skewness of securities react to the sentiment trend, considering that trend is a more rigorous measure than the high–low sentiment criterion. *TK* is a direct proxy of utility that the prospect theory-subject investors gain, whereas *MAX* is a robust proxy for idiosyncratic skewness. By contrast, prior studies disregard *IVOL* and *ISKEW* as direct proxies of lottery stocks, and *JKPOTP* uses firm characteristics indirectly related with the skewness of firms. If sentiment

trend has direct effects on the preference for lottery stocks, as I conjectured, then only robust proxies for lotteries will react to the sentiment trend. From the preceding conjecture, I mainly focus on *TK* and *MAX* for further analysis.

Table 3 provides a direct test of the first hypothesis by sorting a simple and nonparametric method. I report value-weighted returns instead of equal-weighted returns because the former better reflects economically significant magnitudes. With value-weighted returns, all short-leg returns are considerably low following the sentiment uptrend, with the difference ranging from −61 bp to −20 b per month. However, only *TK* and *MAX* demonstrate certain statistical significance. At the 0.05 significance level, *TK* rejects the null hypothesis of no trend-related difference (*t*-statistic: −2.62). This result is remarkable considering that in using the high–low sentiment definition in previous results, *TK* shows insignificant relationship with the sentiment index. Although the statistical significance of *MAX* is relatively weak (*t*-statistic: −1.76), the return is also lower following an uptrend than following other occasions. Furthermore, four out of the five long–short returns are substantially large following a sentiment uptrend. *TK* reports the largest difference at 102 bp, whereas *JKPOTP* shows the lowest with only 7 bp. At the 0.05 significance level, only *TK* rejects the null hypothesis of the no trend-related difference (*t*-statistic: 2.17). Although *MAX* does not reject the null hypothesis, the return on the strategy is almost twice when following an uptrend. From the

fourth to the sixth columns, I report the FF3 alphas. Among the variables, *TK* is the only one robust to the benchmark adjustment, with the *t*-statistic of long–short equal to 2.68. This result is consistent with Figure 2, in which only the *TK* and *MAX* returns react to the sentiment uptrend.

The preceding values are obtained by averaging within the sentiment uptrend versus the no sentiment uptrend months, in which the classification is simply a binary measure. Following Stambaugh Yu and Yuan (2012)[5], I conduct an alternative analysis using predictive regressions to investigate the effect of the sentiment trend. Table 4 reports the results of regressing excess returns on the BW sentiment index**,** the uptrend (n) dummy, and the interaction term. Table 5 reports the results using sentiment-related variables and returns on the Fama–French 3 factors for considerably robust results. From the first hypothesis (i.e., investors react highly to market sentiment after sentiment trend is observed), I anticipate that the uptrend dummy would enhance the explanatory power of investor sentiment on the short leg and long–short returns. The uptrend dummy itself may also be related with the returns for the substantially strong result. Tables 4 and 5 show that the results for both *TK* and *MAX* are consistent with this prediction.

Table 4 shows that sentiment trend adds significant explanatory power

[5] A potential bias exists in predictive regressions, as analyzed by Stambaugh (1999). Stambaugh, Yu, and Yuan (2012) showed that analysis using sentiment index is practically free from such bias.

to investor sentiment in predicting both short leg and long–short returns. The effect of sentiment trend in explaining returns is significant on the short legs of *TK* and *MAX* with coefficients of −0.59 (*t*-statistic: −2.33) and −0.76 (*t*-statistic: −1.97), respectively. Investor sentiment has predictive power in portfolio returns, particularly for *TK*, only when sentiment uptrend exists. Moreover, the trend dummy has its own explanatory power, with *t*-statistic of −2.53 and −1.62, respectively. Explaining the profitability of the long–short portfolio results in the trend dummy itself losing its significance in *MAX*. However, the coefficients for the interaction terms remain large and significant for the long–short returns of both *TK* and *MAX*, with *t*-statistic of 2.29 and 1.86, respectively. On the long–short spread of *TK* and the short leg, investor sentiment possesses the power to predict returns only after joining with the uptrend dummy. In analyzing other variables, I determine no relationship between sentiment uptrend and portfolio returns. Although the IVOL coefficients are consistent in direction with the first hypothesis, the statistical significances of these coefficients are negligible.

Table 5 shows that the aforementioned results remain consistent and statistically significant, which are based on returns adjusted for exposures to the Fama–French 3 factors. For the short legs, the *t*-statistics of *TK* and *MAX* are still relatively significant (*t*-statistic: −1.69 for *TK*, −1.91 for *MAX*) although weaker than the values presented in Table 4. For the uptrend dummy, *TK* is the only variable with valid coefficient at the 0.05

significance level. For the long–short spreads, I obtain results similar to those in Table 4. The coefficients for the interaction term are statistically significant for both *TK* and *MAX*; however, those for the dummy variable are effective only for *TK*. As in Table 4, the sentiment uptrend has no relationship with the other anomalies.

In summary, the results from both sorting and predictive regressions support the first hypothesis that investors become highly optimistic during months following the sentiment uptrend. This result, which holds for two out of the five anomalies (*TK* and *MAX*), is robust for benchmark adjustment. The profitability of long–short strategies on those anomalies is enhanced after the uptrend exists with considerably long persistence.

4.3. Uptrend within Each Sentiment State and Returns

In this section, I test the second hypothesis, that is, only during the optimistic period that the effect of uptrend on people's acceptance of market sentiment persists. Through my analysis, I emphasize the investigation of *TK* and *MAX* as prior results show that the uptrend has relationship with only two out of the five lottery-related anomalies. Tables 6 and 7 both show the value-weighted and benchmark-adjusted returns on the long leg, short leg, and long–short strategies obtained through sorting. Table 6 reports the result for months following the optimistic sentiment, whereas Table 7 for pessimistic sentiment. Returns are measured in percent per month as in the previous analysis.

Support for the second hypothesis is particularly strong. In Table 6, I determine that previous results for the entire sample period (Table 3) last and become considerably strong. Returns for the optimistic period become considerably larger than those for the entire period. For *TK*, the arbitrage return following the uptrend increases from 168 bp per month (*t*-statistic: 3.84) to 257 bp (*t*-statistic: 3.36). Consequently, the difference between the uptrend and other periods becomes considerably large, from 102 bp (*t*-statistic: 2.17) to 205 bp (*t*-statistic: 2.53). As in Table 3, the preceding analysis is robust for benchmark adjustment, with up–other difference of 200 bp (*t*-statistics: 2.39), as well as further holds for *MAX*. The spread following the uptrend increases from 0.49 percent (*t*-statistic: 1.50) for the entire period to 130 bp (*t*-statistic: 2.56) for the optimistic period. Furthermore, the difference between the uptrend and others increases from 24 bp to 32 bp, although this value is still statistically insignificant. However, Table 3 shows that the difference disappears after the benchmark adjustment. For other variables, I determine that the results are inconsistent with my hypothesis, which is similar with the previous analysis. The current results indicate that investors' optimism formed by an uptrend is fortified during the optimistic period.

