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Does good luck make people overconfident? Evidence from a natural experiment in the stock market☆

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ABSTRACT

This paper examines the changes in investors' trading behavior after winning an IPO allotment in China—a purely luck-driven event. We find that these investors subsequently become overconfident: They trade more frequently and lose more money relative to other investors. This effect is stronger when investors are inexperienced and when investors' pre-existing level of overconfidence is low. We also show that investors exhibit a stronger gambling propensity and hold more lottery-like stock after winning an IPO allotment. Our findings are not explained by wealth effects or house money effects. Overall, our evidence indicates that the experience of good luck makes people overconfident about their prospects.

1. Introduction

Overconfidence is a widely documented cognitive bias that significantly influences an individual's decision making (see, for example, Thaler and Johnson, 1990). While most studies in the economics and finance literature focus on the influence of overconfidence, the root cause of overconfidence is relatively under-examined.[1] In this paper, we investigate whether good luck in the present makes people overconfident about their future prospects. We measure "good luck" by exploiting a natural experiment—winning an allotment in IPO subscription in China, which is purely driven by luck. We use retail investors' stock trading behavior to infer their "overconfidence," following Barber and Odean (2001).

We hypothesize that traders believe in luck and can update their belief about whether they are in a lucky stage. Traders who have recently experienced "good luck" may think they are in a lucky stage and become overconfident about their prospects.

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[1] Psychology literature suggests that overconfidence may be caused by self-attribution bias, confirmation bias, hindsight bias, and illusion of control (see, for example, Moore and Healy, 2008; Ehrlinger et al., 2016). However, almost all these studies are based on lab experiments with a limited number of participants.

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The unique feature of winning an IPO allotment in China allows us to estimate its effects in a difference-in-differences framework. Ideally, to study an experiment's effect, one would like to have an exogenous experiment in which individuals are randomly assigned to be affected by the experiment, which would allow us to compare treated and non-treated individuals' outcomes and attribute any differences to the experiment. In China, winning the allotment in an IPO subscription is akin to such an experiment. For each IPO in the Shanghai Stock Exchange, individual investors who applied for an IPO allotment are assigned an IPO application number for each 1000 shares.[2] This IPO application number is randomly assigned by the China Securities Depository and Clearing Corporation (CSDC) and cannot be changed. The winning allotment numbers are drawn randomly from the pool, while the entire process is taped and audited. Moreover, under China's rule of a capped 23× PE ratio for IPO pricing in our sample period, China's IPO is greatly underpriced and investors have the potential to make a considerable amount of money if they win the allotment. Thus, winning an IPO allotment is a good setting to measure how "being lucky" influences people's subsequent behavior. Moreover, we have hundreds of IPO events in our sample, which result in multiple treated investors at different times. This can help avoid the common identification difficulty faced by studies with a single shock: the potential biases and noise coinciding with the shock that directly affects investor behavior (Roberts and Whited, 2013).

We empirically test the effect of winning an IPO allocation on retail investors' stock trading behavior using a panel of over ten million person-period observations of Chinese individual investors during 2014–2016 and a difference-in-differences approach. We find that winning an IPO allotment (a proxy of good luck) leads to more excessive trading (a reflection of overconfidence). On average, individuals who win the IPO allotment experience an increase in turnover rate by 33.1 percentage points in the three-month period following the IPO allotment, relative to individuals who fail to win the IPO allocation. This effect is economically important considering the median turnover rate is approximately 188 percentage points in our sample.

To provide further evidence that the effect of winning an IPO allotment on trading activities is indeed due to overconfidence, we implement triple difference-in-differences tests to examine heterogeneous treatment effects. We show that the treatment effect is indeed tied to investors' experience and pre-existing overconfidence level. Specifically, the treatment effects are stronger when the investors have little experience of trading in the stock market, when the investors have seldom won an IPO allotment in the past, when the investors are in the market bust period, and when the investors have a low pre-existing turnover rate.

To distinguish whether increased turnover rate is due to increased overconfidence or investors' rational responses to winning the IPO allotment (such as portfolio rebalance), we further examine investors' portfolio return. If the changes in the trading behavior reflect any rational response made by the investors, we expect that their portfolio performance should not decline. In contrast, overconfidence implies that investors mistakenly over-estimate their prospect in the stock market, and thus predict that such trading is inefficient and could be associated with lower return. Supporting the overconfidence explanation, we find that investors in the treatment group experience a decrease in their portfolio return by one to two percentage points in the three-month period following the treatment, relative to the investors in the control group. We also compute the net wealth gain of winning an IPO allotment: the gain from the IPO shares versus the loss due to subsequent excessive (and inefficient) trading of their entire portfolio. We find that the latter significantly offsets the gain of the former. For the group of investors with large portfolio wealth, the net wealth gain is negative: The RMB-value loss of excessive trading of the entire portfolio overweighs the RMB-value gain from the IPO stock.

We also examine the volatility of the investors' portfolio (both the idiosyncratic volatility and systematic volatility), and find that the portfolio volatility increases after winning the IPO allotment. Moreover, we separately investigate the volatility of the stocks investors buy and the volatility of stocks investors sell, and we show that the former group has greater volatility than the latter group. In a similar spirit, we find that investors are more likely to purchase lottery-like stock after winning the IPO allotment. These results indicate that investors tend to become more willing to take risks and exhibit a stronger gambling propensity after they believe they are lucky.

Finally, we conduct several additional analysis and robustness checks. First, to provide further evidence that our results are due to investors feeling "luckier" rather than "richer" after winning the IPO allotment, we re-do our main analysis based on a subsample of extremely rich investors, for whom the value-gain of an IPO allotment (usually 15,000 RMB) is not meaningful. Our results still hold, indicating that our results are unlikely to be driven by investors feeling richer after winning the IPO allotment. Second, Gervais and Odean (2001) predict that overconfidence tends to be short-lived and investors can progressively develop a more realistic self-assessment. Thus, we examine how long the increased level of overconfidence lasts. Consistent with Gervais and Odean (2001), we find that our treatment effect diminishes over time and largely disappears nine months after winning the IPO allotment. Third, we implement placebo tests to investigate the possibility that our results are purely driven by chance. Specifically, we randomly select a group of investors as pseudo-treated investors and a group of investors as pseudo-control investors. We repeat this procedure 5000 times. The results indicate that the effect of winning an IPO allotment on trading activities documented in our main tests are unlikely to be spurious: The maximum coefficient in magnitude estimated in the placebo test is substantially smaller than the magnitude of the actual coefficient estimate from the main test. Finally, investors in the control group could either be (1) the ones who apply for the IPO allotment but fail to get one or (2) the ones who do not apply in the first place. Based on a subsample in which information on whether investors participate in the IPO subscription exists, we recreate the control group by focusing on the investors who apply for the IPO allotments but fail to get one. Our results are largely unchanged.

It is worth noting that our results are unlikely driven by the house money effect, which generally refers to the pattern people tend to

[2] Investors with an average stock portfolio worth at least 10,000 RMB in day t-20 to day t-2 relative to the IPO subscription day can apply for IPO allotments. Each 10,000 RMB of stock holding is qualified for applying for 1000 IPO shares. Investors will learn their application results on day t + 2.

take on increased risk after a successful investment because they do not fully integrate the new money as their own, but regard it as the house's money (Thaler and Johnson, 1990). We focus on the individual's overall portfolio trading, excluding the trading of new IPO shares. In other words, we focus on how individuals trade their pre-existing money after winning the IPO allocation. In contrast, the house money effect should predict that individuals take more risk with the new money they earn from the IPO shares, but provide no prediction on how individuals deal with their entire portfolio. Second, given that high risk is usually associated with high return (at least for raw return), the house money effect would predict that individuals could subsequently have higher raw return. However, this is opposite to our findings.

It is also worth noting that our results are unlikely driven by wealth effect (i.e., the effect of winning an IPO allocation on trading is due to changes in risk preference after gaining wealth). First, depending on the assumption of standard utility function, wealth could be positively or negatively correlated with risk preference. Thus, from an ex-ante perspective, it is unclear how the wealth gain from winning the IPO allocation would influence individuals' subsequent trading behavior. Second, we show empirically that wealth is actually negatively associated with turnover rate. This implies that wealth effect would predict a decrease in turnover rate following the winning of an IPO allotment, which is opposite to our findings.

This paper provides at least three major contributions to the existing literature. First, our study is related to the literature on reinforcement learning, which posits that people's choice of actions depends on the payoffs they obtained from the same actions in the past (Erev and Roth, 1998; Camerer and Ho, 1999). Kaustia and Knüpfer (2008) show that individuals' experience of high IPO return leads to more IPO subscription in the future. Chiang et al. (2011) show that individuals' past successful experiences make them become more overconfident in future IPO bidding due to naïve reinforcement learning. Choi et al. (2009) report that high personally experienced returns in 401(k) accounts induce higher 401(k) savings rates. Greenwood and Nagel (2009) find that young mutual fund managers chose higher exposure to technology stocks in the late 1990s than older managers. Similarly, Vissing-Jorgensen (2003) shows that young retail investors with little investment experience had the highest stock return expectations during the stock market boom in the late 1990s. Malmendier and Nagel (2011) show that individuals who have experienced low stock market returns (the Great Depression period) are less willing to participate in the stock market. Malmendier and Nagel (2016) show that differences in life expectancy strongly predict differences in subjective inflation expectations. Our study suggests that the experience of "good luck" in the stock market makes people overconfident about their future prospects.

