

# “Investor sentiment of lottery stock- evidence from the Taiwan stock market”

<b>AUTHORS</b>	Yu-Min Wang Chun-An Li Chia-Fei Lin
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Yu-Min Wang (Taiwan), Chun-An Li (Taiwan), Chia-Fei Lin (Taiwan)

## Investor sentiment of lottery stock – evidence from the Taiwan stock market

### Abstract

This paper examines whether lottery features preference impacts returns and volatility of Taiwan listed stock. The work employs the idiosyncratic price and idiosyncratic volatility (Kumar, 2009), which measure stock with lottery features. Our empirical results show that in regions with higher distraction affect the stock return more than low religion's. Moreover, a rise or fall in investor sentiment does affect stock volatility, particularly the bullish sentiment. The paper showed that the investor sentiment plays an important role for capturing the returns and volatility in the financial market.

**Keywords:** sentiment, lottery stock, gambling.

**JEL Classification:** G10, G14.

### Introduction

Since the traditional financial theory cannot illustrate the process of financial asset pricing, many researchers have begun to examine the behavior of investors. And the most efficacious index measure of investor sentiment is currently used within the financial markets.

In the prior studies on the effects of investor sentiment, there has tended to be a general focus on the relationship between investors and the stock market. Additionally, previous studies have emphasized the potential role of gambling in investment decisions (e.g., Shiller, 1984; Shefrin and Statman, 2000; Statman, 2002; Barberis and Huang, 2008). The extant evidence from lottery studies indicates that the heaviest lottery players are poor, young, and relatively less educated, single men. Therefore, our main conjecture is that investor sentiment effect is different in lottery-type stocks. We hope this article can be provided to individual investors as investment reference.

We begin our tests with the Taiwan stock market, and we employ measure of lottery stock following Kumar (2009); low stock price, high idiosyncratic return volatility and high idiosyncratic return skewness. From the Dorn et al. (2009), we forgo the idiosyncratic skewness because many company characteristic variables are unavailable. The lottery-type stocks have very low prices relative to the highest potential payoff, they have low negative expected returns, their payoff is risky and they have an extremely small probability of a huge reward. With this motivation, we use the empirical definition of lottery-type stocks to observe investor sentiment effect. The empirical results provide evidence of strong spillover effect between the sentiment and lottery-type stock.

Our paper would like to help clarify the channel by which investor sentiment influences stock prices. Baker and Wurgler (2006) show investor sentiment disproportionately affects the prices of stocks that are small, and exhibit extreme growth or distress, which they attribute to more subjective valuations and limits to arbitrage. Kumar (2009) shows that lottery-type stocks are overweighted in portfolio of retail investors but not in those of institutional investors. Green and Hwang (2010) found that it is the lottery-like features of these stocks, combined with a stronger preference for skewness among certain investors that leads to overpricing during periods of high investor sentiment.

Overall, our study would like to improve the relation between investor sentiment and financial market that adopting the concept of lottery-type stocks. The remainder of this paper is organized as follows. Section 1 presents a discussion of the data source and the empirical model adopted for this study. The empirical results and the impact of investor sentiment are presented in section 2, with the conclusions drawn from this study being presented in the final section.

### 1. Data and methodology

**1.1. Data source.** We use the daily closing price and other variables of Taiwan listed company from the Taiwan Economics Journal (TEJ) database covering the period from 3 January 2001 to 31 October 2010. Taiwan's stock market is mainly made up by domestic individual investors who constituted about 67.95% of market volume in 2010. And Chui and Wei (1998) found that Taiwan market has the largest standard deviation of monthly excess returns among the Pacific-Basin emerging markets. Titman and Wei (1999) attribute this phenomenon probably to the investor sentiment. As shown above, these peculiar characteristics in Taiwan's stock market enable us to test the prevalence of investor's behavior. Form Kumar (2009), then we would measure

lottery features with logarithmic price and idiosyncratic volatility. We forgo the expected idiosyncratic skewness because many firm characteristic variables are unavailable. Stock price is a measure at the end of the trading day. I use stock price as one of the defining of lottery-type stocks, the investors would look for relative cheap bets. Idiosyncratic volatility is the standard deviation of residual returns from a CAPM model of daily returns. High idiosyncratic volatility inflates the perception of the chance to realize high returns, thus attracting stock market gamblers. Following Ang, Hodrick, Hodrick, Xing, and Zhang (2006), it is defined as the standard deviation, where

$$SI_1 = \text{Buy-Sell Imbalance } (BSI_t) = \frac{BS_t}{ABS_t}, \tag{1}$$

$$SI_2 = \text{Margin Lending Ratio} = \frac{\text{Margin lending on funds}}{\text{Margin lending on securities}}, \tag{2}$$

$$SI_3 = \text{Turnover Ratio} = \frac{\text{Volume}}{\text{Shares Outstanding}} \times 100\% . \tag{3}$$

