Reference Dependence and Monetary Incentive -Evidence from Major League Baseball-

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(Abstract)

1 Introduction

Reference-point dependence is one of the important concepts to evaluate outcome, and it affects the agents' following economic behavior. Classical economic models assume that economic agents evaluate choice/prospects according to abolute value of (expected) return. On the other hand, Tversky and Kahneman (1992) introduced behavioral assumption: reference-point dependent preference sets some target value of the outcome and then subjects regard the possible outcome as gain or loss from the target. For example, workers feel happy if her/his wage goes up to $15 per hour, but vice versa if it goes down to $15, although the absolute value of $15 is actually same. In this case, s/he evaluates their new wage with the reference point of the previous one.

Prospect theory, which is advocated by Tversky and Kahneman, consists two main charactaristics: one is probability weighting function, and the other is reference dependence, mentioned above. It enabled us to interpret cases that seems inconsistent with the traditional economic theory, and made it possible to understand them with some additional assumptions. Thus, a lot of following researches conducted in field settings or laboratories.

Reference dependence is also observed in the behavior of athletes. Pope and Schweizer (2011) found that professional golf players regard "per," the standard number of shots determined according to the difficuly of each hole, as reference points. Also, Pope and Simonsohn (2011) tested the existance of the reference dependence in the Major League Baseball, a professional baseball league of America.

When dealing with the case of the professional athletes, however, we must pay attenttion to how their salary contract is designed. For example, consider there is some monetary incentive for the professional golf players: that is, if every time s/he saved per in each hole, then s/he can get some reward regardless of their total score. In this case, then, making effort to save per can be interpreted as sufficiently "rational" choice, which denies the existance of reference dependence of the player.

In this paper, I picked up the evidence from Major League Baseball (MLB) players' behavior and find some "possible" choice that shows reference point dependent preference

of them. Concretely, MLB batters seems to have a reference point of a batting statistics, .300 of batting average, and make effort to achieve it. This tendency was not observed other batting statistics, even though those that occupy more weight in evaluating players.

Then, as the most important contribution, I specified if such behavior is in fact drived by "players' " reference-dependent preference. In other words, I try to answer a question "Are there any monetary incentives that make players turn to .300 of batting-average? " If MLB team managers overestimate the contribution of the players with .300 of batting-average to raising winning-perentage of the team and pay them discontinuously higher salary, then the observed behavior of the players are economically rational.

2 Theoretical Frameworks and Literature Review

2.1 Literature

Tversky and Kahneman (1992) mentioned reference point dependence as one of the two distinct respects of their prospect theory. The most primitive form of reference dependent utility function is:

$$u(x|r) = \begin{cases} x - r & \text{if } x \geq r \\ \lambda(x - r) & \text{if } x < r \end{cases}$$

where x denotes a certain outcome, and r is one of reference point. This agent evaluates the outcome by the difference from the reference point. In adiition, they addumed that agents regard loss as larger than gain, or "loss aversion." Then, λ is restricted to larger than 1.

There are a number of empirical literature that specifies the existence of reference dependence in the field or lab studies.

Among them, the most important literature for this paper is Pope and Simonsohn (2011). They picked up three empirical evidence of round number as reference points: SAT (a standardized test for college admission in the United States) scores, laboratory experiment, and baseball. In their section of baseball, they picked up the evidence of Major League Baseball (MLB) players and pointed out that they pay attention to their batting-average (AVG), especially to whether they could finish each season with their batting average of just above .300. They observed position players (= players except for pitchers) with at least 200 at-bats in each season, and found that their distribution of the batting-average has excess mass just above .300. Furthermore, they found that palyers with batting-average of just below .300 are more likely to hit a base-hit and less likely to get a base-on-balls. Both base-hits and base-on-balls avoid the batter from out, so for the team he belongs to, base-on-balls also have important value to win the game. However, batting-average does not count base-on-balls as the element to raise the number (For the definition of performance statistics, see Appendix). Thus, observed behavior they claims is sufficient evidence that shows the existance of round-number reference point deendent preference.

2.2 Frameworks

Excess mass around the reference point dependence is caused by "notch" in the utility function. In this paper, I exploit the framework to specify the utility function of Diecidue and Van De Ven (2008)'s "aspiration level" model, following the way

$$\lim_{\epsilon \to 0} v_r(r+\epsilon) \neq \lim_{\epsilon \to 0} v_r(r-\epsilon)$$

This form of utility function is discontinuous at the reference point r.

2.3 Impact of " *Moneyball* " - Time Series Analysis -

3 Method and Data

3.1 Empirical Method

3.1.1 Test for Bunching

3.1.2 Monetary Incentive

I examine the existance of the monetary incentive by regression analysis below:

$$w_{it} = \beta_0 X_{it} + \beta_1 \text{ABOVE}_{it} + \beta_2 X_{it} \times \text{ABOVE}_{it} + \beta_3 Z_{it}$$

For each player i in the season t, w_{it} is log annual salary in next season $t+1$. X_{it} and Z_{it} are the value of performance statistics (batting-average, on-base percentage,...) and other player-specific characters (age, team he signed, position,...), respectively. ABOVE_{it} is a dummy variable that takes 1 if the player achieves their reference point, and 0 if the failed to do so. I also introduce interaction term of X_{it} and ABOVE_{it}. Age term is introduce as quadratic form. I utilize both simple OLS and player, team, positional fixed effect model.

3.2 Data Description

In order to make empirical research, I need information about players' performance, contracts and other details. Then, I generated panel data that contains these specific information from some open data-source. Each sample is obtained by unit of a single season, but due to lack of open source of information about countracts, time range of the data used in each analysis is unbalanced.

Performance statistics is obtained from baseball fan website: *fangraphs* and *Baseball Reference*.

4 Result

4.1 Full-Sample analysis

4.1.1 Existance of Excess Mass around Round Number

4.2 Time-Series analysis

Through the previous section, I conducted analysis including all the sample as same, as Pope and Simonsohn (2011) did. However, there is some time-specific factor that affect on the behavior of the players, such as the relationship between the player and the team manager, what index was of the most importance to evaluate players, or some macroeconomic trend.

5 Discussions and Conclusion

6 Appendix

6.1 Proxies for Performance

To measure batter's performance, I use some *SABR Metrics*'s statistics. *SABR* is short for *Society of American Baseball Research*, an American organization of analysing baseball. They try to evaluate players in more "efficient " way, or by statistics with more close correlation with the expected wins the team obtain.

7 References

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