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Do Investors Buy Lotteries in China's Stock Market?

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Abstract

Motivated by existing evidence of individual investors' gambling preference in U.S. stock market (Kumar, 2009), this paper investigates characteristics of lottery-type stocks and individuals' gambling preference in China's stock market. Based on the practice situation of China's stock market, this paper improves existing classification method and defines the lottery-type stocks as stocks with high MAX, high turnover rate, and low price. We show some unique characteristics of lottery-type stocks in China's stock market. The distribution of lottery-type stocks in different industries is unbalanced, and the "lottery" feature is not permanent. The empirical results indicate that individual investors overweight stocks with lottery features in China's stock market. Further, we find that individual investors exhibit a stronger gambling preference in the bull market.

JEL classification numbers: G11, G12
Keywords: Behavioral finance, Gambling preference, Lottery-type stocks, Individual investors

1 Introduction

For thousands of years, gambling has been accompanying the development of human society from the dawn of civilization. People may want to ask that, what kinds of features make gambling activities so attractive. There are lots of studies attempting to find a reasonable explanation in different research areas, such as biology, psychology, sociology, religion and economics.

The most important feature of gambling activities is a very low probability to obtain a tremendous positive return, which usually makes the expected return to be negative. Some researchers find that, in fact, human's gambling psychology and behavior exist not only in lottery games or casino, but also in the investment decision process (Friedman and Savage, 1948; Markowits, 1952). Statman (2002) compares the stock market to gambling, and

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believes that human's gambling behavior and stock investment behavior are similar. In this paper, we investigate characteristics of lottery-type stock and individual investor's gambling preference in China's stock market.

From the perspective of behavioral finance, Kahneman and Tversky (1979) propose a theory to explain this phenomenon. They believe that people tend to allocate higher weight to the specific outcome – low probability to achieve high yield – in their utility maximization process, resulting in people preferring gambling, which has positive skewness in return distribution. Barberis and Huang (2008) expand Kahneman and Tversky's (1992) cumulative prospect theory into security market, and find that a positively skewed security is like a lottery, which can be overpriced, and earns a negative average excess return. And it means that gambling preference will affect investor's investment decision and the market price.

Recently, some empirical studies focus on stocks' lottery features and the investor's gambling preference (Brunnermeier et al., 2007; Kumar, 2009; Kumar et al, 2011; Doran et al, 2012). Most researchers believe high (positive) skewness is an important feature of "lottery-type stock". And there are some other measures similar to a high skewness. For example, Green and Hwang (2012) show that IPO stock has a high expected skewness, which shares with the nature of the lottery. They find that individual investors overprice the IPO stocks, which gives a new explanation for the low average return on IPOs. Conrad et al (2014) believe that stocks of companies with high possibility of bankruptcy are lottery-type ones, with the high skewness of their expected return. Kumar (2009) defines the lottery-type stocks as stocks with high skewness, high volatility and low price. And he points out that individual investors present a strong gambling preference in U.S. stock market.

However, there are two limitations in previous studies. First, although researchers believe that skewness and volatility are two major measures to define lottery-type stocks, it is hard to believe investors, especially individual investors, can compute the expected skewness and volatility to identify lottery-type stocks. Secondly, most previous researches focus on the developed markets, and few of them investigate the situation in emerging markets, like China's stock market. However, as we know, there are some huge differences between developed market and China's stock market. So this paper will consider the actual situation of China's stock market, try to improve classification method of lottery-type stock and investigate the individual investors' gambling preference in China's stock market.

First, based on previous studies and the actual situation of China's stock market, this paper improves the classification method and defines lottery-type stocks as stocks with high MAX (the maximum daily return over the past one month), high turnover rate and low price. MAX and turnover rate are two easy-identified measures, which have strong correlations to idiosyncratic skewness and idiosyncratic volatility. Through the study of China's stock market, in 2001 to 2012, this paper finds that lottery-type stocks have some particular characteristics, like high MAX, high turnover rate, low price, high idiosyncratic skewness, high idiosyncratic volatility, small size, high beta, high P/E ratio and low percentage of institutional investors' holding shares. We analyze the distribution of lottery-type stocks in different industries, and find that, industries with the highest concentration of lottery-type stocks are Textile and garment industry (21.53%), Agriculture, forestry, animal husbandry and fishery (21.85%) and Real estate industry (21.4%). There are 2,499 stocks in our data period, 2001 to 2012. The study shows 1,688 stocks (67.55%) are classified as lottery- type stocks at least once, which means that the

"lottery" feature is not permanent, and changes frequently. However, the nature of the lottery-type stock is relatively stable, and more than 90% of lottery-type stocks will be identified as a lottery-type stock again, in future 12 months.

Second, to examine individual investors' gambling preference in China's stock market, this paper uses a unique data set from a major Chinese securities company. This data set contains all trades and holdings positions of 30,331 retail investors, in the January 2003 to June 2009 period. The individual investors in this data set come from 8 different branches in 6 provinces. Using the data from China's stock market, the study shows a consistent result with what Kumar (2009) finds in US stock market. Due to the gambling psychological preference, individual investors prefer stocks with strong lottery features, and overweight lottery-type stocks in their investment portfolios. We also test how individual investors' aggregate preference for lottery-type stocks varies over time. And the empirical result shows that, individual investors exhibit a strong gambling preference, and this kind of preference is stronger in the bull market.