The first sentiment indicator is buy-sell imbalance ( $BSI_t$ ). The  $B_t$  ( $S_t$ ) denotes the buy (sell) value of institutional investors on day  $t$ .  $BS_t$  denotes  $B_t - S_t$ , and  $ABS_t$  is the average of  $B_t - S_t$ , with  $BSI_t$  being positive (negative) when the investor group buys (sells) more securities than it sells (buys) on day  $t$ .

And the margin lending ratio is another measure of spot market sentiment. If the market becomes bullish, they would lend on funds more than lending on securities. Turnover ratio, or liquidity, the ratio of trading volume to the number of shares listed on the Taiwan Stock Exchange, is a simple proxy for this concept and can be considered as an investment index. Baker and Stein (2004) argue that if short-selling is costlier than opening and closing long positions, irrational investors are more likely to trade, and thus add liquidity. More generally, Scheinkman and Xiong (2003) recommend volume reveals underlying difference of opinion.

Table 1 presents the descriptive statistics about excess return and the sentiment data. Following

residual returns are estimated from the Fama and French (1993) three-factor model. And then, we consider all Taiwan stocks and assume that stocks in the lowest (highest) 20% stock price and the highest (lowest) 20% idiosyncratic volatility are likely to be constructed a lottery-type stock or high religion lottery stocks (unlottery-type stock or low religion lottery stocks).

The investor sentiment index was constructed by Wang et al. (2006) and Simon and Wiggins (2001). In the study, we adopt three proxies to measure the investor sentiment on the Taiwan stock market.

Ang, Hodrick, Hodrick, Xing, and Zhang (2006), we divided all Taiwan stocks into five equal parts. And the paper assume that stocks in the lowest (highest) 20% stock price and the highest (lowest) 20% idiosyncratic volatility are likely to be constructed a lottery-type stock (unlottery-type stock). As reported in Panel A of Table 1 the high religion lottery stock have 31 companies. The average price is 11 dollar/per share. And the low religion lottery stock costs probably 32 dollar/per share, it has 15 companies. This study shows that low lottery shares mostly well-known and traditional industries stocks in the Taiwan stock market.

In addition, the table shows all of indices being leptokurtic and also displaying excess kurtosis. It is necessary to adopt the GARCH model for the distributions, which effectively encompasses the features of asymmetry and fat tails.

The asymmetric volatility of investor sentiment is explained by the Glosten, Jagannathan and Runkle “GJR-GARCH” model. Our study measures sentiment and lottery-type stocks at daily frequencies.

Table 1. Descriptive statistics

Indices	Mean	Max.	Min.	Std. dev.	Skewness	Kurtosis	Jarque-Bera <sup>a</sup>
Panel A. High religion lottery stock (31companies)							
$R_t$	0.0210%	9.5000%	-8.4300%	2.8053	0.0835	3.7049	1496.4830***
Price	10.8715	157.3400	1.2400	10.3578	5.5086	46.3818	571320***
$S_1$	1	11359.55	-6532.831	149.1898	6.4568	715.2587	1450000***
$S_2$	1.5420	151.0200	0.0000	4.1659	7.4714	107.8622	3199225***
$S_3$	0.8249	38.3700	0.0001	1.3298	4.8857	49.3288	6390099***

Table 1 (cont.). Descriptive statistics

Indices	Mean	Max.	Min.	Std. dev.	Skewness	Kurtosis	Jarque-Bera <sup>a</sup>
Panel B. Low religion lottery stock (15companies)							
$R_t$	0.0770%	6.7600%	-7.8600%	2.3512	0.0996	4.5763	3770.581***
Price	31.3629	95.0000	0.6000	19.3462	0.4934	2.4397	1923.167***
$S_1$	1	8737.0770	-3902.6330	57.9222	87.1871	15018.03	33700000***
$S_2$	5.3928	90.5800	0.0000	9.6988	3.3970	17.6224	388297.8***
$S_3$	0.6708	24.5100	0.0004	1.2652	4.8845	40.5067	2243700***

Notes: <sup>a</sup> The Jarque-Bera (JB) test concludes normality (or a critical value of 5%) and the series are leptokurtic. \*\*\* Indicates significance at the 1% level.