Second, there exists a large amount of literature which focuses on how overconfidence influences people's decision making. For example, when considering individual investors, overconfidence makes them trade more money as well as lose more money (Barber and Odean, 2001), while overconfident corporate executives usually invest more and make more acquisitions (Malmendier and Tate, 2005, 2008). Complementing this strand of literature, which usually takes overconfidence as given, we investigate why individuals become overconfident in the first place. Does certain experience in the present increase the level of overconfidence in the future? We provide evidence that experience of good luck is an important factor contributing to people's cognitive bias of overconfidence.

Third, our study contributes to the surging field of household finance, which investigates how households make investment decisions in the financial market (Campbell, 2006). Existing literature finds that households' investment decisions are influenced by factors such as gender (Barber and Odean, 2001), parents (Black et al., 2017), language and culture (Grinblatt and Keloharju, 2001), and IQ (Grinblatt et al., 2012). These studies help us understand investors' investment decisions from their demographic background (which is static and time-invariant). Contributing to them, our study focuses on how certain experience in the market changes investors' investment behavior afterwards (which is dynamic and time-varying).

Our paper is related to a contemporaneous study by Anagol et al. (2019), who study investor behavior after winning IPO lotteries in India. Different from China's IPO (which is a pure lottery and guarantees a significant positive return), India's IPO applies a sequential hybrid mechanism and the stock may generate either positive or negative returns. On the Indian market, only those stocks that are oversubscribed will turn into a "lottery" afterwards. Whether an investor can win the "lottery" depends on his initial application amount relative to other peer investors' application amount. Thus, some ability/skill is required to win IPO lotteries in India. In our study, agents update their belief about their probability of being lucky from past lucky events, whereas in their article, agents learn their ability from noise signals. While India's IPO setting is helpful to study the effect of stock return movement on investor behavior, it better captures some random noise shocks rather than "luck." Nonetheless, both studies complement each other in showing that investors' behavior is greatly influenced by their past experience in the stock market.

The remainder of the paper is organized as follows: Section 2 reviews the background of China's IPO allotment; Section 3 develops our hypothesis; Section 4 describes our sample and key variable construction; Section 5 presents the empirical results; and Section 6 concludes.

2. Background on China's allocation of IPO shares

The IPO market is a popular investment opportunity within the Chinese stock market. Gains are virtually assured because regulators, in order to protect individual investors in one of the world's most volatile equity markets, have capped IPO price-to-earnings ratios at levels less than half the median valuation on mainland exchanges. Such a ceiling has led to IPO stocks normally increasing 44% on the first day,[3] and reaching a price limit of 10% several trading days afterwards.

[3] It is regulated that the first-day return cannot exceed 44%. Among the 133 IPO deals in our sample, the first-day return ranges from 43.77% to 44.15%, and 103 IPO deals have a first-day return of exactly 44%. For this reason, the standard deviation of first-day return in our sample reported Table 1 Panel B is not zero.

Table 1
Summary statistics.

Panel A: Probability of winning the IPO allotment across portfolio wealth			
Rank of the 10 portfolio wealth decile	(1)	(2)	(3)
	# of investors who applied for IPO allotments	# of investors who won at least one IPO allotment	Winning probability (2)/(1)
1 (lowest portfolio wealth)	53,755,579	198,167	0.37%
2	53,755,621	244,248	0.45%
3	53,755,661	333,811	0.62%
4	53,755,647	448,841	0.84%
5	53,755,621	599,154	1.11%
6	53,755,664	793,487	1.48%
7	53,755,654	1,051,313	1.96%
8	53,755,626	1,409,031	2.62%
9	53,755,659	1,963,051	3.65%
10 (highest portfolio wealth)	53,755,584	3,365,885	6.26%

Panel B: Characteristics of the IPO stock	Mean	StdDev	25th percentile	Median	75th percentile
IPO price (RMB)	11.74	6.16	7.12	10.6	15.31
Raw return at day 1	44.00%	0.04%	43.98%	44.01%	44.02%
Market-adjusted return at day 1	44.06%	1.95%	43.35%	43.92%	44.63%
Raw return day 1 to day 7	119.13%	23.57%	110.96%	131.89%	131.97%
Market-adjusted return day 1 to day 7	118.85%	23.53%	111.83%	129.27%	132.41%
Raw return day 1 to day 30	307.07%	217.65%	143.57%	231.73%	407.77%
Market-adjusted return day 1 to day 30	304.52%	217.80%	141.22%	226.89%	400.67%
Raw return day 1 to day 90	296.40%	174.90%	168.44%	268.04%	393.27%
Market-adjusted return day 1 to day 90	290.01%	172.85%	170.13%	263.17%	384.84%

Panel C: Summary statistics of investors trading and return	Mean	StdDev	25th percentile	Median	75th percentile
Turnover	381.37%	497.91%	52.43%	188.20%	504.28%
Raw return	6.49%	32.23%	−8.65%	2.63%	20.40%
Own-benchmark abnormal return	−5.33%	40.83%	−21.92%	0.00%	12.79%
Market-adjusted return	−1.77%	25.23%	−15.14%	−1.80%	8.31%
Portfolio wealth (in thousand)	374	2825	68	150	339
Market return	9.52%	22.64%	−9.50%	5.05%	34.62%
Security selection	−0.21%	9.14%	−3.31%	0	3.04%
Disposition effect	0.04	0.11	−0.01	0.03	0.06
Idiosyncratic volatility	0.35	0.13	0.26	0.33	0.42
Systematic volatility	0.31	0.12	0.14	0.28	0.41
Relative idiosyncratic volatility	0.01	0.03	−0.01	0.00	0.02
Relative systematic volatility	0.03	0.15	−0.02	0.01	0.08
Lottery	0.42	0.26	0.23	0.40	0.61
Relative lottery	0.01	0.06	−0.01	0.00	0.03
MAX	1.01	0.10	−0.11	0.70	1.85
Relative MAX	0.33	0.08	−0.44	0.00	0.50

Panel A reports the probability of winning an IPO allotment across investors' portfolio wealth (the market value of their entire stock portfolio), based on a subsample where information about who applied for an IPO allotment is provided. Panel B reports the stock return for 113 IPO stocks used in the sample during 2014–2016. Panel C reports the summary statistics for investor trading and return variables. All variables are measured from Month −4 to Month −2 (pre-treatment period) relative to the IPO month (Month 0) and from the Month +1 to Month +3 (post-treatment period). The sample in Panel C consists of 11,382,612 person-period observations during 2014–2016. We obtain data from Shanghai Stock Exchange. Definitions of all variables are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles.

Investors with qualified holdings can apply for IPO allotments. Investors need to have 10,000 RMB worth of stocks on average during the day t-20 to t-2 period relative to the IPO subscription day. For each 10,000 RMB worth of stock, investors can apply for 1000 IPO shares (labeled as one allotment ticket) on day t. Investors cannot apply for more than 0.1% of total IPO volume for a single firm or the maximum number of shares specified by the underwriter—whichever is lower. The tickets will be drawn randomly under audit on day t + 1, and investors will learn their application results on day t + 2. On average, there are 11 days between IPO allotment application day and IPO public trading day. Although richer investors can apply for more IPO shares and thus have higher chances of winning an IPO allotment, such a chance is still relatively small in the absolute magnitude. As shown in Table 1 Panel A, for the investors in the bottom decile of portfolio wealth, the probability of winning at least one allotment (calculated as the number of investors winning at least one allotment normalized by the total number of applicants) is 0.37%; while for the investors in the top decile of portfolio wealth, the probability is only 6.26%. This result indicates that winning an IPO allotment requires luck no matter how rich the investor is, and that it is highly likely for even those in the richest decile to win nothing.

During our sample period, applying for IPO allotments is almost costless. Qualified investors only need to click an "application" button in the stock trading software provided by their brokerage firms, and no upfront deposits are needed. The average winning probability for an IPO allotment application is 0.48% in our sample period. Although the winning probability is quite low, investors can reap around 15,000 RMB (around 2300 USD) profit by winning one IPO allotment application (i.e., winning 1000 shares of the IPO firm).

Based on the discussion above, from an *ex ante* perspective, applying for an IPO allotment is almost a zero-NPV investment: The cost of doing so is null and the expected benefit is also tiny (=15,000 RMB × 0.48% =72 RMB =11 USD). However, from an *ex post* perspective, winning an IPO allotment depends purely on luck and yields nontrivial monetary payoff.