Compared with the existing literature, the contributions of our research mainly include: first, taking into account actual situation of China's stock market, this paper improves Kumar's (2009) classification method, and uses some observable measures, MAX, turnover rate and price, to identify lottery-type stocks. And it also shows the characteristics of lottery-type stock and the stability of stocks' lottery features in China's stock market. Second, our study is the first study which uses the individual investors trading data set to examine whether individual investors exhibit a stronger preference for lottery-type stocks in the China's stock market. Third, our data set contains individuals' trades in different market situations, bull and bear. It shows that individual investors present a stronger gambling preference, and speculative propensity in the bull market.

Our paper is organized as follows. In section 2, we review the background of China's stock market. Section 3 describes the key hypotheses and the research method. Section 4 shows the individual investors' trading data set and the sample we use in this study. In section 5, we try to find out the characteristics of lottery-type stocks in China's stock market. Section 6 examine whether Chinese individual investors prefer stocks with lottery features. And we conclude in section 7 with a brief summary.

2 What Makes China's Stock Market So Different?

In previous studies, some researchers focus on the investors gambling preference in their investment decisions (Makowiz, 1952; Shiller, 1989; Shefrin and Statman, 2000; Statman, 2002; Baberis and Huang, 2008; Kumar, 2009; Eraker and Ready, 2015). As what we mentioned before, most of the researchers find that investors might prefer to "take large chances of a small loss for a small chance of a large gain", which makes them overprice the lottery-type stocks. And individual investors, who are believed to have psychological biases, exhibit stronger gambling preference in their investments.

However, most of the previous studies focus on the developed stock markets, like US and other European countries. Our paper will be the one of few studies which investigates individual investor's gambling preference in emerging stock market. It needs to be emphasized that there are some huge differences between developed stock market and emerging stock market, like China's. First, individual investors are the major participants in China's stock market. According to statistics from the Shanghai Stock Exchange in 2014, individual investors play a significant role in China's stock market. If we focus on

the trading activities in the market, Chinese individual investors make up 80% of total market trading activities in China's stock market, far larger than institutional investors.
Second, individual investors are in-sophisticated and learning in this market. China is an emerging market whose capitalization and investors base have been growing rapidly. In such a population consisting of relatively new investors, behavior bias and irrational trading preference may be more widespread than in developed markets. And it makes researches on individual investor's behavior more important.
Finally, China's stock market's trading rules are different from developed stock market. From the end of 1996, China's stock market began to practice the price limit rule. Price limit imposes the daily price limit on trading of stocks and mutual funds, with a daily price up/down limit of 10% for stocks and mutual funds and a daily price up/down limit of 5% for stocks under special treatment (ST shares). Price limit is aimed to moderate excessive volatility, mitigate panic behavior, and provide time for reassessment in some other emerging stock markets, not only Chinese (Kim and Yang, 2004). However, some academic researchers have found evidence of costs to impose price limits, like impeding market efficiency.

3 Research Hypothesis and Method

3.1 The Definition of Lottery-type Stocks

From previous studies, researchers consistently show investors prefer stocks with lottery features. But what are the appropriate measures for lottery-type stocks? Kumar (2009) believes that a lottery-type stock should satisfy three characteristics, high idiosyncratic skewness, high idiosyncratic volatility and low price. Following this logic, we try to improve the definition of lottery-type stocks in China's stock market.
Kumar (2009) concludes that there are three salient features of lotteries that can be used to identify lottery-type stocks. First, the major characteristic of the lottery is that a small probability of a huge reward, and a large probability of a small loss. And some researchers used skewness (or idiosyncratic skewness) to measure this lottery feature, and identify the lottery-type stocks. (Barberis and Huang, 2008; Brunnermeier et al., 2007; Kumar, 2009; Kumar et al., 2011; Doran et al., 2012; Liao and Liang, 2013). But as what we said above, individual investors dominate the trades in China's stock market. For them, idiosyncratic skewness (Kumar, 2009) is too hard to compute, and it is hard to measure the lottery feature of stocks directly. Based on Bali et al.'s (2011) research, we use the maximum daily return over the past one month (MAX) to measure this lottery feature, because MAX can be observed by individual investors directly.
Second, lotteries also have an attractive feature, which is high uncertainty. Only high uncertainty can make people take different opinions on the result of gamble. There are some studies which also consider volatility (or idiosyncratic volatility) as one key measure to define lottery-type stocks (Kumar, 2009). However, considering the practical circumstance of China's stock market, we believe that investors, especially individual investors would be more sensitive to some directly-observed indicator, like turnover rate. Since investors who disagree on the price of a stock will trade, turnover rate (or trading volume) can be seen as the disagreement of the market, and also represents the uncertainty of the stock in the future (Chen et al., 2001; Hong and Stein, 2007).
Third, low price is one of the most important features attracting people to buy lotteries.