**1.2. The GJR-GARCH model for the lottery-type stock of investor sentiment.** To analyze the effects of investor sentiment in the Taiwan stock market, we propose a GJR-GARCH(1,1) model and we then model investor sentiment as follows:

$$r_t = \theta_0 + \theta_1 h_t + \theta_2 \Delta SI_t + \varepsilon_t, \quad (4)$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \varepsilon_{t-1}^2 I_{t-1} + \gamma_3 h_{t-1} + \gamma_4 (\Delta SI_{t-1})^2, \quad (5)$$

$$\varepsilon_t \sim N(0, h_t), \quad (6)$$

where  $\theta_2$  is the spillover effects of the returns, which explains how investor sentiment affect returns in the spot market; and  $\varepsilon_{i,t}$  is the error term, which follows normal distribution.

Equation (5) is the variation equation, where (1)  $I_{t-1} = 1$  if  $\varepsilon_{t-1} \leq 0$ , and (2)  $I_{t-1} = 0$  if  $\varepsilon_{t-1} > 0$ ; we expect  $\gamma_2$  to measure the bad news causing the volatility effect. In general, when sentiment in the spot market is higher, this can raise the overall level of confidence in the financial market. Thus, in the present study, we expect to find a significantly positive coefficient on investor sentiment in the lottery or unlottery stock. We use  $(\Delta SI_t)^2$  to measure the volatility of investor sentiment, and  $\text{Var}(\Delta SI_t)$  as the second moment measure of noise trader risk.

Since the mean of the change in sentiment is close to zero, the variance of the change in sentiment can be approximated by  $(\Delta SI_t)^2$ . The coefficient of  $\gamma_4$  captures the sentiment effect of the magnitude of the shifts in the lottery or non-lottery stock market on volatility formation within the futures market. The above models all describe the same period.

**1.3. The asymmetric volatility of investor sentiment for the lottery-type stock.** With a rise or fall in investor sentiment, there will be corresponding fluctuations in the stock market; this is because such fluctuations allow investors to avoid risk more easily and thereby increase their profits. An examination of this topic has already been under-

taken by Lee et al. (2002); we also include this topic in our discussion.

$$r_t = \theta_0 + \theta_1 h_t + \theta_2 \Delta SI_t + \varepsilon_t, \quad (7)$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \varepsilon_{t-1}^2 I_{t-1} + \gamma_3 h_{t-1} + \gamma_4 (\Delta SI_{t-1})^2 D_{t-1} + \gamma_5 (\Delta SI_{t-1})^2 (1 - D_{t-1}), \quad (8)$$

$$\varepsilon_t \sim N(0, h_t), \quad (9)$$

$D_{t-1}$  in equation (8) is a dummy variable, where (1)  $D_{t-1} = 0$  if  $\Delta SI_{t-1} \leq 0$ ; and (2)  $D_{t-1} = 1$  if  $\Delta SI_{t-1} > 0$ . The coefficients ( $\gamma_4, \gamma_5$ ) in the conditional volatility equation capture the effects on volatility from the magnitude of the shifts in sentiment.

## 2. Empirical results and analysis

For the high religion lottery stock and low religion lottery stock, we estimate a base model that includes sentiment as an explanatory variable in the mean and conditional volatility equations. The estimated coefficients of the GJR-GARCH models are reported in Table 2. The major findings are summarized below.

First, we find that investor sentiment is an important factor in explaining returns and changes in conditional volatility. In the mean equation for each of the two religion stock indices, a shift in sentiment has a significant positive impact at 1% level on stock return. For example, an increase of 1 percentage point in high religion lottery stock sentiment is associated,  $S_3$ , with 1.01 percentage point increase in stock returns.