3. Hypothesis development

Our theoretical framework follows the model developed by Gervais and Odean (2001), who show that overconfidence is determined endogenously and changes dynamically based on a trader's past success or failure. When a trader is successful, he attributes too much of his success to his own ability and revises up his belief about his ability too much, which leads to overconfidence about his ability. In their model, traders infer their ability from their experience, and the bias (such as self-serving attribution bias) in the learning process leads to overconfidence about their true ability. The more overconfident an investor is, the more he trades and the lower he gains from trading.

Although traders do not update belief about "luck" in their model, one can easily extend their idea from "inferring ability" to "inferring luck." The outcomes of many risky decisions depend on both ability and luck. In general, economic theories assume that luck is a random, uncontrollable factor that should have little effect on future expectations. Although this is certainly correct scientifically, many people seem to view luck differently. In reality, it is common to see that some people "believe in luck," meaning they believe good luck consistently produces success in their daily lives (Schuster et al., 1989; Wiseman and Watt, 2004). Luck can give people an illusion of control and can be a source of optimism in their lives (Langer and Roth, 1975; Taylor and Brown, 1988). People sometimes say that they have lucky days or that they think of themselves as lucky people in general. For example, Michael Jordan (a professional basketball player for the Chicago Bulls) changed the number on his uniform to "change his luck," following a series of disappointing performances.[4] These statements imply that luck is viewed as a personal quality that can be somewhat stable over a short period of time.

Extending Gervais and Odean's (2001) framework of inferring ability, traders can update their belief as to whether they are in a lucky stage from their recent experience of "lucky events." Traders who have recently experienced "good luck" may inflate their subjective probability of being lucky too much and thus become overconfident about their prospects. Accordingly, this can lead to excessive (and inefficient) trading, similar in spirit to overconfidence about one's ability. Such a conjecture is widely supported by psychology studies. For example, Darke and Freedman (1997) provide evidence that people react to lucky events by becoming more positive about the likelihood of future success, and such irrational beliefs about luck can serve as a source of positive expectations for the outcome of future events. DeMarree et al. (2005), Wheeler et al. (2007), and Kramer and Block (2008) find that "luck" is a concept stored in people's memory and functions in the same way as other concepts (such as skill and ability), and that the exposure to lucky events could increase people's self-assessment of how lucky they are.

In summary, considering that we use the event of winning an IPO allotment as a measure of good luck, and turnover rate as a proxy for traders' overconfidence, we predict that traders will increase their trading volume following the winning of an IPO allotment.

4. Sample formation and variable construction

Our data is from the Shanghai Stock Exchange, which records all individuals' trading activities on the stock exchange. Our dataset covers the following three main files: trading, holding, and account type. In the trading file, we have account-trade level data that cover the common trade variables, security code, encrypted account identifier, trade price, trade volume, trade direction, and the date and time of the trade. The holdings file is recorded daily to reflect each account's end-of-day holdings. The holdings variables include encrypted account identifier, date, security code, holding balance, and effective date. The account type file classifies each account under a specific type, including retail, mutual fund, qualified foreign institutional investor, social security fund, insurance firm, brokerage asset management, broker self-account, hedge fund, and other institutions. In our study, we focus on all individual investor accounts.

We collect all the IPO events on the Shanghai Stock Exchanges from June 30, 2014 to September 1, 2016 (133 IPO events in total). We first identify the individuals who win the IPO allotment (the treated group). Then, for each treated investor, we match him to a control investor who (1) does not win the IPO allotment, and (2) has the same turnover rate (to three decimal points) and the closest average portfolio value in the three-month period prior to the IPO subscription. We choose to match on the dimension of portfolio value because it is positively associated with the likelihood of winning the IPO allotment (see our discussion in Section 2). We also choose to match on the dimension of turnover so that the treated and control groups have similar turnover rates prior to the treatment. We track their stock trading behavior from Month −4 to Month −2 (pre-treatment period) relative to the IPO month (Month 0) and

[4] Jordan goes back to No. 23 (1995, May 11). *USA Today*, p. 8C.

Table 2
Univariate tests.

	Treated group (1)	Control group (2)	Difference-in-differences test: (1)–(2)
Pre-event turnover (a)	365%	365%	
Post-event turnover (b)	411%	383%	
Difference = (b) − (a)	46%	18%	28%***

This table reports the univariate tests that examine the impacts of winning an IPO allotment on investors' trading behavior. Treated group is the group of investors who win an IPO allotment. For each investor in the treated group, we match him to a control investor who (1) does not win the IPO allotment and (2) has the same turnover rate (to three decimal points) and the closest average portfolio value in the three-month period prior to the IPO subscription. Pre-event (Post-event) turnover is the turnover rate measured in the three-month period before (after) winning the IPO allotment. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

from the Month +1 to Month +3 (post-treatment period). We omit Month −1 because it is possible that some investors intentionally buy more stock (thus, abnormally high trading volume) in that month to qualify for more IPO allotment tickets. For each pair of treated and control investors, we compute their turnover rate over each of the three-month periods around the IPO date. Considering that the trading of new IPO shares may bias our results and our interest lies in investors' trading behavior in their entire portfolio, we remove the trading of the new IPO stock for both the treated and control group. Furthermore, to avoid any possible noise caused by non-active stock accounts, we drop accounts with zero trading in a year and require investors in our sample to have an average portfolio size no less than 10,000 RMB in the pre-treatment period. Our final sample consists of 5,665,994 person-period for the treated group and 5,665,994 person-period for the control group (each period corresponds to a span of three months).

Following Barber and Odean (2001), our measure of turnover is the average of buy volume and sell volume divided by the average portfolio size. To gauge the effect of overconfident trading on return performance, we compute the following three variables to measure portfolio return: (1) raw return, (2) market-adjusted return (raw return minus the market index return), and (3) own-benchmark abnormal return. For the own-benchmark abnormal return, the benchmark is the three-month return of the beginning-period portfolio held by individual *i*, which represents the return the individual would have earned by holding his beginning-period portfolio for three months. Own-benchmark abnormal return is the raw return for each investor over the three-month period minus the benchmark return.

Table 1 Panel B provides summary statistics on the 133 IPO events. On average, the IPO offering price is 11.74 RMB (around 1.67 USD). Unsurprisingly, the first day stock return is 44% for all the IPO stocks. The first seven-day stock return following IPO is around 120% on average; the first-month stock return following IPO is about 300%. IPO firms' stock prices seem to be stabilized after one month of IPO, as the average three-month stock return following IPO is 296% (almost the same as the average first-month stock return following IPO). In summary, Panel B indicates that IPO stocks generate sizeable returns following the IPO. Table 1 Panel C presents the summary statistics on investor characteristics. On average, investors in our sample have a turnover rate of around 381% of their entire portfolio, and a stock portfolio value of 374 thousand RMB. Their raw portfolio return is 6.49% and market-adjusted return is −1.77%, indicating that they greatly underperform the market. Their own-benchmark abnormal return is −5.33%, indicating that these investors would be much better off had they not made any trades.

5. Empirical results

5.1. Univariate tests

We examine the before-after effect of the change in trading behavior for the treatment group compared to the before-after effect in the control group. Table 2 reports the univariate test. In the three-month period before the treatment, the turnover rate is 365% for the treated group. The corresponding number is also 365% for the control group, which is unsurprising given that the control group is constructed by matching on turnover rate prior to the IPO allotment. However, in the three-month period following the IPO allotment, the turnover rate for the treated group increases to 411% (an increase of 46 percentage points), while the turnover rate for the control group only increases to 383% (an increase of 18 percentage points). These differences (46 percentage points vs. 18 percentage points) are significant at the 1% level.

Overall, the univariate test shows that the treated group trades more after winning an IPO allotment, compared to the control group. This result provides suggestive evidence that the experience of winning an IPO allotment subsequently makes people overconfident.

5.2. Baseline regression

We implement a standard difference-in-differences test through the following regression:

$$Turnover = \alpha + \beta_1 Treat \times Post + \beta_2 Treat + \beta_3 Post + \beta_4 Ln\ (Portfolio\ wealth) + \beta_5 Market\ performance + \varepsilon. \quad (1)$$

The dependent variable is the turnover rate of an individual's portfolio. The indicator variable *Treat* takes the value of one for the treated group, and zero for the control group. The indicator variable *Post* takes the value of one for the three-month period after

Table 3
The effect of winning an IPO allotment on turnover.