Usually lotteries have very low price relative to the extremely high potential prize. And people always search for cheap bets to gamble. Researchers also find same phenomenon in the stock market. Downs and Wen (2001) show that investors preference for a low price, which is similar to gamblers' preference. And they find that low-priced stocks have a lottery premium at the current period, but lower returns in the future. And researchers also use low-priced as an important indicator to identify lottery-type stocks (Kumar, 2009; Doran et al., 2012; Zheng and Sun, 2013).

Considering what we mention above, this paper improves Kumar's (2009) definition of lottery-type stocks in China's stock market. With this motivation, we assume that individual investors treat high MAX, high turnover, and low priced stocks as lotteries. It means that, in this paper, we will classify stocks in the higher 50% MAX percentile, the higher 50% turnover rate percentile, and the lower 50% stock price percentile as lottery-type stocks. And we also use Kumar's (2009) classification method as the robustness check.

3.2 Research Method and Hypothesis

3.2.1 Research Method

In this paper, we use three observable characteristics: MAX, turnover rate and price to identify lottery-type stocks. MAX is the maximum daily return over the past month. But there is price limit rule in China's stock market. We use the average of three highest daily returns over the past one month as MAX. The turnover rate is average daily turnover rate over the past month. And price is the closing price of the last trading day of the past month. And if a stock is in the higher 50% MAX percentile, the higher 50% turnover rate percentile, and the lower 50% stock price percentile, then we consider it as a lottery-type stock.

Kumar's (2009) method includes three mathematical indicators: idiosyncratic skewness, idiosyncratic volatility and price. To measure idiosyncratic skewness over the past one month, we adopt the Harvey and Siddique (2000) method. And the detail is as follows.

$$r_{i,\tau} - rf_\tau = \alpha'_i + \lambda_i^1 (rm_\tau - rf_\tau) + \lambda_i^2 (rm_\tau - rf_\tau)^2 + \varepsilon'_{i,\tau}$$

And then, we have:

$$\varepsilon'_{i,\tau} = r_{i,\tau} - rf_\tau - \alpha'_i - \lambda_i^1 (rm_\tau - rf_\tau) - \lambda_i^2 (rm_\tau - rf_\tau)^2$$

$$iv'_{i,t} = \left(\frac{1}{N_t} \sum_\tau \varepsilon'^{\,2}_{i,\tau}\right)^{1/2}$$

So idiosyncratic skewness is

$$is_{i,t} = \frac{1}{N_t} \frac{\sum_\tau \varepsilon'^{\,3}_{i,\tau}}{iv'^{\,3}_{i,t}}$$

The idiosyncratic volatility measure is the variance of the residual obtained by fitting Fama-French three-factor model to the daily stock returns over past month.

$$r_{i,\tau} - rf_\tau = \alpha_i + \beta_i^1 (rm_\tau - rf_\tau) + \beta_i^2 smb_\tau + \beta_i^3 hml_\tau + \varepsilon_{i,\tau}$$

And then, we have:

$$\varepsilon_{i,\tau} = r_{i,\tau} - rf_\tau - \alpha_i - \beta_i^1 (rm_\tau - rf_\tau) - \beta_i^2 smb_\tau - \beta_i^3 hml_\tau$$

So idiosyncratic volatility is

$$iv_{i,t} = (\frac{1}{N_t}\sum_{\tau} \varepsilon_{i,\tau}{}^2)^{1/2}$$

The price is the closing price of the last trading day of the past month. And if a stock is in the higher 50% idiosyncratic skewness percentile, the higher 50% idiosyncratic volatility percentile, and the lower 50% stock price percentile, then we consider it as a lottery-type stock for robustness test.

3.2.2 Hypothesis

In general, there are two types of investors, individual investors and institutional investors. The researchers used to think that, institutional investors' behaviors are sophisticated and less biased, since they trade by information. But individual investors are considered as noise traders on the market, which means that there are more behavioral biases in their trades. In particular, due to psychological and physiological effects, individual investors always show some preference to certain kinds of stocks, like local bias, small-cap preference, loyalty preference and gambling preference (French and Poterba, 1991; Daniel and Titman, 1997; Cohan, 2009; Kumar, 2009). Therefore, according to the previous literature, we think individual investors exhibit a stronger gambling preference than institutional investors in China's stock market. Thus we have the following hypothesis:

Hypothesis: *In China's stock market, individual investors exhibit a stronger gambling preference for stocks with lottery features.*

If individual investors have the same preference with institutional investors, then they should have the same proportions of holding (or buying) any kind of stocks in their investment portfolios. It also means that, individual investors exhibit stronger gambling preference, if they overweight lottery-type stocks in their investment portfolios. Regarding related literature, this paper uses individual investors' stock-holding panel data, and introduces the following regression model to examine whether individual investors exhibit a stronger aggregate gambling preference in China's stock market.

$$EW_{i,t} = (w_{i,t} - w'_{i,t})/w'_{i,t}$$

$EW_{i,t}$ is the aggregate investor preference for stock *i* in month *t*, which is the excess portfolio weight allocated to that stock (Kumar, 2009). And $w_{i,t}$ is the actual weight assigned to stock *i* in the aggregate investor portfolio in month *t*. And the $w'_{i,t}$ is the ratio of stock *i*'s market value to the whole market value in month *t*.

$$\begin{aligned} EW_{i,t} = {} & \alpha + \beta_1 \text{lottery\_dummy}_{i,t} + \beta_2 \text{nonlottery\_dummy}_{i,t} + \beta_3 \text{idio\_skewness}_{i,t} + \\ & \beta_4 \text{idio\_volatility}_{i,t} + \beta_5 \text{avg\_dailyreturn}_{i,t} + \beta_6 \text{log\_marketvalue}_{i,t} + \\ & \beta_7 \text{market\_beta}_{i,t} + \beta_8 \text{amihud\_ratio}_{i,t} + F_t + \varepsilon_{i,t} \end{aligned}$$

And definitions of other main variables are in the following Table 1.