We also find that the magnitude of the percentage change in sentiment has a significant impact on the formation of condition volatility, particularly on the turnover ration. Bullish shifts in sentiment in the current period result in statistically significant positive in the volatility of stock returns. The magnitude of the percentage change  $N$  sentiment does appear to lead to alike revisions in volatility. However, the magnitude of the change in sentiment causes the larger revisions in volatility for the high religion lottery stock.

Table 2. Investor sentiment spillover effects

Variables	Panel A: High religion lottery stock			Panel B: Low religion lottery stock		
	$S_{I_1}$	$S_{I_2}$	$S_{I_3}$	$S_{I_1}$	$S_{I_2}$	$S_{I_3}$
$\theta_0$	0.0124 (0.1993)	0.0680 (0.0172)***	0.0104 (0.0151)	0.0711 (0.0159)***	0.0820 (0.0158)***	0.0467 (0.0154)***
$\theta_1$	0.0010 (0.0083)	-0.0048 (0.0026)*	0.0034 (0.0024)	0.0014 (0.0036)	0.0000 (0.0038)	0.0076 (0.0037)**
$\theta_2$	0.0012 (0.0000)***	0.7768 (0.0040)***	1.0082 (0.0081)***	0.0023 (0.0000)***	0.3158 (0.0034)***	0.7909 (0.0110)***
$\gamma_0$	7.8233 (0.9022)***	0.1907 (0.0052)***	0.2878 (0.0068)***	0.0920 (0.0031)***	0.0991 (0.0032)***	0.1172 (0.0038)***
$\gamma_1$	0.1498 (0.0216)***	0.0929 (0.0020)***	0.1244 (0.0028)***	0.0948 (0.0025)***	0.0921 (0.0025)***	0.1037 (0.0029)***
$\gamma_2$	0.0499 (0.0278)***	0.0023 (0.0026)	0.0197 (0.0035)***	0.0068 (0.0034)**	0.0174 (0.0034)***	0.0171 (0.0039)***
$\gamma_3$	0.5994 (0.0435)***	0.8811 (0.0019)***	0.8208 (0.0026)***	0.8879 (0.0022)***	0.8828 (0.0022)***	0.8642 (0.0025)***
$\gamma_4$	-3.25*10 <sup>-7</sup> (5.86*10 <sup>-8</sup> )***	0.0215 (0.0016)***	0.0913 (0.0045)***	-4.14*10 <sup>-7</sup> (2.22*10 <sup>-8</sup> )***	-0.0002 (0.0003)	0.0419 (0.0037)***

Note: The results are based upon the following model:  $R_t = \theta_0 + \theta_1 h_t + \theta_2 \Delta SI_t + \varepsilon_t$ ,  $h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \varepsilon_{t-1}^2 I_{t-1} + \gamma_3 h_{t-1} + \gamma_4 (\Delta SI_{t-1})^2$ ,  $\varepsilon_t \sim N(0, h_t)$ , where, the equation for  $h_t$  is the conditional variance of residuals.  $\theta_2$  measures the futures market returns associated with daily shifts in sentiments.  $\varepsilon_t$  is the error term.  $I_{t-1}$  is the dummy variable to measure bad news or good news.  $\gamma_2$  measures the bad news (or good news) causing the volatility effect.  $(\Delta SI_{t-1})^2$  measures the volatility of investor sentiment. The figures in parentheses are standard errors; \* indicates significance at the 10% level; \*\* indicates significance at the 5% level; and \*\*\* indicates significance at the 1% level.

With a rise or fall in investor sentiment within the stock market, we expect to find different volatility effects being discernible. As shown in Table 3, a rise or fall in investor sentiment does affect stock volatility, particularly the bullish sentiment. The regression results for high religion lottery stock are reported in Panel A of Table 3. Strikingly, the sentiment coefficient estimates are all positive, and statisti-

cally significant at the 1% level. The results from variance regressions indicate that the  $\gamma_4$  are all positive and statistically significant at 1% level. This suggests that an increase in sentiment of good news with a subsequent increase in stock returns. From the  $\gamma_5$ , Panel B of Table 3 reports the same results as Panel A of Table 3. However, it appears the stronger effect in the high religion lottery stock than low religion lottery stock.