	(1)	(2)	(3)
	Without person FE		With person FE
Treat×Post	0.277***	0.331***	0.332***
	(74.97)	(89.70)	(90.63)
Treat	−0.000	−0.002	
	(−0.00)	(−0.43)	
Post	0.186***	0.232***	−0.078***
	(70.99)	(81.47)	(−29.69)
Ln(Portfolio wealth)		−0.569***	−0.576***
		(−407.32)	(−177.78)
Market return		0.448***	−1.267***
		(62.11)	(−206.46)
Constant	3.651***	10.392***	10.768***
	(1320.27)	(595.49)	(277.52)
Person FE	No	No	Yes
Observations	11,331,988	11,331,988	11,331,988
Adj_R^2	0.001	0.021	0.023

This table reports the difference-in-differences tests that examine the impacts of winning an IPO allotment on investors' trading behavior. The indicator variable *Treat* takes the value of one if the investor is in the treated group and zero if the investor is in the control group. The indicator variable *Post* takes the value of one for the three-month period after winning the IPO allotment, and zero for the three-month period before winning the IPO allotment. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

winning the IPO allotment, and zero for the three-month period prior to winning the IPO allotment. We control for the portfolio wealth (measured as the average portfolio wealth of each three-month period) and the return of the stock market index, which is the value-weighted average return of stocks listed in the Shanghai Stock Exchange.[5] Given that our treatment is defined at the person level, we cluster standard errors by person.

The coefficient of interest in this model is the $\beta_1$coefficient, which captures the turnover differences in the treated group before and after the event as opposed to the same before-after differences in the control group.

It is helpful to consider an example. Suppose we want to estimate the effect of winning an IPO allotment on a person's trading behavior. We can subtract the turnover rate before the event from the turnover rate after the event for people who win the IPO allotment. However, economy-wide shocks may occur at the same time and affect people's trading behavior. To difference away such factors, we calculate the same difference in turnover rates for persons who do not win the IPO allotment. Finally, we calculate the difference between these two differences, which represents the incremental effect of winning an IPO allotment on the treated group compared to the control group.

Table 3 presents the regression results. The coefficient estimates on *Treat*×*Post* are positive and statistically significant in all columns. In column (1), we include *Treat*×*Post, Treat,* and *Post* in the regression. We find that the coefficient on *Treat*×*Post* is positive and significant at the 1% level, suggesting that investors trade more after they win the IPO allotment. In addition, we control for *Ln (Portfolio wealth)* and the return of the stock market index in column (2), and the coefficient on *Treat*×*Post* is 0.331 and significant at the 1% level. The economic magnitude is sizable: Turnover rate increases by 33 percentage points after winning the IPO allotment, relative to the sample median turnover rate of 188 percentage points (i.e., an increase of approximately 18%).

It is worth noting that the data from the Shanghai Stock Exchange does not provide much demographic information, such as gender, age, education, profession, and so on. Given that our tests are in the difference-in-differences setting and that demographic information is largely time-invariant, whether to control for demographic information should not affect our results. Nonetheless, we additionally control for person fixed effect in the regression to control for all these time-invariant factors. The results are reported in column (3). After controlling for person fixed effect, the variable *Treat* is omitted, as it is absorbed by the fixed effect. The significance and magnitude of *Treat*×*Post* are largely unchanged (0.332 and significant at the 1% level). Thus, our main results are mostly the same after controlling for person time-invariant factors through person-fixed effects.

With regard to control variables, we find that the coefficient on *Ln (Portfolio wealth)* is significantly negative, indicating that a larger portfolio value is associated with lower turnover rate. This result indicates that our findings of increased turnover following the IPO allotment are not likely driven by wealth effect (i.e., an increase in wealth). We also find that investors tend to trade more when the stock market is booming, which is consistent with Barber and Odean (2001).

Taken together, these results indicate that investors tend to trade more aggressively after they win an IPO allotment.[6] These

[5] We obtained from CSMAR.

[6] As per Barber and Odean (2001), we do not distinguish the turnover rate arising from the buy or sell transactions, because overconfidence-driven excessive trading can be from either side. Nonetheless, in column (6) of Table 5, we provide evidence that investors put more money into the stock market after winning the IPO allotment (i.e., more buy transactions).

Table 4
Heterogeneous treatment effect.

	(1)	(2)	(3)	(4)
	Investor experience	Past record of winning an IPO allotment	Market condition	Pre-existing turnover rate
Treat×Post×Low	0.208***	0.378***	0.194***	0.231***
	(27.21)	(42.08)	(14.86)	(31.82)
Treat×Post	0.144***	−0.004	0.215***	0.190***
	(28.14)	(−0.50)	(29.95)	(64.50)
Treat× Low	0.197***	−0.000	0.000	−0.000
	(24.17)	(−0.04)	(0.03)	(−0.000)
Low ×Post	−0.000	0.586***	2.251***	−1.371***
	(−0.08)	(86.67)	(242.30)	(−261.31)
Treat	−0.068***	−0.001	−0.002	−0.001
	(−12.15)	(−0.12)	(−0.34)	(−1.11)
Post	0.375***	−0.297***	−0.896***	0.744***
	(94.08)	(−49.75)	(−162.33)	(353.45)
Low	0.721***	0.680***	−0.813***	5.901***
	(124.80)	(87.04)	(−122.18)	(1374.23)
Ln(Portfolio wealth)	−0.524***	−0.525***	−0.557***	−0.296***
	(−346.21)	(−369.72)	(−403.56)	(−257.14)
Market return	0.965***	0.344***	0.761***	−0.604***
	(126.44)	(46.41)	(65.74)	(−93.56)
Constant	9.281***	9.280***	10.522***	4.353***
	(478.38)	(472.18)	(598.58)	(310.23)
Observations	9,560,868	11,331,988	11,331,988	11,331,988
Adj_R^2	0.030	0.026	0.035	0.299

This table reports the triple difference-in-differences tests to examine the heterogeneous treatment effects. The indicator variable *Treat* takes the value of one if the investor is in the treated group and zero if the investor is in the control group. The indicator variable *Post* takes the value of one for the three-month period after winning the IPO allotment, and zero for the three-month period before winning the IPO allotment. In column (1), the indicator variable *Low* takes the value of one if the investor's experience (measured as the number of years since he opened his stock trading account) is below the sample median, and zero otherwise. In column (2), the indicator variable *Low* takes the value of one if the number of times the investors won an IPO allotment in the past is below the sample median and zero otherwise. In column (3), the indicator variable *Low* takes the value of one if the market index return is below the sample median and zero otherwise. In column (4), the indicator variable *Low* takes the value of one if the investors' turnover rate in the pre-treatment period is below the sample median and zero otherwise. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

findings are consistent with our hypothesis that people tend to become overconfident after experiencing good luck.

5.3. Heterogeneous treatment effects

To provide further evidence that the effect of winning an IPO allotment on trading activities is indeed related to overconfidence, we implement triple difference-in-differences tests to explore heterogeneity in the treatment effects. Evidence of heterogeneous treatment effects helps alleviate the concern that some omitted variables are driving our results, because such variables would have to be uncorrelated with all the control variables we include in the regression model and would also have to explain the cross-sectional variation in the treatment effect. As pointed out by Claessens and Laeven (2003) and Raddatz (2006), it is less likely to have an omitted variable correlated with the interaction term than with the linear term. We explore four possible sources of heterogeneity in the treatment effect.

First, Gervais and Odean (2001) predict that with more trading experience, people could develop better self-assessment and are less likely to become overconfident. Thus, we expect the treatment effect to be stronger for individuals who are inexperienced in investing in the stock market. We measure investors' experience by the number of years since they opened their stock trading account. The *Low* indicator in Table 4 column (1) takes the value of one if the investor's experience is below the sample median, and zero otherwise. We add the three-way interaction *Treat*×*Post*×*Low*, and estimate the following regression:

$$\begin{aligned} Turnover = {} & \alpha + \beta_1 Treat \times Post \times Low + \beta_2 Treat \times Post + \beta_3 Treat \times Low + \beta_4 Post \times Low + \beta_5 Treat + \beta_6 Post + \beta_7 Low \\ & + \beta_8 Ln(Portfolio\ wealth) + \beta_9 Market\ performance + \varepsilon. \end{aligned} \tag{2}$$

The coefficient on the *Treat*×*Post*×*Low* variable is positive and significant at the 1% level, indicating that the treatment effect is stronger for individuals who have less experience in trading in the stock market. Specifically, the coefficient on *Treat*×*Post* is 0.144 and the coefficient on *Treat*×*Post*×*Low* is 0.208; both are significant at the 1% level. For inexperienced investors, their turnover rate increases by 35.2 (=14.4 + 20.8) percentage points, while the turnover rate increases by 14.4 percentage points for experienced investors.

Second, we examine the investors' past record of winning an IPO allotment. If an investor has never won an IPO allotment in the past (as opposed to the one who has won an IPO allotment many times), he may be more likely to misinterpret this lucky event and become overconfident. Thus, we expect the treatment effect to be stronger for investors who have few records of winning an IPO

Table 5
The effect of winning an IPO allotment on performance.