Table 7 shows that the trend effect simply disappears. The reported results indicate that during the pessimistic period, the return differences between the uptrend and other periods decrease to practically 0 for four out of the five anomalies (i.e., −0.06 for TK, 0.00 for MAX, 0.25 for

IVOL, and −0.05 for ISKEW). The only exception is *JKPOTP*, which shows above 0 but with an insignificant difference of 0.79 (*t*-statistics: 1.69). This result indicates that limited, if none at all, sentiment trend effect exists during the pessimistic period.

Table 8 tests the second hypothesis with predictive regressions as an alternative approach. Thus, I divide the interaction term in Table 5 into two components, namely, optimistic and pessimistic components. My finding that the coefficients for the interaction terms differ for the optimistic and pessimistic periods is consistent with previous results. On the short legs of *TK* and *MAX*, the *t*-statistics of the coefficients for the optimistic period are −2.26 and −2.24, respectively, whereas those for the pessimistic period are 0.41 and 0.83, respectively. Consistent with this result, uptrend adds predictive power to sentiment only during optimistic periods, with coefficients of 2.30 (t-statistics: 1.84) and 1.36 (t-statistics: 2.35). As in previous analyses, other variables indicate no significant results.

This section shows that sentiment uptrend affects investors' optimism in the overall market only during the optimistic–sentiment period. Through sorting and predictive regressions, I demonstrate that the uptrend effect does not exist during the pessimistic months. As I conjectured earlier, this finding is consistent with the short-sale impediment argument of Stambaugh, Yu, and Yuan (2012).

5. Robustness Tests

One may be inclined to seek a macroeconomic-based explanation for our results as an alternative to uptrend-driven overpricing. Macroeconomic explanation would emphasize that even though macroeconomic factors are orthogonalized, the period during which uptrend exists may coincide with the period during an improved overall economy.

In Table 9, I report the results of predictive regressions hiring the identical model used in Table 5. Instead of the BW sentiment index orthogonalized to macroeconomic factors ($\text{SENTIMENT}^{\perp}$), unorthogonalized BW sentiment index (SENTIMENT) is used. Unlike in previous results, the coefficients for the interaction terms do not exhibit a statistical significance for *TK* and *MAX*, although the coefficient for *IVOL* obtained statistical significance at the 0.05 level. From this result, I conjecture that the uptrend containing macroeconomic components affect returns on arbitrage strategy based on *IVOL*. For *TK*, the coefficient for the uptrend dummy on long–short return rejects the null hypothesis at the 0.05 significance level. However, unlike the previous result, the effect mainly originates from the long leg. Given that the long leg is unlikely related to the overreaction of investors, interpreting this result is difficult as evidenced in the reaction of *TK* to the macroeconomic factors.

Table 10 shows the results of the predictive regressions with the model used in Table 5 but with a different specification of uptrend dummy. Thus

far, the analyses required two consecutive months of upward changes to be classified as uptrend period (*uptrend(2))*. Hence, I apply a substantially rigorous criterion that requires three consecutive months (*uptrend(3)*). Using this definition, the number of months with uptrend decreases considerably from 148 months to 72 months. A significantly rigorous definition is inappropriate to apply in the analysis because the months following four consecutive months of uptrend numbers are only slightly over 40. These results are consistent with previous results; the coefficients of the interaction term are 1.59 (*t*-statistics: 1.96) and 0.94 (t-statistics: 1.95) for TK and MAX, respectively. The only difference is that the coefficients for the uptrend dummy are already insignificant for both short leg and long–short profitability of *TK*.

In summary, the result does not hold for the unorthogonalized sentiment index, indicating that the over-time variation in the anomaly returns is caused purely by sentimental reasons and unlikely by economic factors. Furthermore, I determine that the result is robust to a considerably rigorous specification of sentiment trend.

6. Conclusion

In the Bayesian setting, investors shape their beliefs on future returns by the trend that a series of news forms. This study uses this setting to explore the sentiment trend effect, that is, investors become overly

optimistic after observing an uptrend. The long–short profitability of the lottery-related anomalies can become substantially large during an uptrend period because preference for such stocks reveals optimism in the investors' beliefs on future returns.

Consistent with this hypothetical setting, overpricing occurs during the period of uptrend for many lottery stocks. Given that investors raise the probability that they are in the trending regime after observing an uptrend, the predictive power of sentiment on anomaly returns becomes considerably large during such period. Furthermore, the uptrend effect is limited to the period when overall sentiment is optimistic. This phenomenon happens because an uptrend fortifies overall optimism among investors but does not significantly weaken their overall pessimism. The effect is limited on lotteries that use observable market return information in construction.

Numerous studies have assessed the relationship between market-wide sentiment and a broad set of anomalies. However, attempts to justify the usage and interpretation of the sentiment index have been scarce in the literature. Thus, the current study aims to provide a model-based explanation for such robust empirical results. Although this approach reveals a novel link between the investor sentiment and sentiment index models, numerous studies will certainly be conducted in the future to advance a significant understanding of how sentiment affects investors' mind.

Appendix: Definition of Key Variables

Sentiment: The Baker–Wurgler sentiment index is defined as the first principal component of levels in the six measures of sentiment, namely, closed-end fund discount (CEFD), detrended log turnover (TURN), number of IPOs (NIPO), first-day return on IPOs (RIPO), dividend premium (PDND), and equity share in new issues (S).

Sentiment$^{\perp}$: The Baker–Wurgler sentiment index orthogonalized to the macroeconomic variables

Optimistic: Months when the sentiment index is above zero

Pessimistic: Months when the sentiment index is below zero

Trend(n): This measure indicates the existence of a series of good or bad sentiment news. Changes in each variable are considered news that indicates the overall market sentiment. Thus, we use 1 if the sentiment index changes in the same direction for over two successive periods and 0 otherwise. The direction can be either positive or negative.

Uptrend (n)**:** Months when the sentiment trend (n) is 1 and the direction is positive

***Downtrend (n)*:** Months when the sentiment trend (n) is 1 and the direction is negative

IVOL: To estimate the monthly idiosyncratic volatility of an individual stock, I use the Fama–French 3 factor model to determine the idiosyncratic return.

$$r_{i,d} - r_{f,d} = \alpha_i + \beta_i MKT_d + s_i SMB_d + h_i HML_d + \epsilon_{i,d}, \qquad (3)$$

where ϵ_i is the idiosyncratic return on day *d*.

The idiosyncratic volatility of stock *i* in month *t* is defined as the standard deviation of the daily residuals from month *t − 2* to month *t*.

