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Good luck, bad luck, and risk taking: Evidence from a natural experiment in the housing lottery

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ABSTRACT

This study investigates whether random shock signals affect individuals' investment decisions of risk taking using a unique data set from the housing lottery in Hangzhou, a major city in eastern China. New housing projects in Hangzhou are sold to individuals through housing lotteries with price caps. Our empirical evidence suggests that individuals' subsequent housing lottery decisions are significantly affected by their prior lottery results. After experiencing better lottery outcomes, which are purely driven by good luck, they tend to participate in hot projects with low lottery winning rates, taking more risks, and vice versa. However, this effect diminishes over time.

1. Introduction

Substantial evidence suggests that investors learn from their past investment experiences, even random experiences. Kaustia and Knüpfer (2008) first document a strong positive link between past IPO returns and future subscriptions at the investor level in Finland. Recent studies have provided more solid evidence by exploiting natural experiments. Anagol et al. (2021) study a natural experiment from India's IPO lotteries. They find that gains (losses) from winning the lottery lead investors to increase (decrease) portfolio trading volume in non-IPO stocks because investors mistakenly learn from random experiences about their ability. Similarly, Gao et al. (2021) observe that owing to overconfidence after winning China's IPO allotment, which is determined by good luck, investors are encouraged to trade more frequently. However, it is difficult to fully attribute such risk-taking behavior indicated by trade volume and frequency to pure luck and completely rule out other alternative mechanisms, such as "house money effect" or "playing safe effect" studied by Liu et al. (2010) and Suhonen and Saastamoinen (2018). Meanwhile, the significant impact of past random gains and losses on risk taking is not supported by the experiment in Gneezy and Potters (1997). Therefore, more corroborative evidence on the effect of pure luck is needed to help us better understand investor behavior from the perspective of reinforcement learning (Kaustia and Knüpfer, 2008), particularly concerning past randomized personal experiences.

In this study, we present evidence on whether individuals' risk-taking behavior in investment responds to pure luck in a field setting, the housing lottery in Hangzhou, which is a major city in eastern China. Since April 2018, the local government has implemented price caps and a lottery system for the sales of new housing projects to curb soaring housing prices. To purchase a new house from a housing project, one must first win the housing lottery organized for the project. The lower the price cap of a housing project compared with the market price is, the hotter the project is (i.e., more participants and lower winning rate). Individuals can observe price caps, market prices, and the number of houses for sale of different projects and thus estimate the number of participants and winning rates before deciding whether to participate in hot projects (i.e., taking more risks). Each participant of a housing project will receive the lottery result in the form of a randomly assigned ranking between 1 and the number of participants. The participant can win the lottery and have the right to purchase a house of the project, only if the ranking is higher than or equal to the number of houses for sale. We establish that individuals' subsequent housing lottery decisions of risk taking are significantly affected by their prior lottery results. Not only winning the lottery but also higher random rankings conditional on winning or losing significantly increase the probability that individuals later participate in hot projects with low lottery winning rates. However, this impact of pure luck diminishes over time.

2. Data

Since April 2018, new housing projects in Hangzhou have begun to be sold through housing lotteries with price caps lower

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than market prices. All housing lotteries must be notarized by Hangzhou National Notary Public Office, and the lottery results of all housing projects are publicized on its official website.[2] We obtain a panel data of 2,121,548 lottery records from April 2018 to January 2022 at the project-participant level covering 1602 housing projects and 653,296 participants. On average, each individual participates in 3.25 housing projects, each project attracts 1324 participants, and each project has 171 houses for sale. Using the data on names and ID numbers of all participants, we can identify the same participants across different projects and link their previous records to subsequent records. A lottery record contains the ranking information that a participant receives and the winning rate of the lottery, which enables us to explore the causal relationship between prior lottery results and subsequent lottery decisions.