4 Data Sources

The data used by this paper include two parts, one is the data and information of China's stock market; and the other is the individual investors' trading data. Our Chinese market data set is from RESSET data base. For each stock in our sample, we obtain daily return, closing price, turnover rate, market capitalization, beta, and other information from RESSET.

To test the individual investors' gambling preference, we use data from a major national-level brokerage company. The brokerage is a large national-level brokerage house with about 76 branches in more than 40 cities within 14 different provinces. The company ranks in the top quartile among all Chinese brokerage companies, in terms of transaction volume. In this paper, we get the trading records of investors from 8 branches within 6 different provinces at this brokerage house. And the sample period is between January 2003 and June 2009. Our data set is similar with Liao et al.'s (2013). And we believe that this data can precisely describe the situation of individual investors in China's stock market.

Table 1: Definitions of main variables

Variable	Description
Panel A: Stock characteristics reported in Table 3	
MAX	The maximum daily return over the past one month.
Idiosyncratic skewness	Scaled measure of the third moment of the residual from Harvey and Siddique's (2000) method.
Idiosyncratic volatility	Standard deviation of the residual from Fama-French 3-factor model.
Last month return %	Monthly return of the past month.
Stock price	Closing stock price at the end of month.
Daily turnover rate	Average daily turnover rate of stock over the past one month.
Market beta	Beta from CAPM model.
Firm size (billions)	Market capitalization of stock at the end of month.
P/E ratio	Price divided by earnings per share at the end of month.
Institutional holding %	Percentage of total shares outstanding owned by institutions.
Panel B: Additional variables in regressions reported in Table8 and Table 9	
Lottery-type	Dummy variable, set to one if the stock is classified as lottery-type stock.
Nonlottery-type	Dummy variable, set to one if the stock is classified as nonlottery-type stock.
Amihud ratio	Absolute daily returns per unit of trading volume.
Bull	Dummy variable, set to one if the time is in the July 2006 to September 2007 period.

Since this study focuses on individual investors' preference in China's stock market, we try to exclude some trading records of investors who may be considered as the institutional. We exclude investors who have any single transaction of more than 300,000 RMB, which is about 50,000 U.S. dollars throughout the whole sample period. After that, the final sample includes 30,331 investors, and about 3.72 million transactions. And we can see details of our data set in Table 2.

Table 2 shows that, in our sample, the number of male investors is nearly equal to that of

the females; most of the investors come from branch 5 (22.78%) and branch 7 (24.90%); most of the investors opened their accounts from 1996 to 2001; and most of the investors are born in 1960s. And there is some other information not shown in this table: the investors make 1,961,835 purchases and 1,760,568 sells in this period; the average holding value of stocks is about 42 thousand RMB; and the average holding number of stocks is 2.37.

Table 2: Summary statistics of the national brokerage data

Sex	No. of Account	%
Female	23,769	48.29
Male	25,455	51.71
Location (Branches)	No. of Account	%
Branch-1	1,527	3.10
Branch-2	3,232	6.57
Branch-3	1,126	2.29
Branch-4	8,148	16.55
Branch-5	15,155	30.79
Branch-6	8,306	16.87
Branch-7	8,936	18.15
Branch-8	2,794	5.68
Opened time	No. of Account	%
<=1995	1,045	2.12
1996-1999	21,002	42.67
2000-2002	21,730	44.15
2003-2005	5,447	11.07
Birthday (Year)	No. of Account	%
<1950	8,772	17.82
1950-1959	13,165	26.75
1960-1969	16,283	33.08
1970-1979	10,036	20.39
>=1980	968	1.97

5 What Are Lottery-type Stocks in China's Stock Market?

5.1 The Characteristics of Lottery-type Stocks

As what we discussed above, this paper will use the improved method (high MAX, high turnover rate, and low price) to identify lottery-type stocks, but also we still present some results of Kumar's (2009) method as a robustness check. Table 3 presents the averages of several basic characteristics of lottery-type stocks, measured during Jan 2003 to Jun 2009 sample period in China's stock market. And the nonlottery-type stocks are in the lower 50% MAX percentile, lower 50% turnover rate percentile, and the higher 50% stock price percentile for the improved method. The remaining stocks are identified as "other stocks".