ISKEW: To estimate the monthly idiosyncratic skewness of an individual stock, I use the Fama–French 3 factor model to determine the idiosyncratic return.

$$r_{i,d} - r_{f,d} = \alpha_i + \beta_i MKT_d + s_i SMB_d + h_i HML_d + \epsilon_{i,d}, \qquad (4)$$

where ϵ_i is the idiosyncratic return on day *d*.

The idiosyncratic skewness of stock *i* in month *t* is defined as the skewness of the daily residuals from month *t − 2* to month *t*.

JACKPOTP: The predicted jackpot probability is constructed from the baseline model in Conrad et al. (2014) (Table 3, Panel A). In particular, I first estimate the baseline logit model for each firm using data from the past 20 years at the end of June every year:

$$Prob_{t-1}(Jackpot_{i,t} = 1) = \frac{\exp(a + b \times X_{i,t-1})}{1 + \exp(a + b \times X_{i,t-1})}, \qquad (5)$$

where $Jackpot_{i,t} = 1$ is a dummy equal to 1 if firm *i*'s log return in the following 12-month period is larger than 100%. The vector $X_{i,t-1}$ is a set of firm-specific variables known at time t − 1, including skewness of log daily returns (centered around 0) over the last three months, log stock return over the past year, firm age as the number of years since its appearance on CRSP, asset tangibility as the ratio of gross property plant and equipment (PPE) to total assets, the log of sales growth over the prior year, detrended stock turnover as the difference between the average past 6-month turnover and the average past 18-month turnover, volatility as the standard deviation of daily returns (centered around 0) over the past three months, and the log of market equity in thousands. Thereafter, I use these estimated parameters to construct the out-of-sample predicted jackpot probability (*Jackpotp*). The logistic regression is re-estimated once a year in June, whereas the out-of-sample jackpot probability is re-estimated every month.

MAX: The maximum daily return within a month

$$MAX_{i,t} = \max\left(R_{i,d}\right), d = 1, \dots, D_t, \tag{6}$$

where $R_{i,d}$ is the return on stock *I* on day d and D_t is the number of trading days in month *t*.

TK: Computed as in Barberis et al. (2014), the prospect theory value for each stock is the utility of each investor who are subject to prospect theory, that is, the utility that comes from obtaining the stock. When the *TK* value of a stock is high, such stock appeals to investors; thus, the stock will be overvalued and subsequently earns substantially low returns. The calculation of the *TK* value is based on the cumulative prospect theory model and the estimated model parameters from Tversky and Kahneman (1992), that is,

$$\alpha = 0.88, \gamma = 0.61, \delta = 0.69, \lambda = 2.25.$$

Following Barberis et al. (2014), the stock's historical return distribution is then

$$\left(r_{-m}, \frac{1}{60};\ r_{-m+1}, \frac{1}{60}; \dots r_{-1}, \frac{1}{60};\ r_1, \frac{1}{60}; \dots;\ r_{n-1}, \frac{1}{60};\ r_n, \frac{1}{60}\right) \tag{7}$$

Hence, the distribution that assigns 1/60 for each of the 60 excess returns the stock posted over the previous 60 months. I assume m of these returns are negative, whereas the remaining n = 60 − m are positive. All excess returns are ranked in order; thus, r_{-m} is the most negative monthly return among the 60-month historical returns, whereas r_n as the most positive return. Therefore, the prospect theory value of this distribution is

$$\text{TK} = \sum_{j=-m}^{-1} v(r_j)\left\{w^-\left(\frac{j+m+1}{60}\right) - w^-\left(\frac{j+m}{60}\right)\right\} + \left\{w^+\left(\frac{n-j+1}{60}\right) - w^+\left(\frac{n-j}{60}\right)\right\} \quad (8)$$

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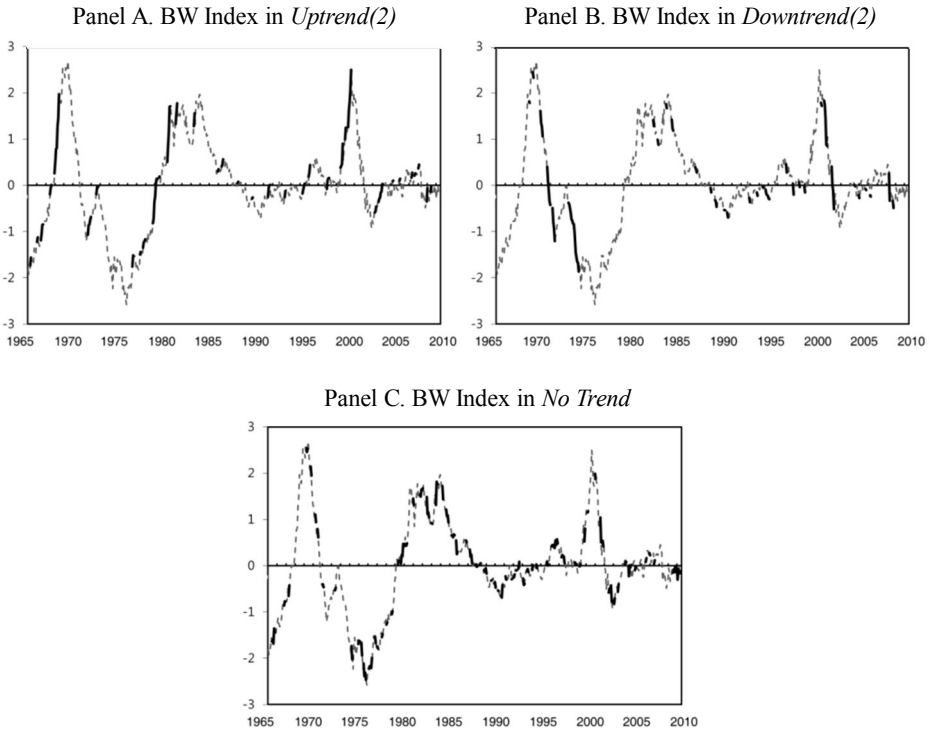

Figure 1. Investor Sentiment and Sentiment Trend, 1965 to 2010.

This figure plots the historical investor sentiment index with its trend. Investor sentiment is measured using the monthly sentiment index ($SENTIMENT^{\perp}$) constructed by Baker and Wurgler (2006). This index is orthogonalized to recession indicators. This index is also the first principal component of trading volume, dividend premium, closed-end fund discount, number and first day returns in IPOs, and equity share in new issues. Following Baker and Wurgler (2006), I define sentiment as *optimistic* if the index is above zero and *pessimistic* if the index is below zero. Sentiment trend is defined as *Uptrend(2)* if the index increased in two successive prior months, *Downtrend(2)* if the index decreased in two successive prior months, and *no trend*

if the index changes its direction in each two successive prior months. The bold line in the first panel shows the investor sentiment index when uptrend exists. Uptrend occurs in 148 months with an average index value of 0.05. (77 optimistic months, 71 pessimistic months). The bold line in the second panel shows the investor sentiment index when downtrend exists. Downtrend occurs in 130 months with an average index value of −0.02. (53 optimistic months, 77 pessimistic months). The bold line in the third panel shows the Baker–Wurgler investor sentiment index when no trend exists. No trend occurs in 268 months with an average index value of −0.02. (134 optimistic months, 134 pessimistic months).

