The Impact of Luck on Evaluation: Evidence of the Causal Effect from MLB *

Yusuke Tanahara† and Koji Yashiki‡

Abstract

This article investigated whether principal distinguishes between an action and luck to evaluate agent correctly in professional sports. We utilize high-frequency data provided by Major League Baseball to verify the effect of luck identified from a signal on principal. We find the evidence that principal is affected by an accidental success by agent. The principal's decision-making is changed by the fluctuation of outcome due to luck even if the agent's action is equivalent to each other. This evidence includes the implication for subjective evaluation and contracts in business.

JEL Classification: D86; M55; Z20; Z21

Keywords: principal agent problem; contract theory; baseball statistics

*We thank Rui Ota and Quin-Yuan Sui for their comments and suggestions.
†Yokohama City University, i170439d@yokohama-cu.ac.jp
‡Yokohama City University, m205118e@yokohama-cu.ac.jp

1 Introduction

In contract theory, the observation of an action by principal is an important issue. Principal requires the action that is at least better than the other for agent and make marginal cost equal to a marginal product, to agent. The distressing problem in satisfying the restrictions, however, is that principal cannot perfectly observes an action. In the imperfect information, principal observes agent's signal including a noise instead of a true action. As a result, the informativeness principal tends to make the subjective evaluation that may include a bias (Frederiksen et. al., 2017). In general, however, the perfect observation of an action is either impossible or prohibitively costly (Hölmström, 1979). Moreover, verifying whether principal evaluates agent based on an action isolated from a signal is difficult for researchers (Gauriot and Page, 2019).

The general method to study the relationship between principal and agent is an experiment (Angelovski et. al. (2016); Sebald and Walzl (2014)). Brownback and Kuhn (2019) conducts the experiment that makes the observation of agent's effort possible. This experiment shows that principal tends to evaluate agent based on an outcome instead of an action even in the perfect information that principal realizes a noise including in agent's signal. In ordinary, however, identifying the noise is difficult (Brownback and Kuhn, 2019).

Utilizing of high-frequency data of sports is one of the approaches to tackle this difficulty without conducting an experiment. In sports, a performance indicator is available as a player's signal[1], and more high-frequency data like a tracking data shows us a player's action. Gauriot and Page (2019), the first study exploiting this advantage, creates the situation as if the outcome is randomly determined in order to identify a luck from an outcome. Flepp and Franck (2020) also uses sports data to verify whether luck affected the team's performance through the dismissal of the coach.

We conduct the further study about the effect on principal's decision-making by a luck using high-frequency data on baseball. In sports, especially baseball has many objective

[1]The study using performance indicator in sports is Baumer (2014) and Hakes and Sauer (2006), etc.

indicators of player's productivity, and almost all of them are open to the public through the media. This circumstance is the unique advantage lacking in other labor markets in the sense of disclosure of the information about agent. However, the evidence of an inefficient labor market where wage does not appropriately reflect productivity (Hakes and Sauer, 2006) implies the existence of information asymmetry in also sports where the rich information is available. In addition, loss-averse behavioral change seeking own reputation (Yashiki and Nakazono, 2020) suggest that information asymmetry between principal and agent could let agent select the not optimum behavior.

We utilize high-frequency data provided by Major League Baseball (MLB) to verify the effect of luck identified from a signal on principal. To identify a luck from outcome, we focus on the event when outcome is different though action is equivalent to each other. As a result, lucky successes have positive significant effect on the agent's evaluation by principal. This evidence includes the implication for subjective evaluation and contracts in business.

2 Strategy for Causal Inference

This study focuses on baseball to identify the effect of lack on principal's decision-making. We utilize the high-frequency data on all games from 2015 to 2019 provided by MLB. This dataset has not only the play result but also tracking data indicating details of the play, which is exit velocity, angle, and direction of the batted ball. We isolate the sample that has the different outcome though action is equivalent to each other from 3.6 million data in 5 years. More precisely, our subject of analysis is following.[2]

1. The sample that is equal in velocity, angle, and direction to a certain home run, but not a homerun.

[2]One of the factors that leads the different outcome though action is equivalent is the size of the ballpark. In fact, there are no strict regulations about the size of ballpark according to baseball rule. For example, the difference between Yankees Stadium and Wrigley Field is 11.9 meters in the right field and 11.3 meters in the left field. In addition, many ballparks are an outdoor stadium so that weather, wind, and atmosphere effect on a batted ball. These factors are uncontrollable for players, however, influence the play result as random noise.