Table 3 shows some important characteristics of lottery-type stocks in China's stock market. There are about 15% stocks classified as lottery-type stocks, and 14% classified as nonlottery-type stocks. And there are 1,688 out of 2,499 stocks classified as lottery-type stocks at least once; 1,820 stocks are classified as nonlottery-type stocks at least once. Table 3 indicates that lottery-type stocks have high MAX (5.36%), high daily turnover rate (3.34%), low price (7.19 RMB per share), high idiosyncratic skewness (0.7025), high idiosyncratic volatility (0.0216), high last month return (5.01%), high market beta (1.11), very low market capitalization (2.99 billion RMB), high P/E ratio (66.22), and relatively low institutional ownership (11.02%). Nonlottery-type stocks have completely opposite characteristics, and "other stocks" have characteristics in between these two extremes. And Table 3 also shows that Kumar's (2009) method gets a result consistent with the improved method.

Table 3: Basic characteristics of lottery-type stocks

	Improved method (I)			Kumar's (2009) method (II)		
	Lottery	Non-lottery	Others	Lottery	Non-lottery	Others
Months (Period)	144	144	144	144	144	144
Times	30,033	28,660	141,354	26,426	25,796	147,825
Percentage %	15.01	14.33	70.66	13.21	12.89	73.90
At least once be	1,688	1,820	2,497	1,608	2,057	2,497
MAX %	5.36	2.77	3.84	4.80	3.23	3.72
Idiosyncratic skewness	0.7025	0.3591	0.5244	1.2019	-0.0335	0.5531
Idiosyncratic volatility	0.0216	0.0147	0.0170	0.0229	0.0142	0.0168
Last month return %	5.01	-1.72	1.95	2.17	0.39	1.46
Stock price	7.19	21.02	12.79	7.08	21.55	13.15
Daily turnover rate %	3.34	0.94	1.75	2.58	1.27	1.69
Market beta	1.11	0.76	0.91	1.14	0.75	0.89
Firm size (billions)	2.99	12.61	6.82	2.86	10.32	7.24
P/E ratio	66.22	43.41	48.21	62.51	39.77	48.58
Institutional holding %	11.02	17.65	16.73	11.22	19.18	16.32

5.2 The Distribution of Lottery-type Stocks in Different Sectors

To describe what the lottery-type stock is, this paper also analyzes the distribution of lottery-type stocks in different industries. Using the CSRC industry classification, we classify all stocks into 22 different industries. Table 4 presents the sector distribution of lottery-type stocks and nonlottery-type stocks.

As Table 4 presents, we find that lottery-type stocks concentrates in Agriculture, forestry, animal husbandry and fishery, Textile and garment, and Real estate sectors. The industries with the highest concentration of nonlottery-type stocks include Pharmaceuticals and biotechnology, Financial sector and Food and beverage sectors. The classification of lottery-type stocks is related to industrial traits of different stocks. For

example, industries with higher proportion of lottery-type stocks are usually more sensitive to regulation, as with the case of real estate industry in China. The sensitivity brings about strong uncertainty, giving investors a small chance to achieve a large return. On the other hand, industries with higher proportion of nonlottery-type stocks are relatively more stable and less uncertain regarding regulation environment. Industries dominated by large state-owned enterprises, such as mining sector and financial sector, share the traits of stability in profit and market share. Stocks in such industries usually generate more stable return. These results are very different from Kumar's (2009) study on U.S. stock market.

Table 4: Sector distribution of lottery-type stocks

	Industry	Lottery	Nonlottery	Dif
A	Agriculture, forestry, animal husbandry and fishery	21.85%	9.33%	12.51%
B	Mining industry	9.51%	18.39%	-8.89%
C0	Food and beverage	13.22%	20.38%	-7.16%
C1	Textile and garment	21.53%	10.36%	11.17%
C2	Woods and furniture	20.43%	5.75%	14.68%
C3	Paper and print	17.26%	12.70%	4.55%
C4	Petrochemistry	17.40%	11.52%	5.88%
C5	Electronics	15.50%	9.89%	5.61%
C6	Metal and non-metal	14.66%	11.13%	3.54%
C7	Mechanical equipment	14.30%	14.60%	-0.30%
C8	Pharmaceuticals and biotechnology	10.77%	24.02%	-13.25%
C9	Other manufacturing	13.14%	16.03%	-2.89%
D	Electricity, heat, gas and water production and supply	13.27%	13.05%	0.22%
E	Building industry	16.10%	11.32%	4.78%
F	Transportation, storage and postal services	10.25%	14.20%	-3.95%
G	Transmission of information, software and IT services industry	9.99%	17.63%	-7.63%
H	Wholesale and retail trade	15.07%	17.36%	-2.29%
I	Financial sector	9.36%	22.95%	-13.59%
J	Real estate	21.41%	10.64%	10.76%
K	Health and social work	16.71%	15.17%	1.54%
L	Media	11.68%	11.24%	0.43%
M	Other	16.01%	11.80%	4.20%
	Average	15.01%	14.33%	0.69%

5.3 Is "Lottery" A Permanent Feature of Stocks?

There is another question we try to answer: is "lottery" a permanent feature of stocks? If "lottery" is a permanent feature to given stocks, then overweighting lottery-type stocks

may not be driven by investors' gambling preference, but could be driven by other permanent features which are strongly correlated with lottery features. If "lottery" is not a permanent feature of stocks, overweighting lottery-type stocks means that investors chasing the lottery features but not specific stocks. However, to ensure the accuracy of our classification method, we do not hope a stock to frequently change from lottery-type category to nonlottery-type category.