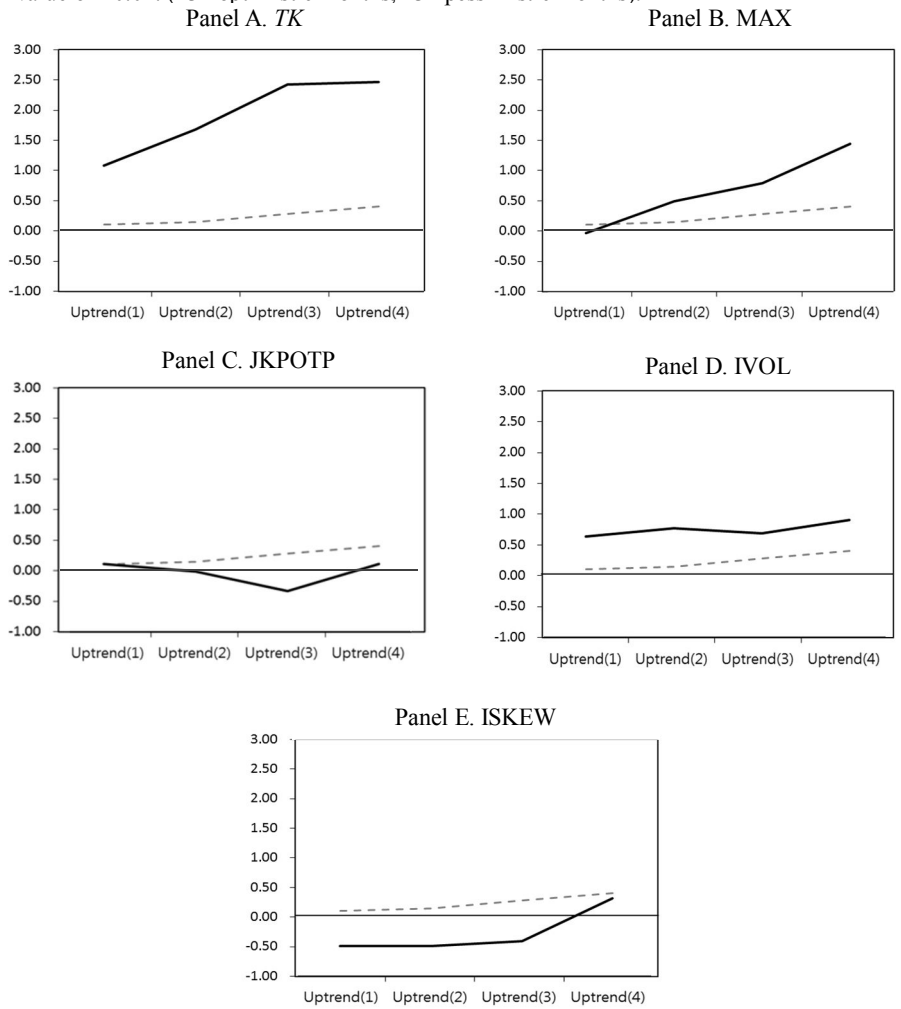

Figure 2. Returns and Uptrend, 1 to 4 Consecutive Months

This figure plots the value-weighted excess returns of the long–short strategy (decile1 to decile 10) for each lottery anomaly, namely, TK, MAX, JKPOTP, IVOL, and ISKEW. Investor

sentiment is measured using the monthly sentiment index ($SENTIMENT^{\perp}$) constructed by Baker and Wurgler (2006). This index is orthogonalized to recession indicators. *Uptrend(n)* exists if the BW index increased in over *n* consecutive prior months. The bold lines are the excess returns of each anomaly, whereas the dotted lines are the investor sentiment index level for each *Uptrend (n)* period. The period with *Uptrend (1)* includes 282 months, *Uptrend (2)* includes 148 months, *Uptrend (3)* includes 78 months, and *Uptrend (4)* includes 42 months. The sample period is from August 1965 to December 2012, except for the jackpot probability, the data of which begin after January 1972.

Table 1. Summary Statistics

This table presents the summary statistics for the key variables used in this study. These variables are defined in Appendix A. *Uptrend (n)* is defined as the period with the increase in sentiment index ($SENTIMENT^{\perp}$) in over *n* consecutive prior months. Panel A presents the statistics for all firm months when data are available for each variable. Panel B presents the statistics for the sub-sample period when sentiment is uptrend (i.e., when the sentiment index increases in two subsequent periods). Panel C shows the statistics for the sub-sample period when sentiment is downtrend (i.e., when sentiment index increases in two subsequent periods)

	IVOL	*ISKEW*	*JKPOTP*	*MAX*	*TK*
Panel A: Full Sample					
Mean	0.033	0.417	0.022	0.079	−0.061
Standard deviation	0.028	1.276	0.030	0.098	0.039
Minimum	0.000	−8.060	0.442	−0.417	1.084
Maximum	2.309	8.060	0.000	19.000	−0.377
Observations	2,699,367	2,698,436	1,626,242	2,699,945	1,601,871
Panel B: *Uptrend (2)* Subsample					
Mean	0.033	0.449	0.023	0.080	−0.058
Standard deviation	0.028	1.268	0.031	0.096	0.039
Minimum	0.000	−8.002	0.000	−0.369	−0.342
Maximum	1.230	8.054	0.442	9.222	1.084
Observations	714,635	714,396	427,781	714,824	436,234

Table 2. Optimistic Investor Sentiment and Lotteries: Sorts

This table shows the value weighted average excess returns and the Fama–French 3 factor alphas during the months following high and low levels of investor sentiment. Investor sentiment is measured using the monthly sentiment index ($SENTIMENT^{\perp}$) constructed by Baker and Wurgler (2006). This index is orthogonalized to recession indicators. Months with index level above 0 are classified as optimistic months (OPT), whereas months with index level below 0 are classified as pessimistic months (PES). All portfolios are based on deciles: long leg for decile 1 and short leg for decile 10. The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