	(1) Raw return	(2) Own-benchmark abnormal return	(3) Market-adjusted abnormal return	(4) Security selection	(5) Ln (Portfolio wealth)	(6) Disposition effect
Treat×Post	−0.010***	−0.020***	−0.012***	−0.002***	0.095***	0.034***
	(−32.93)	(−46.05)	(−37.84)	(−18.72)	(157.21)	(11.47)
Treat	0.009***	0.008***	0.010***	−0.001***	−0.003***	−0.011***
	(42.71)	(32.24)	(49.12)	(−7.21)	(−2.95)	(−29.83)
Post	−0.045***	−0.093***	−0.042***	−0.013***	−0.067***	−0.014***
	(−209.12)	(−286.21)	(−200.36)	(−164.84)	(−137.28)	(−54.76)
Ln(Portfolio wealth)	0.005***	0.010***	0.006***	0.001***		−0.005***
	(84.07)	(113.11)	(96.91)	(36.06)		(−43.33)
Market return	0.886***	0.716***	−0.079***	0.028***	−0.033***	−0.005***
	(1990.03)	(1186.14)	(−177.68)	(180.89)	(−21.32)	(−43.33)
Constant	−0.051***	−0.186***	−0.063***	−0.008***	11.985***	−0.001***
	(−66.62)	(−170.68)	(−83.45)	(−26.61)	(16,296.09)	(−17.54)
Observations	11,331,988	11,331,988	11,331,988	11,331,988	11,331,988	11,331,988
Adj_R^2	0.381	0.194	0.009	0.014	0.001	0.010

This table reports the difference-in-differences tests that examine the impacts of winning an IPO allotment on investors' stock performance. The indicator variable *Treat* takes the value of one if the investor is in the treated group and zero if the investor is in the control group. The indicator variable *Post* takes the value of one for the three-month period after winning the IPO allotment and zero for the three-month period before winning the IPO allotment. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

allotment in the past. The *Low* indicator in column (2) takes the value of one if the number of times an investor wins an IPO allotment is below the sample median, and zero otherwise.

The coefficient on the *Treat*×*Post*×*Low* variable is positive and significant at the 1% level, while the coefficient on the *Treat*×*Post* indicator variable is an insignificant −0.004. This result indicates that the treatment effect is stronger for individuals who have seldom won an IPO allotment in the past and is virtually absent for individuals who have won an IPO allotment many times.

Third, existing literature shows that investors tend to be more overconfident when the market is booming (Akerlof and Shiller, 2010). We expect that the incremental effect of winning an IPO allotment on overconfidence is larger when the investors have a low level of overconfidence to begin with (i.e., the market bust period). In column (3), the *Low* indicator takes the value of one if the market index return is below the sample median, and zero otherwise. The coefficient on the *Treat*×*Post*×*Low* variable is positive and significant at the 1% level, indicating that the treatment effect is stronger for the market bust period (when the pre-existing level of overconfidence is likely low). Specifically, the coefficient on *Treat*×*Post* is 0.194 and the coefficient on *Treat*×*Post*×*Low* is 0.215; both are significant at the 1% level. During the market bust period, investors' turnover rate increases by 40.9 (=19.4 + 21.5) percentage points, while the turnover rate increases by only 21.5 percentage points during the market boom period.

Finally, considering that turnover rate is positively correlated with the level of overconfidence, we also expect that the incremental effect of winning an IPO allotment on overconfidence is larger when the investors' pre-treatment turnover rate is low (i.e., when the investors have a low level of overconfidence to begin with). In column (4), the *Low* indicator takes the value of one if the investor's turnover rate in the pre-treatment period is below the sample median, and zero otherwise. The coefficient on *Treat*×*Post* is 0.190 and the coefficient on *Treat*×*Post*×*Low* is 0.231; both are significant at the 1% level. For the investors with a low pre-existing overconfidence level (i.e., low turnover rate in the pre-treatment period), turnover rate increases by 42.1 (=19.0 + 23.1) percentage points, while the turnover rate increases by only 19 percentage points for those with high pre-existing levels of overconfidence.

In summary, the cross-sectional variations in the treatment effects show that the effect of winning an IPO allotment on trading is indeed tied to investors' experience and pre-existing overconfidence level. Specifically, we find that the treatment effects are stronger when the investors have little experience with trading in the stock market, when the investors have seldom won an IPO allotment in the past, when the investors are in the market bust period, and when the investors have a low pre-existing turnover rate.

5.4. Portfolio return

In this section, we examine the portfolio return of these investors. Examining their portfolio return could further help to distinguish whether increased turnover rate is due to increased overconfidence or due to some rational response made by the individuals. If the changes in the trading behavior reflect any kind of rational response made by the individuals, we expect that their stock performance would not worsen. An example of such rational response is that winning an IPO allotment could affect a person's risk preference and make him more risk-seeking. Thus, high turnover rate could simply reflect a change in risk-taking preference. However, this type of explanation could predict higher raw return in the post-event period, considering that high risk is associated with high raw return. Another example of rational response could be portfolio rebalancing: After winning the IPO allotment, investors rationally rebalance their existing portfolio, which subsequently leads to a higher turnover rate. This explanation, however, does not predict a performance decline. In contrast, overconfidence implies that investors mistakenly over-estimate their prospects in the stock market, and thus predict that such trading should be associated with lower return.

We re-estimate Eq. (1) by using a person's portfolio return as the dependent variable. In column (1) Table 5, we use the raw return as the dependent variable. The coefficient on *Treat*×*Post* is −0.01 and is significant at the 1% level. This result indicates that individuals in the treated group experience a decrease in raw return by one percentage point over the three-month period following the winning of the IPO allotment (an annualized return of −4 percentage points).

In column (2), the dependent variable is the own-benchmark abnormal return, which represents the return that the investor would have earned if he had merely held his beginning-of-period portfolio for the entire period. The coefficient on *Treat*×*Post* is −0.02 and is significant at the 1% level. This result indicates that investors in the treated group experience a decrease in their own-benchmark abnormal return by two percentage points over the three-month period following the winning of an IPO allotment.

In column (3), we examine the market-adjusted return as the dependent variable. The coefficient on *Treat*×*Post* is −0.012 and is significant at the 1% level: Investors in the treated group experience a decrease in their market-adjusted return by 1.2 percentage points over the three-month period following the winning of the IPO allotment.

Overconfidence could hurt investors' stock performance through not only excessive trading but also inferior security selection. Following Barber and Odean (2001), we measure an investor's security selection ability by comparing the returns of stocks they bought with those of stocks they sold. For both the pre-treatment and post-treatment periods, we construct a value-weighted portfolio comprised of stocks purchased and a value-weighted portfolio comprised of stocks sold by investors. Thus, in total, we construct four portfolios: (1) the purchase portfolio in the pre-treatment period, (2) the sell portfolio in the pre-treatment period, (3) the purchase portfolio in the post-treatment period, and (4) the sell portfolio in the post-treatment period. We then calculate the returns of each transaction in the portfolio in the next three months.[7] Finally, the return of the portfolio is the value-weighted return of all transactions in the portfolio. The variable *Security selection* is computed as follows: the three-month return of purchase portfolio - the three-month return of sell portfolio. The dependent variable in column (4) is the variable *Security selection*. The coefficient on *Treat*×*Post* is negative and significant at the 1% level. This result indicates that investors' security selection ability becomes worse after winning an IPO allotment.

Moreover, following the IPO allotment, does the treated group input more money into the stock market (in addition to the money invested in the IPO shares)? In column (5), the dependent variable is *Ln (Portfolio wealth)*, which is the market value of the investor's portfolio (excluding the IPO shares). The coefficient on *Treat*×*Post* is 0.095 and is significant at the 1% level: The portfolio value of the treated group (excluding the IPO shares) increases by approximately 10% ($=e^{0.095}-1$) after winning the IPO allotment. Even though the treated group's stock performance is declining, they input more money into the stock market. This result is broadly consistent with the view that winning an IPO allotment makes these investors overconfident.

Last, as pointed out by Barber and Odean (1999), in addition to overconfidence, disposition effect is another type of investors' behavioral biases, which is characterized as investors commonly disposing of winning shares and keeping losing ones. Thus, it may be an interesting question to investigate whether winning the IPO allotment affects investors' disposition effect. Existing literature shows that investors' behavioral biases tend to be correlated: An investor with one type of bias is more likely to have another type of bias (Bailey et al., 2011). If winning the IPO allotment makes investors overall less rational, we expect that the disposition effect increases accordingly.

Following Odean (1998), we compute the disposition effect of each investor in the following way. We first compute the proportion of gains realized (*PGR*) as the number of realized gains divided by the number of realized gains plus the number of unrealized gains. We then compute the proportion of loss realized (*PLR*) as the number of realized losses divided by the number of realized losses plus the number of unrealized losses.[8] The variable *Disposition* is measured as *PGR - PLR*. The dependent variable in column (6) is *Disposition*. The coefficient on *Treat*×*Post* is 0.034 and is significant at the 1% level: The disposition effect of the treated group increases (as compared to the control group) by approximately 3.4 percentage points after winning the IPO allotment. This effect is economically sizeable considering that the sample average of disposition effect is 0.04.

Overall, Table 5 shows that after winning the IPO allotment, investors earn significantly lower return compared to the investors in the control group. This result is consistent with the view that higher turnover rate after the IPO allotment reflects overconfidence rather than any rational response made by investors. Table 5 also indicates that investors tend to demonstrate stronger disposition effect after winning the IPO allotment.