Table 5 shows the continuity of lottery-type stocks and nonlottery-type stocks. If a stock has been classified as a lottery-type stock, it will be classified as a lottery-type stock with 46.92% probability in the next month; and only 0.25% probability to be classified as a lottery-type stocks in the next 12 consecutive months. However, we also find that a lottery-type stock has only 0.19% chance to be classified as a nonlottery-type stock in the next month, and most of lottery-type stock (91.94%) will not switch to nonlottery-type category in the next 12 consecutive months. And the situation of nonlottery-type stocks is similar.

Table 5: Lottery (or Nonlottery) feature of stocks

Lottery-type stocks				
Month	No. included continuously	%	No. included at least once	%
t	30,033		30,033	
t+1	14,090	46.92	14,090	46.92
t+3	4,316	14.37	21,663	72.13
t+6	1,004	3.34	24,957	83.10
t+9	268	0.89	26,201	87.24
t+12	76	0.25	26,840	89.37
Nonlottery-type stocks				
Month	No. included continuously	%	No. included at least once	%
t	28,660		28,660	
t+1	14,665	51.17	14,665	51.17
t+3	5,328	18.59	21,701	75.72
t+6	1,636	5.71	24,346	84.95
t+9	621	2.17	25,278	88.20
t+12	247	0.86	25,735	89.79

Table 6: Interchange of category between lottery-type and nonlottery-type

	Lottery-type to Nonlottery-type		Nonlottery-type to Lottery-type	
Month	No. of Change	%	No. of Change	%
t	30,033		28,660	
t+1	57	0.19	132	0.46
t+3	287	0.96	718	2.51
t+6	917	3.05	1,854	6.47
t+9	1,704	5.67	3,066	10.70
t+12	2,450	8.16	4,142	14.45

From the Table 5 and Table 6, it is obvious that "lottery" is not a permanent feature of stocks. It means that a stock can always be a lottery-type stock, but would not be a lottery-type stock all the time.

6 Do Individuals Buy Lotteries in China's Stock Market?

6.1 Aggregate Gambling Preference of Individual Investors

In some previous studies, researchers find that the gambling preference will make investors chase and overprice lottery-type stocks (or underprice nonlottery-type stocks) in the current month, which leading lottery-type stocks to have worse performance in the future (Barberis and Huang, 2008; Kumar, 2009; Bali et al., 2011; Liao and Liang, 2013). Kumar (2009) finds that individual investors have a strong preference to lottery-type stocks in U.S. stock market, even the lottery-type stocks' performance is worse. And Liao and Liang (2013) show that the average abnormal return of lottery-type stocks is negative in the following three months in China's stock market. If the lottery-type stocks' performance is worse, do individual investors still prefer to hold or buy this type of stocks in China's stock market?

To answer the question above, we analyze the individual investors trading data. Figure 1 describes the holding and buying preference of individual investors for lottery-type stocks varying over time. We find that individual investors continuously overweight lottery-type stocks in their investment portfolio (holding or buying). And also, the difference of the average weight of lottery-type stocks in individual investors' portfolios and in the market portfolio is larger in the bull market. This result indicates that individual investors exhibit a gambling preference in China's stock market, and this preference is stronger in the bull market.