		Excess Return			FF3 alpha		
	Sentiment State	Long Leg	Short Leg	Long–Short	Long Leg	Short Leg	Long–Short
TK	TOTAL	1.38	0.45	0.93	1.20	0.46	0.73
		(8.25)	(4.45)	(5.15)	(7.28)	(4.59)	(4.23)
	OPT	1.42	0.30	1.11	1.27	0.31	0.96
		(5.31)	(1.84)	(3.74)	(4.76)	(2.03)	(3.29)
	PES	1.34	0.59	0.75	1.13	0.60	0.53
		(6.53)	(4.83)	(3.59)	(5.77)	(4.83)	(2.63)
	OPT–PES	0.07	−0.29	0.36	0.14	−0.29	0.43
		(0.22)	(−1.43)	(1.00)	(0.43)	(−1.46)	(1.20)
MAX	TOTAL	0.67	0.36	0.31	0.63	0.29	0.34
		(8.04)	(2.38)	(1.98)	(7.59)	(2.01)	(2.18)
	OPT	0.79	−0.28	1.07	0.75	−0.29	1.04
		(5.98)	(−1.23)	(4.51)	(6.04)	(−1.34)	(4.78)
	PES	0.56	0.96	−0.40	0.52	0.84	−0.32
		(5.39)	(5.03)	(−2.00)	(4.50)	(4.46)	(−1.52)
	OPT–PES	0.24	−1.24	1.48	0.24	−1.13	1.36
		(1.43)	(−4.17)	(4.76)	(1.44)	(−3.98)	(4.53)
JKPOTP	TOTAL	0.44	0.26	0.18	0.40	0.19	0.21
		(6.47)	(1.51)	(1.08)	(5.89)	(1.09)	(1.20)
	OPT	0.38	−0.65	1.03	0.35	−0.66	1.01
		(3.83)	(−2.48)	(4.03)	(3.59)	(−2.51)	(3.90)
	PES	0.49	1.11	−0.62	0.45	0.99	−0.55
		(5.33)	(5.26)	(−3.02)	(4.97)	(4.73)	(−2.64)
	OPT–PES	−0.11	−1.87	1.76	−0.10	−1.76	4.66
		(−0.83)	(−5.15)	(4.97)	(−0.79)	(−4.95)	(4.78)
IVOL	TOTAL	0.63	0.37	0.33	0.59	0.18	0.41
		(8.35)	(1.54)	(1.66)	(7.87)	(0.93)	(2.08)
	OPT	0.89	−0.64	1.53	0.85	−0.70	1.55
		(7.96)	(−2.59)	(5.85)	(8.07)	(−2.61)	(5.70)

	PES	0.38	1.18	−0.80	0.34	1.01	−0.67
		(3.84)	(4.14)	(−2.89)	(3.35)	(3.87)	(−2.52)
	OPT–PES	0.51	−1.82	2.33	0.51	−1.71	2.22
		(3.39)	(−4.82)	(6.12)	(3.48)	(−4.62)	(5.90)
ISKEW	TOTAL	0.61	1.12	−0.51	0.52	1.02	−0.51
		(6.14)	(10.83)	(−4.56)	(5.13)	(9.78)	(−4.47)
	OPT	0.63	1.03	−0.41	0.55	0.96	−0.41
		(4.31)	(6.31)	(−2.45)	(3.98)	(6.57)	(−2.51)
	PES	0.59	1.19	−0.61	0.48	1.08	−0.60
		(4.37)	(9.36)	(−4.03)	(3.57)	(7.62)	(−3.80)
	OPT–PES	0.04	−0.16	0.20	0.07	−0.12	0.19
		(0.21)	(−0.76)	(0.89)	(0.37)	(−0.61)	(0.86)

Table 3. Sentiment Uptrend and Lotteries: Sorts

This table presents the value-weighted average returns and Fama–French 3 factor alpha during the months when the *Uptrend (2)* dummy is equal to 1. Investor sentiment is measured using the monthly sentiment index ($SENTIMENT^{\perp}$) constructed by Baker and Wurgler (2006). This index is orthogonalized to recession indicators. *Uptrend (2)* is the dummy variable assigned for each month; we use 1 if the index increased in over two consecutive prior months, otherwise 0. Months having 1 for the *Uptrend (2)* dummy are classified as uptrend months (UP), whereas months having 0 for the dummy are classified as other months (OTHER). Portfolios are based on decile sorting: long leg for decile 1 and short leg for decile 10. The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

		Excess Return			FF3 alpha		
	Sentiment State	Long Leg	Short Leg	Long–Short	Long Leg	Short Leg	Long–Short
TK	UP	1.70	0.02	1.68	1.61	0.10	4.51
		(4.40)	(0.09)	(3.84)	(4.11)	(0.50)	(4.44)
	OTHER	1.26	0.61	0.65	1.05	0.60	0.45
		(7.07)	(5.20)	(3.53)	(5.99)	(5.13)	(2.15)
	UP–OTHER	0.43	−0.60	1.02	0.56	−0.50	1.06
		(1.01)	(−2.62)	(2.17)	(1.30)	(−2.30)	(2.68)
MAX	UP	0.40	−0.09	0.49	0.38	0.05	0.33
		(2.31)	(−0.29)	(1.50)	(2.35)	(0.17)	(1.15)
	OTHER	0.77	0.52	0.25	0.73	0.39	0.34
		(8.20)	(3.04)	(1.39)	(7.63)	(2.26)	(1.93)
	UP–OTHER	−0.37	−0.61	0.24	−0.35	−0.34	−0.01
		(−1.99)	(−1.76)	(0.64)	(−1.87)	(−1.08)	(−0.04)
JKPOTP	UP	0.24	0.25	−0.01	0.24	0.36	−0.12
		(1.84)	(0.66)	(−0.02)	(1.94)	(0.95)	(−0.32)
	OTHER	0.51	0.26	0.25	0.46	0.13	0.33
		(6.46)	(1.39)	(1.37)	(5.81)	(0.69)	(1.78)
	UP–OTHER	−0.28	−0.02	−0.26	−0.22	0.23	−0.45
		(−1.83)	(−0.04)	(−0.63)	(−1.50)	(0.55)	(−1.09)
IVOL	UP	0.47	−0.30	0.77	0.48	−0.21	0.68
		(3.40)	(−0.94)	(2.33)	(3.53)	(−0.64)	(2.01)

	OTHER	0.61 (7.55)	0.04 (0.21)	0.57 (2.89)	0.56 (6.98)	−0.12 (−0.62)	0.69 (3.48)
	UP–OTHER	−0.14 (−0.88)	−0.34 (−0.91)	0.20 (0.52)	−0.09 (−0.58)	−0.08 (−0.22)	−0.01 (−0.02)
ISKEW	UP	0.48 (2.84)	0.96 (5.21)	−0.49 (−2.57)	0.44 (2.63)	0.93 (4.49)	−0.49 (−2.22)
	OTHER	0.65 (5.45)	1.17 (9.50)	−0.52 (−3.80)	0.54 (4.74)	1.06 (8.49)	−0.52 (−3.86)
	UP–OTHER	−0.17 (−0.78)	−0.20 (−0.90)	0.03 (0.13)	−0.10 (−0.50)	−0.13 (−0.59)	0.03 (0.13)