5.5. *Portfolio volatility*

In this section, we examine the volatility of investors' portfolios. We estimate *Idiosyncratic volatility* as the standard deviation of the residuals of daily stock return from Fama-French three factors, following Ang et al. (2006). We estimate *Systematic volatility* as the sum of squared daily returns over the past 22 days, adjusting for first-order autocorrelations, following French et al. (1987) and Schwert

[7] In untabulated analysis, we measure the portfolio return in the subsequent 6 months and 12 months. Our inference is unchanged.

[8] For the pre-treatment period, we use the transaction data starting from month −6 (i.e., three months before the pre-treatment period) to determine the average purchasing price of stocks in each individual's portfolio. For the post-treatment period, we use the transaction data starting from month −2 (i.e., three months before the post-treatment period) to determine the average purchasing price of stocks in each individual's portfolio. For each day, we record the stocks sold as a winner and the stocks sold as a loser by comparing the selling price and the average purchasing price. For stocks that didn't have transactions, we record whether they are winners or losers based on their end-of-day price relative to their average purchase price. For both the pre-treatment period and post-treatment period, we add up the number of realized gains and the number of unrealized gains as well as the number of realized losses and the number of unrealized losses.

Table 6
The effect of winning an IPO allotment on volatility.

	(1)	(2)	(3)	(4)
	Idiosyncratic volatility	Systematic volatility	Relative idiosyncratic volatility	Relative systematic volatility
Treat×Post	0.022***	0.058***	0.003***	0.009***
	(251.42)	(226.33)	(141.70)	(79.37)
Treat	−0.005***	−0.015***	0.001***	0.003***
	(−74.84)	(−78.11)	(46.79)	(43.61)
Post	0.009***	−0.035***	−0.001***	−0.011***
	(147.48)	(−196.35)	(−78.17)	(−148.24)
Ln(Portfolio wealth)	−0.005***	−0.012***	−0.001***	−0.004***
	(−175.65)	(−183.91)	(−22.23)	(−125.53)
Market return	−0.180***	−0.272***	−0.005***	−0.013***
	(−137.40)	(−529.52)	(−88.86)	(−62.57)
Constant	0.409***	0.102***	0.008***	−0.015***
	(130.14)	(203.91)	(108.79)	(−38.42)
Observations	11,331,988	11,331,988	11,331,988	11,331,988
Adj_R^2	0.068	0.022	0.003	0.003

This table reports the difference-in-differences tests that examine the impacts of winning an IPO allotment on investors' stock volatility. The indicator variable *Treat* takes the value of one if the investor is in the treated group and zero if the investor is in the control group. The indicator variable *Post* takes the value of one for the three-month period after winning the IPO allotment and zero for the three-month period before winning the IPO allotment. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

and Seguin (1990). The dependent variables in columns (1) and (2) of Table 6 are idiosyncratic volatility and systematic volatility of investors' portfolios, respectively. The coefficients on *Treat×Post* are positive and significant at the 1% level in both columns, indicating both types of volatility increase after investors believe they are lucky.

Next, we examine the difference in volatility between the stocks purchased and the stocks sold.[9] In particular, we compute the idiosyncratic volatility and systematic volatility for both the purchase portfolio and the sell portfolio. Then we define the *Relative idiosyncratic volatility* variable as *Idiosyncratic volatility* of the purchase portfolio - *Idiosyncratic volatility* of the sell portfolio. The *Relative systematic volatility* variable is defined similarly. The dependent variables in columns (3) and (4) of Table 6 are *Relative idiosyncratic volatility* and *Relative systematic volatility*, respectively. The coefficients on *Treat×Post* are positive and significant at the 1% level in both columns, indicating that following the IPO allotment, investors' purchase portfolio has higher volatility than their sell portfolio. Existing literature has documented two types of overconfidence: Investors can be overoptimistic (they make incorrect inferences about the mean of a distribution) or they can be overprecise (they make incorrect inferences about the standard deviation of the distribution) (see, e.g., Moore and Healy, 2008). Our findings of greater portfolio volatility suggest that investors seem to become overprecise after they believe they are lucky.

5.6. Gambling propensity and lottery-like stock in the portfolio

In this section, we examine whether winning the IPO allotment increases these "lucky" investors' gambling propensity by holding more lottery-like stock in their portfolio. Following Han and Kumar (2013), we measure the lottery-like stock using the composite lottery index (*Lottery*). The lottery index of a stock in a given three-month is defined as the sum of the vigintile assignments to its idiosyncratic volatility, idiosyncratic skewness, and nominal stock price. Nominal stock price is the average daily closing stock price in the given three-month period. Idiosyncratic volatility is the volatility of the residual obtained from regressing the firm's daily returns on corresponding Fama-French three factors and the momentum factor. Idiosyncratic skewness is the third moment of the residual obtained by fitting a two-factor model (market returns and the square of market returns). Idiosyncratic volatility and idiosyncratic skewness are both estimated using daily returns over the past six months. We also use Bali et al.'s (2011) *MAX* as an alternative measure of stock lottery. *MAX* is defined as the average of the five largest daily returns over the corresponding three-month period (measured in percentage points). For each investor, we calculate the dollar-weighted average lottery characteristics of his entire portfolio.

In columns (1) and (2) of Table 7, the dependent variables are *Lottery* and *MAX*, respectively; the coefficients on *Treat×Post* are positive and significant at the 1% level in both columns. These results indicate that following the IPO allotment, investors tend to hold more lottery stocks in their portfolio.

To compare the lottery characteristics between investors' purchase portfolio and their sell portfolio, we define *Relative lottery* as *Lottery* of the purchase portfolio - *Lottery* of the sell portfolio. Thus, the *Relative lottery* variable measures the difference in gambling propensity for the stock purchased and the stock sold. Similarly, we define the *Relative MAX* as *MAX* of the purchase portfolio- *MAX* of the sell portfolio. The dependent variables in columns (3) and (4) of Table 7 are *Relative lottery* and *Relative MAX*, respectively. The

[9] The details of purchase portfolio and sell portfolio are provided in Section 5.4 when we construct the variable *Security selection*.

Table 7
The effect of winning an IPO allotment on gambling propensity.

	(1)	(2)	(3)	(4)
	Lottery	MAX	Relative lottery	Relative MAX
Treat×Post	0.110***	0.428***	0.004***	0.091***
	(62.13)	(254.05)	(98.25)	(68.44)
Treat	−0.061***	−0.030***	−0.001***	−0.006***
	(−106.47)	(−28.51)	(−22.73)	(−6.46)
Post	−0.030***	0.394***	−0.004***	−0.009***
	(−27.96)	(331.08)	(−127.60)	(−9.06)
Ln(Portfolio wealth)	−0.054***	−0.019***	−0.003***	−0.004***
	(−93.89)	(−62.24)	(−115.72)	(−6.48)
Market return	0.047***	2.652***	0.004***	0.167***
	(140.16)	(917.28)	(46.23)	(71.64)
Constant	0.366***	0.795***	−0.018***	−0.002
	(566.75)	(206.39)	(−63.90)	(−0.02)
Observations	11,331,988	11,331,988	11,331,988	11,331,988
Adj_R^2	0.003	0.045	0.008	0.001

This table reports the difference-in-differences tests that examine the impacts of winning an IPO allotment on investors' gambling propensity. The indicator variable *Treat* takes the value of one if the investor is in the treated group and zero if the investor is in the control group. The indicator variable *Post* takes the value of one for the three-month period after winning the IPO allotment and zero for the three-month period before winning the IPO allotment. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8
Net wealth effect of winning the IPO allotment.

Rank of the 10 portfolio wealth decile	(1)	(2)	(3)
	Gain from IPO	Loss due to overconfidence	Net wealth effect (1) + (2)
1 (lowest portfolio wealth)	15,381	−362	15,020
2	15,398	−932	14,467
3	15,421	−1605	13,817
4	15,439	−1820	13,619
5	15,461	−2860	12,601
6	15,495	−3461	12,034
7	15,553	−5194	10,359
8	15,642	−8064	7578
9	15,818	−10,550	5268
10 (highest portfolio wealth)	16,933	−24,574	−7640

This table reports the net wealth effect of winning an IPO allotment. We divide our full sample into deciles based on portfolio wealth. For each group, we re-estimate the model of column (1) of Table 5 and obtain the coefficient on *Treat*×*Post*. Gain from IPO is defined as IPO shares × (share price at the end of post-treatment period — IPO price). Wealth loss due to overconfidence is defined as portfolio wealth × the coefficient on *Treat*×*Post*. The net wealth effect is the sum of IPO gain and the wealth loss due to overconfidence.

coefficients on *Treat*×*Post* are also positive and significant at the 1% level in both columns, indicating that investors' purchase portfolios are more like lotteries than their sell portfolios.

Overall, Table 7 indicates that investors tend to purchase more lottery stocks after winning the IPO allotment. These results are broadly consistent with our hypothesis that good luck makes investors overconfident (especially the overprecise type of overconfidence).