2. The sample that is equal in velocity, angle, and direction to a certain out or hit, but a homerun.

Launched ball is uncontrollable for batter so that we can assume that the factor effecting on the result after the ball is hit is determined randomly. Therefore, the difference in results between the above two groups has no information about the agent's actions.

To verify whether noise affects the principal's decision-making, we adopt the nearest-neighbor matching following to Abadie and Imbens (2006). Let Y be principal's decision-making. The average difference $\hat{\tau}_M$ is the impact of luck on principal's decision-making, which is the interest of this study.

$$\hat{\tau}_M = \frac{1}{N}\sum_{i=1}^{N}(\hat{Y}_i(1) - \hat{Y}_i(0))$$

Let $\frac{1}{M}\sum_{j\in J_M(i)} Y_j$ be the potential outcome of Y_i, and average of elements of the nearest M neighbors of Y_i. The potential outcome of homerun is following.

$$\hat{Y}_i(1) = \begin{cases} Y_i & \text{if a homerun is scored} \\ \dfrac{1}{M}\sum_{j\in J_M(i)} Y_j & \text{if non-homerun is scored} \end{cases}$$

Similarly, the potential outcome of a non-homerun is following.

$$\hat{Y}_i(0) = \begin{cases} \dfrac{1}{M}\sum_{j\in J_M(i)} Y_j & \text{if a homerun is scored} \\ Y_i & \text{if no homerun is scored} \end{cases}$$

Our default specification is a one nearest neighbor matching using a Euclidean distance.

3 Result

The principal, manager, selects the best member for winning every game. Our interest is whether the principals' decisions, $D^{Starter}$, are influenced by luck. According to Table 1, average treatment effect by homerun is positive significant. The result shows that the player who hits a homerun is approximately 3.5% more likely to be a starter the next game than one who is out though they do the same action. Therefore the evidence suggests that principals' decisions are influenced by luck.

References

Abadie, A., and Imbens, G., (2006) "Large Sample Properties of Matching Estimators for Average Treatment Effects " *Econometrica* 74, 235–267.

Angelovski, A., Brandts, J., and Sola, C., (2016) "Hiring and escalation bias in subjective performance evaluations: A laboratory experiment " *Journal of Economic Behavior & Organization* 121, 114–129.

Baumer, B., and Zinbalist, A., (2000) "Quantifying Market Inefficiencies in the Baseball Players' Market" *Eastern Economic Journal* 40, 488–498.

Brownback, A., and Kuhn, Michael, A., (2019) "Understanding outcome bias" *Games and Economic Behavior* 117, 342–360.

Flepp, R., and Franck, E., (2020) "The performance effects of wise and unwise managerial dismissals" *Economic Inquiry*.

Gauriot, R., and Page, L., (2019) "Fooled by performance randomness: overrewarding luck" *The Review of Economics and Statistics* 101, 658–666.

Frederiksen, A., Kahn, F., and Lange, B., (2017) "Subjective performance evaluations and employee careers" *Journal of Economic Behavior & Organization* 134, 408–429.

Hakes, Jahn K., and Sauer, Raymond, D., (2006) "An Economic Evaluation of the Moneyball Hypothesis" *Journal of Economic Perspectives* 20, 173–185.

Hölmström, B., (1979) "Moral Hazard and Observability" *Bell Journal of Economics* 10:1 74-91.

Sebald, A., and Walzl, M., (2014) "Subjective Performance Evaluations and Reciprocity in PrincipalAgent Relations" *Scandinavian Journal of Economics* 116:2 570–590.

Yashiki, K., and Nakazono, Y.,(2020) "To Swing or Not to Swing? Reference Point and Professional Baseball Players" *ESRI Discussion Paper Series* 354.

Table 1: Effect of Homerun on Principals' Decisions

Dependent variable: Dummy variable ($D^{Starter}$)			
	Model		
	(1)	(2)	(3)
Effect of Homerun	$0.040***$	$0.037***$	$0.034***$
	(0.003)	(0.003)	(0.004)
Player characteristics		✓	✓
Launched ball			✓
Observation	$69,345$	$65,010$	$65,010$

Note: Standard errors are in parentheses. *** indicates 1% significance. $D^{Starter}$ takes one when a player is starter next game; otherwise zero. Player characteristics cover players' performance of last year and market values. Launched ball cover exit velocity, angle, and direction of the batted ball.