Table 4. Sentiment Uptrend and Returns: Predictive Regressions for Excess Returns

This table presents the estimates of the coefficients in the regression as follows:

$$R_{i,t} = a + b_{sent} * Sent_{t-1} + b_{up} * Uptrend_{t-1} + c * Sent_{t-1} * Uptrend_{t-1},$$

where $R_{i,t}$ is the excess return in month *t* on either the long leg, short leg, or the difference; $Sent_t$ is the level of investor sentiment index orthogonalized to recession indicators ($SENTIMENT^{\perp}$); and $Uptrend_t$ is the dummy variable equal to 1 if the index increased in over two consecutive prior months (*Uptrend[2]*). The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

Anomaly	Long Leg			Short Leg			Long–Short		
	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c
TK	−0.24 (−1.42)	0.39 (0.99)	1.03 (1.57)	0.01 (0.02)	−0.57 (−2.53)	−0.59 (−2.33)	−0.24 (−1.38)	0.96 (2.18)	1.61 (2.29)
MAX	0.06 (0.57)	−0.37 (−1.92)	−0.09 (−0.40)	−0.74 (−4.84)	−0.52 (−1.62)	−0.76 (−1.97)	1.74 (5.18)	1.48 (0.43)	0.68 (1.86)
JKPOTP	0.00 (0.01)	−0.26 (−1.76)	−0.27 (−1.67)	−0.99 (−6.12)	0.03 (0.08)	0.34 (0.70)	0.99 (6.62)	−0.30 (−0.74)	−0.61 (−1.37)
IVOL	0.08 (0.99)	−0.15 (−0.90)	−0.05 (−0.31)	−1.21 (−7.02)	−0.25 (−0.71)	−0.11 (−0.32)	1.29 (7.54)	0.11 (0.30)	0.06 (0.16)
ISKEW	0.05 (0.46)	−0.17 (−0.84)	−0.06 (−0.26)	−0.65 (−2.93)	−0.18 (−0.82)	0.03 (0.14)	0.41 (3.20)	0.01 (0.02)	−0.09 (−0.36)

Table 5. Sentiment Uptrend and Returns: Predictive Regressions for Benchmark-adjusted Returns

This table presents the estimates of the coefficients in the regression as follows:

$$R_{i,t} = a + b_{sent} * Sent_{t-1} + b_{up} * Uptrend_{t-1} + c * Sent_{t-1} * Uptrend_{t-1} + \mathrm{d} * RMRF_t + e * SMB_t + f * HML_t,$$

where $R_{i,t}$ is the excess return in month *t* on either the long leg, short leg, or the difference; $Sent_t$ is the level of Investor Sentiment index orthogonalized to recession indicators ($SENTIMENT^{\perp}$); and $Uptrend_t$ is the dummy variable equal to 1 if the index increased in over two consecutive prior months (*Uptrend(2)*). Reported further are the returns on the value-weighted strategies of Fama–French (1993). The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

Anomaly	Long Leg			Short Leg			Long–Short		
	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c
TK	−0.17 (−1.02)	0.53 (1.29)	1.05 (1.65)	−0.01 (−0.13)	−0.49 (−2.24)	−0.42 (−1.69)	−0.15 (−0.87)	1.01 (2.28)	1.48 (2.16)
MAX	0.05 (0.52)	−0.35 (−1.89)	−0.03 (−0.12)	−0.66 (−4.40)	−0.28 (−0.95)	−0.65 (−1.91)	0.71 (4.63)	−0.06 (−0.22)	0.62 (1.80)
JKPOTP	0.00 (0.04)	−0.21 (−1.46)	−0.19 (−1.18)	−0.93 (−5.93)	0.26 (0.63)	0.44 (0.92)	0.93 (6.18)	−0.46 (−1.16)	−0.62 (−1.45)
IVOL	0.07 (0.99)	−0.09 (−0.62)	0.03 (0.20)	−1.14 (−6.98)	−0.03 (−0.09)	−0.02 (−0.05)	1.21 (7.29)	−0.06 (−0.17)	0.05 (0.13)
ISKEW	0.08 (0.71)	−0.11 (−0.52)	−0.02 (−0.09)	−0.32 (−2.72)	−0.12 (-0.55)	0.04 (0.18)	0.40 (3.16)	0.01 (0.06)	−0.06 (−0.25)

Table 6. Optimism and Sentiment Uptrend: Sorts

This table shows the value-weighted average returns and the Fama–French 3 factor alpha during the months when the *Uptrend (2)* dummy is equal to 1 and investor sentiment is above 0 (total of 77 months out of 266 optimistic months). Investor sentiment is measured using the monthly sentiment index ($SENTIMENT^{\perp}$) constructed by Baker and Wurgler (2006). This index is orthogonalized to recession indicators. *Uptrend (2)* is the dummy variable assigned for each month; we use 1 if the index increased in over two consecutive prior months, otherwise 0. Months having 1 for the *Uptrend (2)* dummy are classified as uptrend months (UP), whereas months having 0 for the dummy are classified as other months (OTHER). Portfolios are based on decile sorting: long leg for decile 1 and short leg for decile 10. The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

		Excess Return			FF3 alpha		
	Trend	Long Leg	Short Leg	Long–Short	Long Leg	Short Leg	Long–Short
TK	UP(2)	2.15	−0.42	2.57	2.05	−0.32	2.37
		(3.15)	(1.45)	(3.36)	(2.94)	(−1.20)	(3.18)
	OTHER	1.12	0.60	0.52	0.93	0.56	0.37
		(4.53)	(3.06)	(1.95)	(3.66)	(2.95)	(1.33)
	UP–OTHER	1.04	−1.01	2.05	1.12	−0.88	2.00
		(1.43)	(−2.92)	(2.53)	(1.51)	(−2.68)	(2.48)
MAX	UP(2)	0.47	−0.83	1.30	0.42	−0.59	1.02
		(1.69)	(−1.75)	(2.56)	(1.66)	(−1.44)	(2.39)
	OTHER	0.93	−0.06	0.98	0.85	−0.17	1.02
		(6.33)	(−0.22)	(3.74)	(5.89)	(−0.65)	(3.88)
	UP–OTHER	−0.45	−0.80	0.32	−0.43	−0.43	0.00
		(−1.44)	(−1.43)	(0.55)	(−1.46)	(−0.90)	(0.01)
JKPOTP	UP(2)	−0.02	−0.02	0.01	−0.05	0.14	−0.18
		(−0.08)	(−0.04)	(0.01)	(−0.24)	(0.22)	(−0.30)
	OTHER	0.54	−0.91	1.46	0.47	−1.01	1.48
		(4.82)	(−3.32)	(5.68)	(4.15)	(−3.76)	(5.86)
	UP–OTHER	−0.56	0.89	−1.45	−0.51	1.16	−1.67
		(−2.48)	(1.34)	(−2.20)	(−2.38)	(1.74)	(−2.55)
IVOL	UP(2)	0.53	−1.03	1.56	0.49	−0.83	1.32
		(2.38)	(−2.10)	(2.98)	(2.28)	(−1.63)	(2.43)