3. Empirical results

3.1. Measurement of pure luck by prior lottery results

Pure luck is measured by randomly assigned rankings that lottery participants receive. The ranking is between 1 and the number of participants of a housing project. The higher the ranking is, the better the luck is. A participant can win the lottery and have the right to purchase a house of the project, only if the ranking is higher than or equal to the number of houses for sale of the project. For the comparability across the housing projects, rankings are standardized for lottery winners and losers, respectively, using the following equations:

$$standard\_ranking_{ih} = (ranking_{ih} - N\_winner_h)/N\_winner_h, \text{ for winners;}$$

$$standard\_ranking_{ih} = (ranking_{ih} - N\_winner_h)/N\_loser_h, \text{ for losers,}$$

where $ranking_{ih}$ represents the ranking that participant i receives in housing project h, N_winner_h denotes the number of winners of project h (i.e., the number of houses for sale of project h), and N_loser_h indicates the number of losers of project h (i.e., the number of participants minus the number of winners). For winners, $standard\_ranking_{ih}$ is negative ranging from -1 to 0, and for losers, it is positive ranging from 0 to 1. The higher the ranking is, the smaller the value of $standard\_ranking_{ih}$ is.

3.2. Prior lottery results and subsequent lottery decisions

As mentioned previously, each new housing project and the corresponding lottery is a separate natural experiment wherein the lottery results are randomly assigned. Our empirical specification is to compare the subsequent lottery decisions of risk taking among individuals who have participated in the same housing project, but experienced different lottery outcomes determined by pure luck.

$$hot\_project_{ih} = \alpha + \theta\ win_{ih} + \beta\ standard\_ranking_{ih} + X_i\gamma + \mu_h + \varepsilon_{ih},$$

where the dependent variable, $hot\_project_{ih}$, is an indicator of hot projects that individual i participates in after project h; it takes the value of 1 for hot projects with winning rates lower than 10% and 0 for ordinary projects with winning rates higher than or equal to 10%.[3] win_{ih} indicates that individual i wins the lottery

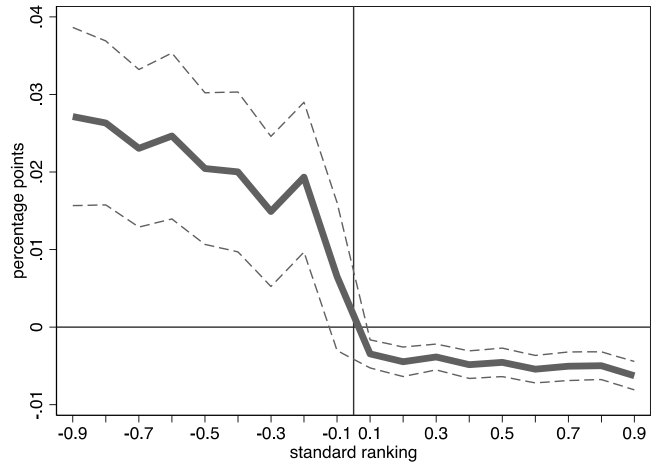

Fig. 1. The nonlinear effect of $standard\_ranking_{ih}$
Notes: Dashed lines depict the 90 percent confidence interval.

organized for project h. $standard\_ranking_{ih}$ represents the standardized ranking defined earlier that individual i receives from project h. The term X_i is a vector of characteristics of individual i, including family size, gender, and an indicator for Hangzhou natives. μ_h denotes the housing project fixed effect to compare individuals who have participated in the same project. Standard errors are clustered at the housing project level.

The subsequent tendency of participant i to take risk after his/her participation in project h is reported in Table 1. For the full sample, the estimates reveal that the lottery results of project h significantly impact participants' subsequent lottery decisions of risk taking. Experiencing good luck in project h, which is indicated by winning the lottery or higher rankings, encourages individuals to participate in hot housing projects with low winning rates. In Column (1), the coefficient of win_{ih} is 0.0426, which suggests that winning the lottery of project h increases the probability of participation in subsequent hot projects after project h by 4.26 percentage points. The coefficient of $standard\_ranking_{ih}$ is –0.0050, which means that the ranking at the top compared with the bottom is associated with 1 (= –0.0050 × (–1–1) ×100) percentage point more likely to participate in subsequent hot projects after project h. These estimates are stable to the inclusion of individual characteristics in Column (2). We change the criterion of hot projects to winning rates of 5% in Column (3) and 15% in Column (4), and our results are insensitive to the definition of hot projects. The estimates for winner and loser samples respectively are presented in Column (5)–(8), which indicate that the magnitude of the effect of rankings is much larger for winner samples. Fig. 1 further demonstrates the nonlinear effect of $standard\_ranking_{ih}$ based on the specification in Column (2). We split $standard\_ranking_{ih}$ into 20 bins of 0.1 width each. The group of $standard\_ranking_{ih}$ between –0.1 and 0.1 serves as the omitted group. Consistent with the results in Column (5)–(8), the profile is much steeper for winners (the left part of Fig. 1 with negative $standard\_ranking_{ih}$) than for losers (the right part with positive $standard\_ranking_{ih}$).