5.7. Net wealth gain of winning an IPO allotment

Although the IPO shares increase an investor's welfare, the subsequent excessive trading decreases his welfare. An expected question arises: What is the net wealth gain of winning an IPO allotment? Considering that the RMB-value loss associated with excessive trading should be larger for investors with larger portfolios, we expect the net wealth effect to decrease with investors' portfolio wealth.

To formally estimate the net wealth effect, we first divide our sample into 10 deciles based on investors' wealth level. Then, for each group, we re-estimate the model reported in column (1) of Table 5 and obtain the coefficient β_1 on *Treat*×*Post*. Finally, the RMB-value

Table 9
Subsample analysis on rich individuals.

	(1)	(2)
	Top 10% wealthy investor	Investors with portfolio wealth greater than 1.5 million RMB
Treat×Post	0.150***	0.143***
	(13.52)	(8.66)
Treat	−0.001	−0.000
	(−0.17)	(−0.02)
Post	0.523***	0.603***
	(63.72)	(49.92)
Ln(Portfolio wealth)	−0.525***	−0.587***
	(−104.22)	(−75.78)
Market return	0.860***	0.780***
	(47.51)	(30.16)
Constant	9.696***	10.597***
	(133.76)	(91.04)
Observations	1,133,198	430,434
Adj_R^2	0.013	0.018

This table reports the difference-in-differences tests that examine the impacts of winning an IPO allotment on investors' trading behavior and portfolio return, based on a group of highly wealthy investors. The indicator variable *Treat* takes the value of one if the investor is in the treated group and zero if the investor is in the control group. The indicator variable *Post* takes the value of one for the three-month period after winning the IPO allotment and zero for the three-month period before winning the IPO allotment. In column (1), we focus on the subsample of investors whose portfolio wealth is in the top 10% of our full sample. In column (2), we focus on the subsample of investors whose portfolio wealth is at least 1.5 million RMB. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

net wealth is defined as the gain from winning the IPO allotment + portfolio wealth×β_1. The gain from winning the IPO allotment is defined as shares obtained ×cumulative post-IPO stock return in three months. We report the net wealth effect in Table 8.[10]

Consistent with our expectation, the net wealth gain of winning an IPO allotment decreases with the investor's wealth. For investors in the bottom decile (lowest portfolio wealth), their net wealth effect is around 15 thousand RMB. Such a net wealth effect gradually decreases to around five thousand RMB for the second top decile wealthy group. For those in the top decile (i.e., investors with the largest portfolio wealth), their net wealth effect is −7.6 thousand RMB. Such a negative value indicates that the loss of excessive trading surpasses the gain obtained from the IPO shares. Overall, winning the IPO allotment itself indeed benefits the winner; but the overconfidence greatly offsets (or even reverses) the gain.

5.8. *Additional investigation and robustness check*

5.8.1. *Subsample analysis of rich investors*

Our findings may be due to investors feeling "richer" rather than "luckier" after winning the IPO allotment (this is also related to the possible wealth effect and/or house money effect). To examine this possibility, in this subsection we focus on the subsample of rich investors, which enables us to better distinguish the above two explanations because the average value-gain of winning an IPO allotment (around 15,000 RMB or 2147 USD) is unlikely to make rich investors feel "richer."

In Table 9 column (1), we focus on the group of investors whose portfolio wealth is in the top 10% of all investors in our sample, and re-estimate Eq. (1). The regression specification is the same as that in column (2) of Table 3. The coefficient on the *Treat*×*Post* indicator is still significantly positive. The coefficient on *Treat*×*Post* is 0.15 and significant at the 1% level, indicating that turnover rate increases by approximately 15 percentage points after winning the IPO allotment.

In Table 9 column (2), we re-estimate column (1) by focusing on the group of investors whose portfolio wealth is at least 1.5 million RMB. We choose such a cutoff value so that the RMB value gain of each IPO allotment is less than 1% of the investors' portfolio wealth. Thus, the wealth effect or house money effect of winning an IPO allotment can be negligible. Such a restriction greatly reduces our sample to 430,434 observations, because only very a small number of investors are this wealthy. The coefficient on *Treat*×*Post* is 0.143 and significant at the 1% level, indicating that turnover rate increases by approximately 14 percentage points after winning the IPO allotment.

Overall, our main results still hold even for a group of wealthy individuals, indicating that our findings are unlikely due to individuals feeling "richer."

5.8.2. *How long does the effect last?*

A related question is: How long does the increased level of overconfidence last? We compute the turnover rate of our sample

[10] It is worth noting that the gain from IPO is quite similar across the ten groups. This is largely because, although wealthy investors are eligible for more IPO allotment tickets, it is rare in reality for an investor to win more than one allotment in an IPO.

Table 10
How long does the effect persist?

Panel A: Investors' trading behavior during months 4–6 and months 7–9

	(1)	(2)
	Turnover (months 4–6)	Turnover (months 7–9)
Treat×Post	0.093***	0.035***
	(23.74)	(8.93)
Treat	0.000	0.000
	(0.04)	(0.07)
Post	−0.025***	−0.342***
	(−8.05)	(−108.37)
Ln(Portfolio wealth)	−0.049***	−0.094***
	(103.33)	(302.16)
Market return	2.239***	2.907***
	(306.18)	(406.07)
Constant	2.676***	2.007***
	(428.53)	(441.81)
Observations	11,331,988	11,331,988
Adj_R^2	0.011	0.029

Panel B: Effect of investors' performance during months 1–3 on their trading behavior during months 4–6 and months 7–9

	(1)	(2)
	Turnover (months 4–6)	Turnover (months 7–9)
Treat×Post×Low	−0.046***	−0.030***
	(−47.59)	(−49.96)
Treat×Post	0.120***	0.051***
	(58.02)	(59.07)
Treat×Low	0.031***	0.029***
	(39.59)	(37.55)
Post×Low	0.040***	0.060***
	(53.86)	(78.22)
Treat	−0.032***	−0.024***
	(−105.83)	(−106.66)
Post	−0.056***	−0.419***
	(−269.44)	(−194.80)
Low	0.174***	0.151***
	(28.25)	(24.38)
Ln(Portfolio wealth)	−0.050***	−0.094***
	(−103.68)	(−302.85)
Market return	2.268***	2.905***
	(306.31)	(406.66)
Constant	2.671***	2.080***
	(428.36)	(442.06)
Observations	11,331,988	11,331,988
Adj_R^2	0.017	0.026

This table reports the difference-in-differences tests that examine the impacts of winning an IPO allotment on investors' trading behavior over a longer period. The indicator variable *Treat* takes the value of one if the person is in the treated group and zero if the person is in the control group. In columns (1) and (2) of both panels, the indicator variable *Post* takes the value of one for the three-month period (months 4–6 and months 7–9, respectively) after winning the IPO allotment and zero for the three-month period (months −4 to −1) before winning the IPO allotment. In Panel B, the *Low* indicator takes the value of one if the investor's portfolio return over months 1–3 is below the sample median and zero otherwise. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

investors over months 4–6 and months 7–9 following the IPO allotment.

In columns (1) and (2) of Table 10 Panel A, we examine the effect of winning an IPO allotment on turnover during the two periods specified above. The coefficients on *Treat*×*Post* are much smaller in magnitude than our baseline regression reported in Table 3, and decrease over time. For example, the coefficient on *Treat*×*Post* is 0.093 in column (1), indicating that the treatment effect is only 1/3 as large during the period of months 4–6 (0.093 vs. 0.331 reported in column (2) of Table 3). In column (2), where we examine the turnover rate during months 7–9, the coefficient on *Treat*×*Post* further shrinks to 0.035. The results indicate that the effect of winning an IPO allotment on turnover decreases over time and largely vanishes at the end of month 9.