	OTHER	0.70 (6.06)	−0.88 (−3.04)	1.58 (5.26)	0.63 (5.46)	−0.93 (−3.17)	1.56 (5.10)
	UP–OTHER	−0.18 (−0.71)	−0.15 (−0.26)	−0.03 (−0.05)	−0.14 (−0.56)	0.11 (0.19)	−0.24 (−0.40)
ISKEW	UP(2)	0.46 (1.83)	0.80 (2.62)	−0.35 (−1.19)	0.38 (1.47)	0.73 (2.38)	−0.35 (−1.15)
	OTHER	0.70 (3.94)	1.13 (5.83)	−0.43 (−2.15)	0.60 (3.29)	0.99 (5.17)	−0.39 (−1.95)
	UP-OTHER	−0.24 (−0.79)	−0.33 (−0.91)	0.05 (0.24)	−0.22 (−0.69)	−0.26 (−0.71)	0.04 (0.12)

Table 7. Pessimism and Sentiment Uptrend: Sorts

This table presents the value-weighted average returns and Fama–French 3 factor alpha during the months when the *Uptrend(2)* dummy is equal to 1 and investor sentiment is below 0 (71 months out of the 282 pessimistic months). Investor sentiment is measured using the monthly sentiment index ($SENTIMENT^{\perp}$) constructed by Baker and Wurgler (2006). This index is orthogonalized to recession indicators. *Uptrend (2)* is the dummy variable assigned for each month; we use 1 if the index increased in over two consecutive prior months, otherwise 0. Months having 1 for the *Uptrend (2)* dummy are classified as uptrend months (UP), whereas months having 0 for the dummy are classified as other months (OTHER). Portfolios are based on decile sorting: long leg for decile 1 and short leg for decile 10. The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

		Excess Return			FF3 alpha		
	Trend	Long Leg	Short Leg	Long–Short	Long Leg	Short Leg	Long–Short
TK	UP	1.20 (4.07)	0.49 (1.93)	0.71 (2.11)	1.13 (3.64)	0.54 (2.15)	0.59 (1.70)
	OTHER	1.39 (5.44)	0.63 (4.49)	0.77 (3.00)	1.13 (4.75)	0.63 (4.46)	0.50 (2.12)
	UP–OTHER	−0.20 (−0.51)	−0.14 (−0.49)	−0.06 (−0.14)	−0.00 (−0.01)	−0.09 (−0.34)	0.09 (0.22)
MAX	UP	0.32 (1.64)	0.71 (2.09)	−0.39 (−1.06)	0.32 (1.67)	0.73 (2.24)	−0.42 (−1.13)
	OTHER	0.64 (5.28)	1.04 (4.60)	−0.40 (−1.71)	0.61 (4.87)	0.89 (4.03)	−0.28 (−1.23)
	UP–OTHER	−0.32 (−1.38)	−0.33 (−0.80)	0.00 (0.02)	−0.16 (−0.41)	−0.16 (−0.41)	−0.13 (−0.30)
JKPOTP	UP	0.51 (3.22)	0.54 (1.28)	−0.03 (−0.06)	0.54 (3.64)	0.59 (1.41)	−0.05 (−0.12)
	OTHER	0.49 (4.36)	1.31 (5.36)	−0.82 (−3.47)	0.44 (3.99)	1.16 (4.81)	−0.72 (−2.98)
	UP–OTHER	0.02 (0.12)	−0.77 (−1.59)	0.79 (1.69)	0.10 (0.55)	−0.57 (−1.21)	0.67 (1.46)
IVOL	UP	0.41 (2.54)	0.49 (1.29)	-0.08 (-0.21)	0.44 (2.88)	0.48 (1.14)	-0.04 (-0.11)

	OTHER	0.54 (4.71)	0.86 (3.21)	−0.33 (−1.34)	0.50 (4.42)	0.58 (2.26)	−0.09 (−0.38)
	UP-OTHER	−0.12 (−0.61)	−0.37 (−0.80)	0.25 (0.56)	−0.05 (−0.29)	−0.10 (−0.24)	0.05 (0.12)
ISKEW	UP	0.51 (2.25)	1.15 (5.78)	−0.64 (−2.71)	0.50 (2.35)	1.12 (5.70)	−0.62 (−2.59)
	OTHER	0.61 (3.78)	1.21 (7.71)	−0.59 (−3.22)	0.48 (3.03)	1.12 (7.02)	−0.64 (−3.33)
	UP–OTHER	−0.10 (−0.38)	−0.05 (−0.22)	−0.05 (−0.16)	0.02 (0.07)	0.00 (−0.02)	0.02 (0.08)

Table 8. Optimism and Sentiment Uptrend: Predictive Regressions for Benchmark Returns

This table shows the estimates of the coefficients in the regression as follows:

$$R_{i,t} = a + b_{sent} * Sent_{t-1} + b_{up} * Uptrend_{t-1}$$
$$+c_{pes} * Sent_{t-1} * Uptrend_{t-1} * Opt_{t-1} + c_{opt} * Sent_{t-1} * Uptrend_{t-1} * Pes_{t-1}$$
$$+ \mathrm{d} * RMRF_t + e * SMB_t + f * HML_t,$$

where $R_{i,t}$ is the excess return in month *t* on either the long leg, short leg, or the difference; $Sent_t$ is the level of the BW investor sentiment index (unorthogonalized to macroeconomic factors); and $Uptrend_t$ is the dummy variable that equals 1 if the index has increased in over two consecutive prior months. Opt_t is the dummy variable equal to 1 if $Sent_t$ is above the index median, and Pes_t is the dummy variable equal to 1 if the index is below the index median. Reported further are returns on the value-weighted strategies of Fama–French (1993). The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