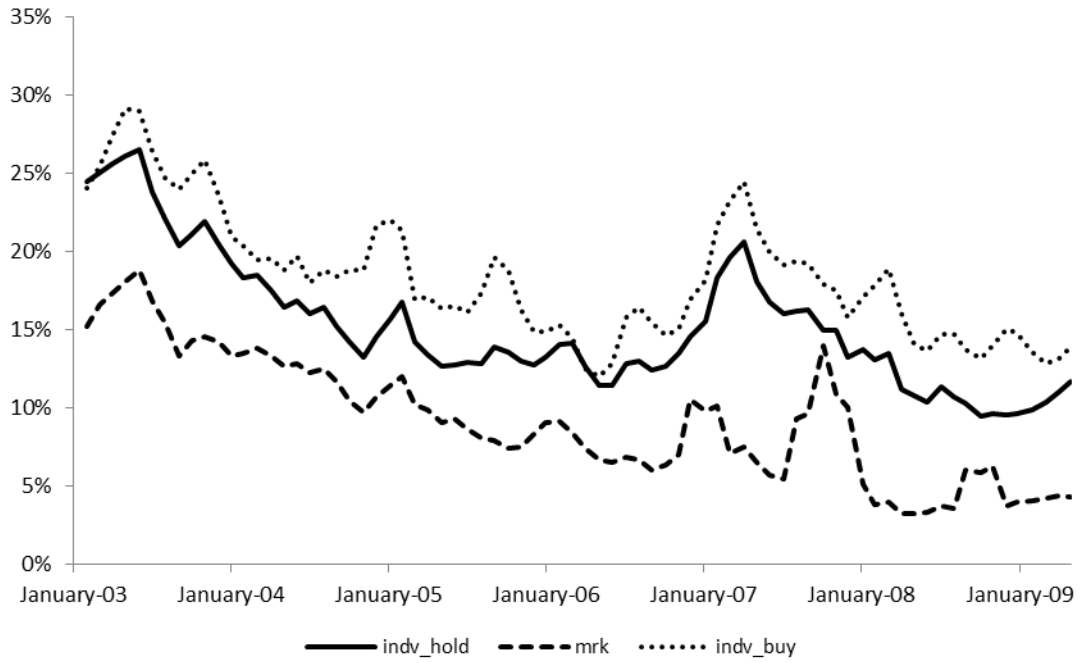

Figure 1: Aggregate gambling preference of individual investors vary over time

Table 7 presents numerical results of individual investors' gambling preference. The table indicates that, relative to the market portfolio, individual investors significantly overweight lottery-type stocks in their investment portfolios. As shown in Table 7, the average weights allocated to lottery-type stocks in the aggregate individual holding portfolios, buying portfolios and market portfolios are 15.34%, 18.42 and 9.22%, respectively. In contrast, the average weights allocated to nonlottery stocks in the aggregate individual holding portfolios, buying portfolios, and market portfolios are 15.26%, 10.81% and 24.52%, respectively. In conclusion, our results reveal that individual investors exhibit a strong preference for stocks with lottery features, and aversion for nonlottery-type stocks.

To ensure the accuracy of above results, we estimate fixed time panel data regressions to characterize investors' aggregate preference for lottery-type stocks. In these regressions, the dependent variable is the aggregate preference of individual investors ($EW_{i,t}$), and the independent variables are some stock characteristics, including measures that investors might use to identify lottery-type stocks. The results of these regressions are presented by Table 8.

Table 7: Aggregate gambling preference of individual investors
(Statistical evidences)

	Individual holding portfolio %	Market portfolio %	Dif %
Lottery-type stocks	15.3396	9.2207	6.1189***
			(16.64)
Nonlottery-type stocks	15.2597	24.5153	-9.2556***
			(-12.35)
	Individual buying portfolio %	Market portfolio %	Dif %
Lottery-type stocks	18.4162	9.2207	9.1955***
			(21.52)
Nonlottery-type stocks	10.8133	24.5153	-13.702***
			(-15.25)

t-statistics are in parentheses. ***, **, * significant at the 1%, 5%, and 10% level, receptively.

In the first regression, the independent variables include lottery-type dummy variable and other stock characteristics as control variables, such as idiosyncratic skewness, idiosyncratic volatility, and daily return. Column (1) shows that lottery-type dummy has a significantly positive effect on individual investors' aggregate preference, when other potential effects are controlled. In the second regression, we try to examine individual investors' aggregate preference for nonlottery-type stocks. Column (2) shows that the coefficient estimate of nonlottery-type dummy is -0.6834, which is significant. It means that individual investors exhibit aversion for nonlottery-type stocks. In Column (3), we put lottery-type dummy and nonlottery-type dummy together into the regression. This stock-level regression result is consistent with the findings above. In China's stock market, individual investors prefer lottery-type stocks, but are averse to nonlottery-type stocks, at the cost of losing money. And this result confirms the hypothesis we make in section 3.
In Column (1) to (3), we also find that Chinese individual investors prefer high-skewness, low-volatility, low-return, small-size and big-beta stocks. Furthermore, individual investors prefer to hold stocks with high liquidity feature in China's stock market.
In Column (4), we test the individual investors' gambling preference in the bull market. The coefficient estimate of the variable *Bull*lottery-type* indicates that individual investors' aggregate gambling preference is stronger in the bull market. Gervais and Odean (2001) show that, in their multi-period model, investors can be more overconfident by learning from their trading performance. In the bull market of China (2006-2007), individual investors may not evaluate their investment ability accurately, which means that they would overvalue their ability, and trade overconfidently. It is not hard to understand that individual investors exhibit a stronger propensity to invest lottery-type stocks in the bull market.

6.2 Robustness Check: Kumar's (2009) Method

For robustness, our study also uses Kumar's method to classify stocks into lottery-type,

nonlottery-type and other categories. In Table 9, we also do the similar regressions with Table 8, to test individual investors' aggregate preference for lottery-type stocks with Kumar's (2009) method.

Table 8: Aggregate stock preference of individual investors
(Regression estimates)

Variables	(1)	(2)	(3)	(4)
Lottery-type	0.5191***		0.4509***	0.3224***
	(33.53)		(30.32)	(16.60)
Nonlottery-type		-0.6834***	-0.6318***	-0.6420***
		(-43.05)	(-39.75)	(-36.41)
Idiosyncratic skewness	0.0685***	0.0668***	0.0557***	0.1727***
	(8.87)	(8.70)	(7.28)	(21.38)
Idiosyncratic volatility	-0.3699***	-0.3702***	-0.4146***	0.2389***
	(-40.31)	(-40.77)	(-45.25)	(29.42)
Daily return	-0.4196***	-0.5208***	-0.6377***	-0.7745***
	(-8.36)	(-10.39)	(-12.75)	(-19.87)
Log_size	-0.5597***	-0.5495***	-0.5256***	-0.0453***
	(-94.33)	(-92.90)	(-88.43)	(-8.54)
Beta	0.3318***	0.2865***	0.2654***	0.1953***
	(28.37)	(24.39)	(22.66)	(15.04)
Amihud ratio	-0.0037***	-0.0033***	-0.0031***	-0.0040***
	(-10.60)	(-9.59)	(-8.87)	(-10.32)
Bull*lottery-type				0.5840***
				(15.88)
Intercept term	YES	YES	YES	YES
Fixed time effect	YES	YES	YES	NO
Adj. R-sqr	0.244	0.2500	0.2572	0.0649
Obs.	88,858	88,858	88,858	88,858

t-statistics are in parentheses. ***, **, * significant at the 1%, 5%, and 10% level, receptively.