3.3. Timing of subsequent lottery decisions with respect to prior lottery results

In this section, we examine whether the effect of pure luck diminishes over time. We calculate the time gap between lottery results of project h and lottery decisions for project k using the following equation:

$$time\_gap_{ihk} = timing\_decision_{ik} - timing\_result_{ih}.$$

[2] The website address is https://www.hz-notary.com/lottery/index

[3] We also present results based on the criteria of 5% and 15% in column (3) and (4) of Table 1. Except where noted, the remaining analyses focus on the criterion of 10%.

Table 1
The effects of prior lottery results on subsequent lottery decisions of risk taking.

	Full sample				Winners of project *h*		Losers of project *h*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Win	0.0426*** (0.0026)	0.0414*** (0.0026)	0.0459*** (0.0027)	0.0465*** (0.0024)				
Standard ranking	−0.0050*** (0.0009)	−0.0050*** (0.0009)	−0.0056*** (0.0008)	−0.0055*** (0.0008)	−0.0226*** (0.0051)	−0.0225*** (0.0051)	−0.0043*** (0.0009)	−0.0043*** (0.0009)
Individual characteristics	No	Yes	Yes	Yes	No	Yes	No	Yes
Housing project fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.1296	0.1299	0.1045	0.0899	0.1195	0.1203	0.1305	0.1307
Mean dependent variable	0.5914	0.5915	0.3951	0.7826	0.5631	0.5632	0.5923	0.5923
Observations	7,369,862	7,369,107	7,369,107	7,369,107	204,636	204,620	7,165,201	7,164,462

Notes: *p<0.1; **p<0.05; ***p<0.01.

Table 2
Timing of subsequent lottery decisions with respect to prior lottery results.

Time gaps:	0 ∼ 90 days	90 ∼ 180 days	180 ∼ 270 days	> 270 days	< 0 days
	(1)	(2)	(3)	(4)	(5)
Win	0.0748*** (0.0039)	0.0535*** (0.0038)	0.0383*** (0.0042)	−0.0037 (0.0037)	0.0005 (0.0012)
Standard ranking	−0.0080*** (0.0010)	−0.0057*** (0.0013)	−0.0017 (0.0015)	0.0009 (0.0016)	0.0011 (0.0007)
Individual characteristics	Yes	Yes	Yes	Yes	Yes
Housing project fixed effect	Yes	Yes	Yes	Yes	Yes
R^2	0.2577	0.3420	0.3561	0.1257	0.0813
Mean dependent variable	0.6049	0.5787	0.6284	0.5540	0.6963
Observations	3,344,565	1,515,346	916,356	1,593,532	7,369,862

Notes: *p<0.1; **p<0.05; ***p<0.01.

We separately estimate the effects by time gaps based on the specification in Column (2) of Table 1. In Column (1)–(4) of Table 2, the coefficients of win_{ih} and $standard\_ranking_{ih}$ significantly decrease in magnitude over time, and for the subsample with time gaps of over 270 days, the effects of $standard\_ranking_{ih}$ and win_{ih} both become statistically insignificant. Furthermore, the estimate reported in Column (5) can be considered a placebo test. For this subsample, lottery decisions are made before lottery results indicated by negative time gaps and thus cannot be affected by these lottery results.

4. Conclusions

This study complements the existing literature on the economic effects of random shock signals by exploiting the housing lottery in Hangzhou, a major city in eastern China. We find that individuals mistakenly regard prior lottery results as informative signals, and therefore, take more risks in their subsequent lottery decisions after experiencing good luck, and vice versa. However, mechanisms should be further explored in future studies.

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