	Long Leg				Short Leg				Long–Short			
	b_{sent}	b_{up}	c_{opt}	c_{pes}	b_{sent}	b_{up}	c_{opt}	c_{pes}	b_{sent}	b_{up}	c_{opt}	c_{pes}
TK	−0.17	0.26	1.42	0.58	−0.01	−0.15	−0.87	0.16	−0.15	0.41	2.30	0.42
	(−1.04)	(0.65)	(1.24)	(1.04)	(−0.11)	(−0.56)	(−2.26)	(0.41)	(−0.90)	(0.92)	(1.84)	(0.73)
MAX	0.05	−0.30	−0.09	0.06	−0.66	0.31	−1.45	0.39	0.71	−0.61	1.36	−0.33
	(0.52)	(−1.41)	(−0.30)	(0.17)	(−4.37)	(0.76)	(−2.44)	(0.83)	(4.60)	(−1.48)	(2.35)	(−0.67)
JKPOTP	0.00	−0.04	−0.42	0.11	−0.92	0.32	0.35	0.54	0.93	−0.35	−0.77	−0.43
	(0.06)	(−0.21)	(−1.72)	(0.45)	(−5.93)	(0.63)	(0.44)	(0.88)	(6.19)	(−0.69)	(−1.05)	(−0.76)
IVOL	0.07	−0.08	0.01	0.06	−1.13	0.25	−0.39	0.47	1.21	−0.33	0.41	−0.41
	(1.00)	(−0.42)	(0.05)	(0.22)	(−6.96)	(0.51)	(−0.75)	(0.90)	(7.27)	(−0.69)	(0.67)	(−0.79)
ISKEW	0.08	−0.02	−0.14	0.13	−0.32	−0.13	0.06	0.03	0.40	0.11	−0.20	0.11
	(0.72)	(−0.07)	(−0.43)	(0.41)	(−2.72)	(−0.51)	(0.14)	(0.09)	(3.17)	(0.38)	(−0.50)	(0.28)

Table 9. Unorthogonalized Investor Sentiment and Returns: Predictive Regressions for Benchmark Returns

This table presents the estimates of the coefficients in the regression as follows:

$$R_{i,t} = a + b_{sent} * Sent_{t-1} + b_{up} * Uptrend_{t-1} + c * Sent_{t-1} * Uptrend_{t-1} + \mathrm{d} * RMRF_t + e * SMB_t + f * HML_t,$$

where $R_{i,t}$ is the excess return in month t on either the long leg, short leg, or the difference; $Sent_t$is the level of the BW investor sentiment index (unorthogonalized to macroeconomic factors); and $Uptrend_t$ is the dummy variable equal to 1 if the index has increased in over two consecutive prior months. Reported further are returns on value-weighted strategies of Fama–French (1993). The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

Anomaly	Long Leg			Short Leg			Long–Short		
	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c
TK	0.00 (0.02)	0.82 (2.15)	0.12 (0.24)	0.05 (0.39)	−0.12 (−0.57)	−0.33 (−1.50)	−0.05 (−0.22)	0.94 (2.31)	0.45 (0.84)
MAX	0.13 (1.20)	−0.10 (−0.57)	−0.26 (−1.43)	−0.56 (−3.46)	0.04 (0.14)	−0.70 (−2.36)	0.69 (3.89)	−0.14 (−0.42)	0.45 (1.46)
JKPOTP	0.08 (0.98)	0.15 (1.10)	−0.28 (−1.98)	−0.82 (−5.02)	0.40 (1.10)	−0.24 (−0.66)	0.89 (5.56)	−0.26 (−0.72)	−0.03 (−0.10)
IVOL	0.09 (1.19)	0.25 (1.69)	−0.05 (−0.34)	−0.88 (−4.66)	0.03 (0.09)	−0.73 (−2.41)	0.98 (5.54)	0.22 (0.63)	0.68 (2.04)
ISKEW	0.13 (1.05)	0.03 (0.16)	−0.13 (−0.63)	−0.28 (−2.27)	0.12 (0.59)	−0.14 (−0.59)	0.42 (2.95)	−0.09 (−0.41)	0.01 (0.04)

Table 10. Sentiment Trend(3) and Anomalies: Predictive Regressions for Benchmark Returns

This table shows the estimates of the coefficients in the regression as follows:

$$R_{i,t} = a + b_{sent} * Sent_{t-1} + b_{up} * Uptrend(3)_{t-1} + c * Sent_{t-1} * Uptrend_{t-1} + \mathrm{d} * RMRF_t + e * SMB_t + f * HML_t,$$

where $R_{i,t}$ is the excess return in month t on either the long leg, short leg, or the difference; $Sent_t$ is the level of the investor sentiment index; and $Uptrend(3)_t$ is the dummy variable equal to 1 if the index has increased in over three consecutive prior months. Reported further are returns on the value-weighted strategies of Fama–French (1993). The sample period is from August 1965 to December 2010, except for the jackpot probability, the data of which begin in January 1972. All t-statistics reported are the heteroskedasticity-consistent standard errors of White (1980).

Anomaly	Long Leg			Short Leg			Long–Short		
	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c	b_{sent}	b_{up}	c
TK	−0.01 (−0.06)	−0.17 (−0.32)	0.37 (0.63)	−0.10 (−0.87)	−0.18 (−0.45)	−0.79 (−1.86)	0.08 (0.38)	0.01 (0.02)	1.59 (1.96)
MAX	0.05 (0.54)	−0.13 (−0.54)	−1.01 (−0.38)	−0.79 (−5.10)	−0.36 (−0.86)	−1.04 (−2.28)	0.84 (5.14)	0.23 (0.52)	0.94 (1.95)
JKPOTP	−0.01 (−0.13)	−0.31 (−1.71)	−0.22 (−1.05)	−0.91 (−6.16)	0.44 (0.77)	0.69 (0.95)	0.91 (6.42)	−0.75 (−1.33)	−0.91 (−1.36)
IVOL	0.07 (0.89)	−0.17 (−0.89)	0.00 (−0.02)	−1.24 (−7.86)	0.02 (0.04)	−0.03 (−0.05)	1.30 (8.33)	−0.19 (−0.39)	0.02 (0.04)
ISKEW	0.03 (0.29)	−0.22 (−0.89)	0.10 (0.39)	−0.35 (−3.07)	−0.25 (−0.95)	0.05 (0.14)	0.37 (3.28)	0.03 (0.10)	0.05 (0.14)

국문 초록

투자자 심리의 추세가 복권형 주식의 가격 결정에 미치는 영향

서울대학교 대학원

경영학과 재무금융전공

임 찬

기존의 투자자 심리에 관한 이론연구에 기반하여, 본 연구는 투자자 심리의 추세가 복권형 주식의 가격결정에 횡단면 적으로 어떤 영향을 미치는지 살펴보았다. 상승추세가 관측되었을 때 주가의 고가책정이 예측된 바, 이는 투자자들이 시장이 계속 호황을 유지할 가능성을 최근의 추세를 근거로 과대평가하기 때문이다. 또한 공매도 계약 상의 제약으로 인해, 상승추세의 효과는 전반적인 시장 심리가 긍정적일 때만 나타날 것으로 예상된다. 복권형 이상현상에 기반한 롱숏전략의 수익률은 상기의 예상에 잘 부합하고 있다.

주요어: 심리 추세, 투자자 심리, 복권

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