The regression estimates reported in Table 9 confirm that *Lottery-type* dummy plays a significantly positive role in individual investors' aggregate stock preference, but the *Nonlottery-type* dummy displays a significantly negative effect. In Column (4), the regression result also shows that individual investors exhibit a stronger aggregate gambling preference in the bull market. So, all of the results are consistent with the results of our improved method. And it reconfirms our hypothesis that individual investors exhibit stronger gambling preference for stocks with lottery features, in China's stock market.

Comparing the coefficient estimates of lottery-type dummy in Table 8 and Table 9, we find that the *Lottery-type* coefficient estimate in Table 9 is smaller than that in Table 8. And the *Nonlottery-type* coefficient estimate is bigger. These results indicate that in our improved method, individual investors exhibit a stronger propensity to holding the stocks with high MAX, high turnover rate and low price features than lottery-type stocks with Kumar's (2009) method. It means that our improved method can more accurately capture individuals' behavior preference for stocks with lottery features in China's stock market.

Table 9 Robustness check: Kumar's (2009) method

Variables	(1)	(2)	(3)	(4)
Lottery-type	0.2740***		0.2392***	0.3391***
	(16.56)		(14.39)	(16.74)
Nonlottery-type		-0.3630***	-0.3347***	-0.4412***
		(-20.62)	(-18.92)	(-22.80)
Turnover rate	0.0338***	0.0315***	0.0276***	0.1732***
	(9.45)	(8.78)	(7.70)	(58.33)
Daily return	-0.5178***	-0.5225***	-0.65197***	-1.1185***
	(-10.03)	(-10.14)	(-10.09)	(-27.38)
Log_size	-0.5544***	-0.5530***	-0.5434***	-0.0535***
	(-90.97)	(-90.96)	(-88.93)	(-10.64)
Beta	0.2646***	0.2535***	0.2428***	0.2409***
	(22.43)	(21.44)	(20.52)	(18.81)
Amihud ratio	-0.0035***	-0.0034***	-0.0034***	-0.0032***
	(-9.77)	(-9.56)	(-9.51)	(-8.50)
Bull*lottery-type				0.4357***
				(13.14)
Intercept term	YES	YES	YES	YES
Fixed time effect	YES	YES	YES	No
Adj. R-sqr	0.2246	0.2259	0.2277	0.0669
Obs.	88,858	88,858	88,858	88,858

t-statistics are in parentheses. ***, **, * significant at the 1%, 5%, and 10% level, receptively.

7 Conclusion

In previous studies, although researchers did some work on investors' gambling preference research, most of them focus on U.S. market or European market. In order to fill this gap, in this paper, we look into China's stock market, and use the improved classification method to examine individual investors' gambling preference in emerging capital market. Based on Kumar's (2009) method, we consider the actual situation of China's stock market, and define the lottery-type stocks as stocks with high MAX, high turnover rate and low price. The three characteristics are directly observable for any individual investors. This paper shows that lottery-type stocks have other characteristics, including high idiosyncratic skewness, high idiosyncratic volatility, high last month return, high market beta, very low market capitalization, high P/E ratio, and relatively low institutional ownership. Nonlottery-type stocks have completely opposite characteristics. The distribution of lottery-type stocks in different industries is unbalanced. Lottery-type stocks concentrate in Agriculture, forestry, animal husbandry and fishery, Textile and garment, and Real estate sectors. This paper also analyzes the continuity of lottery features of stocks. The results show that "lottery" is not a permanent feature of stocks. It means that a stock can always be a lottery-type stock, but would not be a lottery-type stock all the time.

In the second part, this paper uses the monthly portfolio holdings and trading data from a large Chinese brokerage house to test whether individual investors have a strong

preference in stocks with lottery features. We find that relative to the market portfolio, individual investors significantly overweight lottery-type stocks, and underweight nonlottery-type stocks in China's stock market. To characterize investors' aggregate preference for lottery-type stocks more accurately, we perform panel data regression to test individual investors' stock preference. This paper shows that individual investors prefer to hold lottery-type stocks while we control some other important features. And the aggregate gambling preference is much stronger in the bull market.

Overall, these empirical findings indicate that lottery-type stocks have some special characteristics in China's stock market. Some of these characteristics are different from those in U.S. stock market. Also this paper shows that individual investors invest disproportionately more in stocks with lottery features, and exhibit a stronger gambling preference in the bull market. And the findings suggest that the market regulator should extensively develop the financial education program to improve investors' financial literacy level, and reduce their gambling preference in China's stock market.

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