Table 3. Investor sentiment asymmetric spillover effects

Variables	Panel A: High religion lottery stock			Panel B: Low religion lottery stock		
	$S_{I_1}$	$S_{I_2}$	$S_{I_3}$	$S_{I_1}$	$S_{I_2}$	$S_{I_3}$
$\theta_0$	0.0761 (0.0173)***	0.0695 (0.0171)***	-0.0244 (0.0149)	0.0708 (0.0159)***	-0.0060 (0.1025)	0.0377 (0.0154)**
$\theta_1$	-0.0067 (0.0025)	-0.0050 (0.0026)**	0.0083 (0.0023)***	0.0018 (0.0036)	0.0119 (0.0132)	0.0094 (0.0036)***
$\theta_2$	0.0014 (0.0000)***	0.7911 (0.0051)***	1.0606 (0.0084)***	0.0023 (0.0000)***	0.3536 (0.0045)***	0.8108 (0.0111)***
$\gamma_0$	0.2005 (0.0056)***	0.1708 (0.0048)***	0.2679 (0.0063)***	0.0903 (0.0031)***	3.5607 (0.1490)***	0.1126 (0.0036)***
$\gamma_1$	0.1053 (0.0023)***	0.0886 (0.0019)***	0.1180 (0.0027)***	0.0951 (0.0026)***	0.0927 (0.0055)***	0.1012 (0.0029)***
$\gamma_2$	-0.0077 (0.0029)***	-0.0001 (0.0026)	0.0211 (0.0033)***	0.0040 (0.0034)	-0.0135 (0.0075)*	0.0171 (0.0038)***
$\gamma_3$	0.8741 (0.0021)***	0.8893 (0.0017)***	0.8294 (0.0025)***	0.8892 (0.0022)***	0.4667 (0.0199)***	0.8672 (0.0025)***
$\gamma_4$	2.5*10 <sup>-7</sup> (8.15*10 <sup>-8</sup> )***	0.0465 (0.0035)***	0.2769 (0.0117)***	-3.25*10 <sup>-7</sup> (3.11*10 <sup>-8</sup> )***	-0.0106 (0.0006)***	0.1108 (0.0100)***
$\gamma_5$	-4.79*10 <sup>-8</sup> (6.28*10 <sup>-8</sup> )	-0.0188 (0.0021)***	-0.1421 (0.0054)***	-6.11*10 <sup>-7</sup> (3.33*10 <sup>-8</sup> )***	-0.0124 (0.0013)***	-0.0353 (-0.0353)***

Note: The model incorporate the effect of changes in investor sentiment as measured by  $\Delta SI_t$ . Dummy variable  $D_{t-1}$  and  $(1 - D_{t-1})$  are used to indicate the direction of changes toward more bullish and bearish sentiment, respectively.  $\mu_t = \theta_0 + \theta_1 h_t + \theta_2 \Delta SI_t + \varepsilon_t$ ,  $h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \varepsilon_{t-1}^2 I_{t-1} + \gamma_3 h_{t-1} + \gamma_4 (\Delta SI_{t-1})^2 D_{t-1} + \gamma_5 (\Delta SI_{t-1})^2 (1 - D_{t-1})$ . In additional,  $\gamma_4$  and  $\gamma_5$  capture the effect of the magnitude of shifts in sentiment on the volatility. \*\* and \*\*\* denote significance at 5% and 1% level. The numbers in parentheses are standard errors.

Given the above results, the change in sentiment tends to be more significant in high religion lottery stock than the low religion lottery stocks. These results indicate that the magnitude of the lottery premium is incrementally affected by the gambling property.

### Conclusion

This article examines the investor sentiment impact of lottery stock in Taiwan. We first separated two lottery stocks, high religion and low religion stock. In doing so it extends the traditional analysis to examine whether lottery stock has increased stock returns by considering the issue of volatility and asymmetric.

We use religion as a proxy for lottery stock and examine whether lottery stock affects stock returns. We focus on Taiwan listed company which the existing literature has suggested the role of gambling, as lottery stock. Our results indicate that in regions with higher distraction affect the stock return more than low religion's. Furthermore, the asymmetric models capture the momentum effects. The models that further allow vary with investor sentiment can often capture the impact of good news and bad news on volatility. Overall, the evidence suggests that investor sentiment plays an important role for capturing the stock returns, especially obvious in the lottery stock.

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