Moreover, we distinguish investors who did well in the first three months after winning the lottery from those who did poorly during the same period. In Panel B, the *Low* indicator takes the value of one if the investor's portfolio return over months 1–3 is below the sample median, and zero otherwise. We find that the coefficients on *Treat*×*Post*×*Low* are negative and significant at the 1% level in both columns. These results indicate that the effect of winning an IPO allotment on turnover in months 4–6 and months 7–9 is

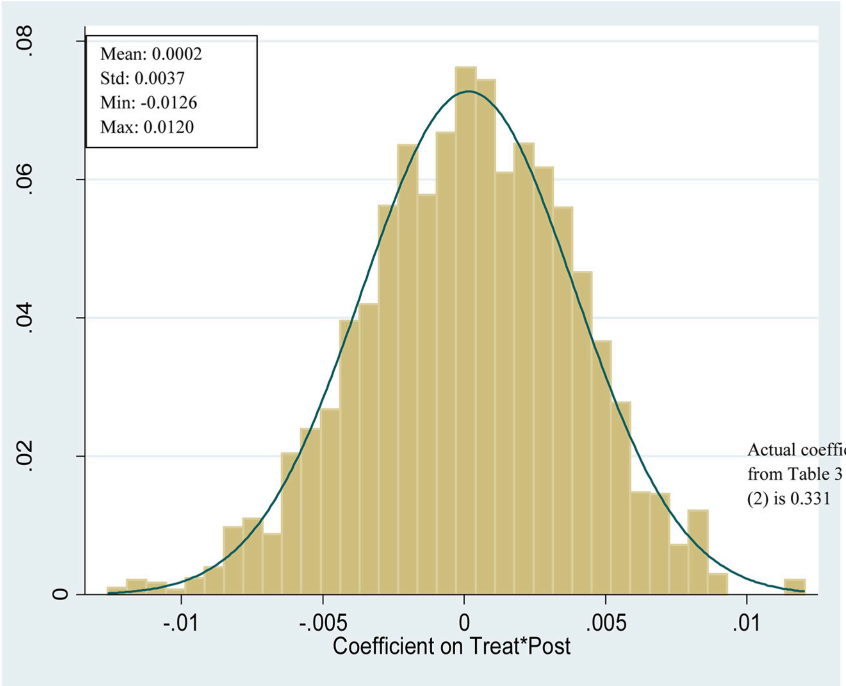

Fig. 1. Placebo test.
This figure shows a histogram of the coefficients on *Treat*×*Post* from 5000 bootstrap simulations of the model in column (2) of Table 3. For each iteration, we draw a random sample of 2,832,997 investors (the same number of the actual investors in our treatment group) as the "treatment group" from our sample pool, and then treat the rest of the pool as the control group. Based on these "pseudo" treated and control groups, we re-estimate column (2) Table 3 and save the coefficients on *Treat*×*Post*.

particularly smaller for the investors who perform poorly in the first three months after the IPO allotment. Taking column (1) for example, the coefficient on *Treat*×*Post* is 0.120 and the coefficient on *Treat*×*Post*×*Low* is −0.046; both are significant at the 1% level. For investors performing poorly during months 1–3, their turnover rate in months 4–6 increases by 7.4 (=12–4.6) percentage points, while the turnover rate increases by 12 percentage points for investors performing well during months 1–3. Such a finding is understandable, considering that investors who perform poorly during months 1–3 could probably realize that they are not lucky anymore and become less overconfident.

Overall, we show that the effect of winning an IPO allotment on investors' trading activities diminishes over time. These results also indicate that experience of "good luck" has a relatively short-term impact on investors' level of overconfidence. These findings are consistent with Gervais and Odean (2001), who state that overconfidence tends to be short-lived and investors progressively develop a more realistic self-assessment (especially after performing poorly in the stock market).

5.8.3. Placebo test

In this section, we implement placebo tests to investigate the possibility that our results are purely driven by chance. Specifically, we draw a random sample of 2,832,997 investors (the same number as the actual investors who won an IPO allotment) as the "pseudo-treated group" from our sample pool, and then treat the rest of the pool as the "pseudo-control group." Based on these "pseudo" treated and control groups, we re-estimate column (2) of Table 3 and save the coefficients on *Treat*×*Post*. We repeat this procedure 5000 times.

Fig. 1 plots the distribution of the coefficients on *Treat*×*Post*. The actual coefficient on *Treat*×*Post* of 0.331 (see column (2) of Table 3) is more than 88 times the standard deviation (0.0037) above the mean (0.0002) of the distribution, and much larger than the maximum coefficient estimate (0.012). This result indicates that our results are indeed driven by winning an IPO allotment and are unlikely to be driven by chance.

5.8.4. Participation in the IPO allotment

So far, the control group consists of the investors who do not win the IPO allotment. These investors could be either (1) the ones who apply for the IPO allotment but fail to get one or (2) the ones who did not apply in the first place. These two types of investors are likely to differ. In this subsection, we focus on a subsample in which information on whether an investor applied for an IPO allotment exists, and we require that the control investors are the ones who indeed applied but failed to get the IPO allotment. Then, we re-estimate the baseline regression. Table 9 presents the results. Although our sample size in Table 11 shrinks to about only one fifth of our full sample used in Table 3, we continue to find a significant increase in turnover rate in the treatment group as compared to the new control group.

Table 11
The effect of winning IPO allotment on turnover, subsample where all control investors have applied for IPO.

	(1)	(2)	(3)
	Without person FE		With person FE
Treat×Post	0.098***	0.146***	0.148***
	(13.47)	(20.26)	(20.68)
Treat	0.000	−0.002	
	(0.00)	(−0.29)	
Post	−0.163***	−0.217***	−0.399***
	(−31.55)	(−41.16)	(−80.00)
Ln(Portfolio wealth)		−0.843***	−0.865***
		(−246.39)	(−117.62)
Market return		0.091***	−2.126***
		(5.01)	(−132.20)
Constant	3.477***	13.609***	14.068***
	(571.49)	(316.98)	(159.06)
Person FE	No	No	Yes
Observations	2,427,328	2,427,328	2,427,328
Adj_R^2	0.001	0.035	0.039

This table reports the difference-in-differences tests that examine the impacts of winning an IPO allotment on investors' trading behavior, based on a subsample where information on whether investors have applied for the IPO subscription exists. We require that all investors in the control group are the ones who have applied for the IPO allotment but failed to get one. The regression specification is the same as that in Table 3. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. T-statistics based on robust standard errors clustered by person are in parentheses. The superscripts ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Overall, these results indicate that our inference is unchanged when the control group is the one who has applied for the IPO allotment (but failed to get one).

6. Conclusions

Overconfidence is a cognitive bias that is confirmed empirically to predict a wide range of economic outcomes. In this paper, we ask: What makes people overconfident? Does the experience of good luck in the present make people overconfident about their future prospects? Existing literature in economics and finance provides little evidence on this question, possibly because "good luck" is difficult to measure empirically. In this paper, we exploit a natural experiment in China's stock market to examine whether experiencing good luck makes people overconfident about their future prospects. We use the winning of an IPO allotment—an event purely driven by luck in China—as a measure of good luck. We find that investors who win an IPO allotment subsequently trade more frequently in the stock market and lose more money (a reflection of overconfidence). Such effects are stronger when investors are inexperienced and when investors have a low pre-existing level of overconfidence. We also show that investors exhibit a stronger gambling propensity and hold more lottery-like stock after winning an IPO allotment. Finally, we consider alternative explanations such as wealth effect and house money effect; we provide evidence that these explanations are unlikely to hold. Overall, our results are consistent with the view that an experience of good luck makes people overconfident about their future prospects.

Our study has implications on people's perception of luck. Do people believe in luck, meaning do they tend to view good luck as a stable (at least for a short period) and internal attribute which they possess? Or do people not believe in luck and instead maintain the rational view that it is external and unreliable (as modeled in most of the economic and finance literature)? Do people (incorrectly) revise their subjective assessment of luck after experiencing some good luck? Contributing to these debates, our study provides suggestive evidence that people tend to believe in luck and become overconfident about their future prospects after experiencing lucky events in the present.

Appendix 1. Variable definitions

Variable	Definition
Disposition	*PGR* - *PLR*. *PGR* is the number of realized gains divided by the number of realized gains plus the number of unrealized gains. *PLR* is the number of realized losses divided by the number of realized losses plus the number of unrealized losses.
Idiosyncratic volatility	Standard deviation of the residuals of daily stock return from Fama-French three factors.
IPO price	Offering price per share of the IPO.
Lottery	Lottery index of a stock, which is defined as the sum of the vigintile assignments to its idiosyncratic volatility, idiosyncratic skewness, and nominal stock price.
Market-adjusted return	Raw portfolio return - return of market index.
Market index	Market return of the composite in the Shanghai Stock Exchanges.
MAX	Average of the five largest daily returns over the corresponding three-month period (in percentage points).

(*continued on next page*)

(*continued*)

Variable	Definition
Own-benchmark abnormal return	Raw portfolio return - return of beginning of period portfolio.
Portfolio wealth	Value of total stock holding.
Raw return	Raw portfolio return.
Relative idiosyncratic volatility	*Idiosyncratic volatility* of the purchase portfolio -*Idiosyncratic volatility* of the sell portfolio.
Relative lottery	*Lottery* of the purchase portfolio -*Lottery* of the sell portfolio.
Relative max	*Max* of the purchase portfolio -*Max* of the sell portfolio.
Relative systematic volatility	*Systematic volatility* of the purchase portfolio-*Systematic volatility* of the sell portfolio.
Security selection	We construct a value-weighted portfolio comprised of those stocks purchased and a value-weighted portfolio comprised of those stocks sold by investors. We then calculate the returns of each transaction in the portfolio in the next three months. The return of the portfolio is the value-weighted return of all transactions in the portfolio. The variable *Security selection* is computed as the three-month return of purchase portfolio – the three-month return of sell portfolio.
Systematic volatility	Systematic volatility is the sum of squared daily returns over the past 22 days, adjusting for first-order autocorrelations.
Turnover	(half of buy volume + half of sell volume)/average portfolio wealth.

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