Reference Dependence and Monetary Incentive

-Evidence from Major League Baseball-

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Abstract

- Empirical research that specifies the existance of reference point dependence observed in field setting:
  We pick up evidence of Major League Baseball (MLB)
- Players take some round numbers of the batting performance indexes as reference points, and adjust their effort level to meet the goals
- There are NOT observed any evidence for the monetary incentives that is paid to the players if they achieve these internal goals

Introduction

- Reference dependence is one of the two main charactaristics of the Tversky and Kahneman (1992)'s prospect theory: Individuals evaluate outcomes by the relative value to their internal benchmarks, or reference point, not by their absolute ones.
- Prospect theory enabled us to interpret some inconsistent empirical decision making with the traditional microeconomic theory, by applying additional assumptions.
- There are a lot of following researches that tests the reference dependence in field or laboratory settings.

Contents

Literature

Pope and Simonsohn (2011)

- presents three empirical evidences that verify the reference dependence, with the reference points "round numbers."
- One of them picked up Major League Baseball (MLB) players, about the observed attitude to their performance indexes.
- MLB position players manipulate their batting-average (AVG), in order to meet their internal goals: .300
- As a results, there is observed excess mass, or "bunching" around .300 of AVG.

Contribution

- Professional athletes receive monetary rewards according to the contracts they signed.
- Their contracts might include some incentivesed parts, which pay them additional bonus when their AVG reaches a certain cutoff point.
- If so, the observed behavior might be caused by the discontinuity of their profit function, not by the reference dependence.
- The contribution of our research is to examine this: examine if there exists any monetary incentives that make players make effort to the cutoff point.

Theoretical Frameworks

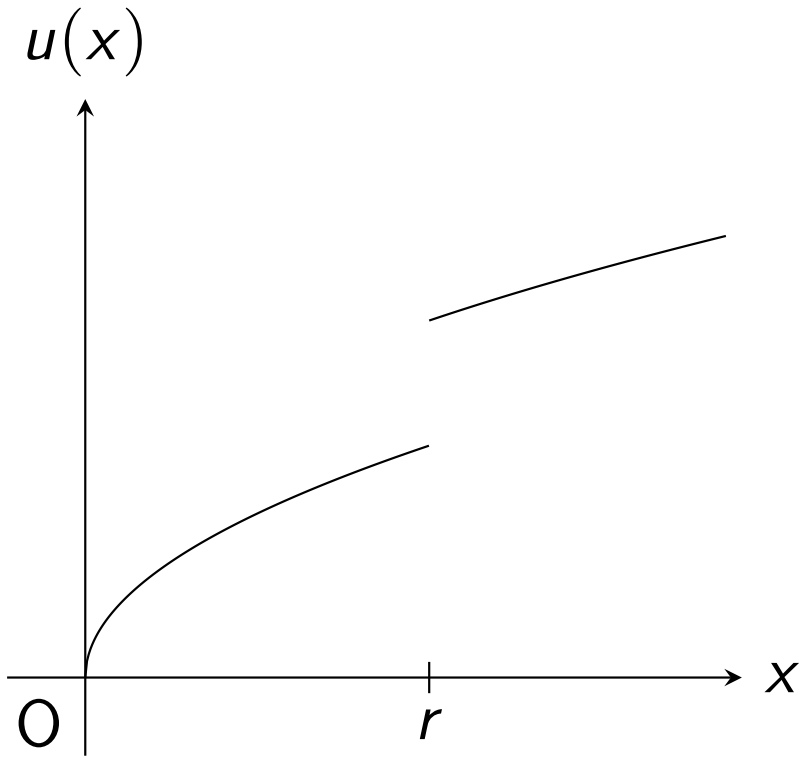

Figure: discontinuous utility function

- Following Allen et al. (2016) assume utility function $u(x)$ that jumps at the cutoff point, or the reference point.

  x stands for the performance index.

- This disconituity generates excess mass, or "bunching" around the possible reference point.

- We consider if this utility is derived by the descontinuous design of the monetary reward of the players.

Specification: Manipulation

- We exploit the McCrary (2007)'s manipulation test, which is used in regression discontinuity design.
- Local-linear regression of undersmoothed histgram around the given cutoff point: .300 of AVG, 20 homeruns, ...
-

Specification: Contract Design

- Discontinuity of the contract design is tested by RDD methodology:

$$w_{it} = \beta_0 X_{it} + \beta_1 \text{ABOVE}_{it}$$

- To check the robustness of our results, we also conduct the same local regression including the interaction term of X_{it} and ABOVE_{it}.

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

Data

We obtain information about the players' stats (indexes) and annual salary.

- Stats Data
  - From *fangraphs*
  - Play stats from 1957 to 2018
  - We restrict the sample to the players with at least 200 plate-appearances $N = 18143$
- Salary Data
  - From *USA TODAY* and *Baseball Prospectus*
  - Salary information from 1987 to 2017 $N = 8915$

Results: Manipulation

Figure: Histgram of Batting-Average

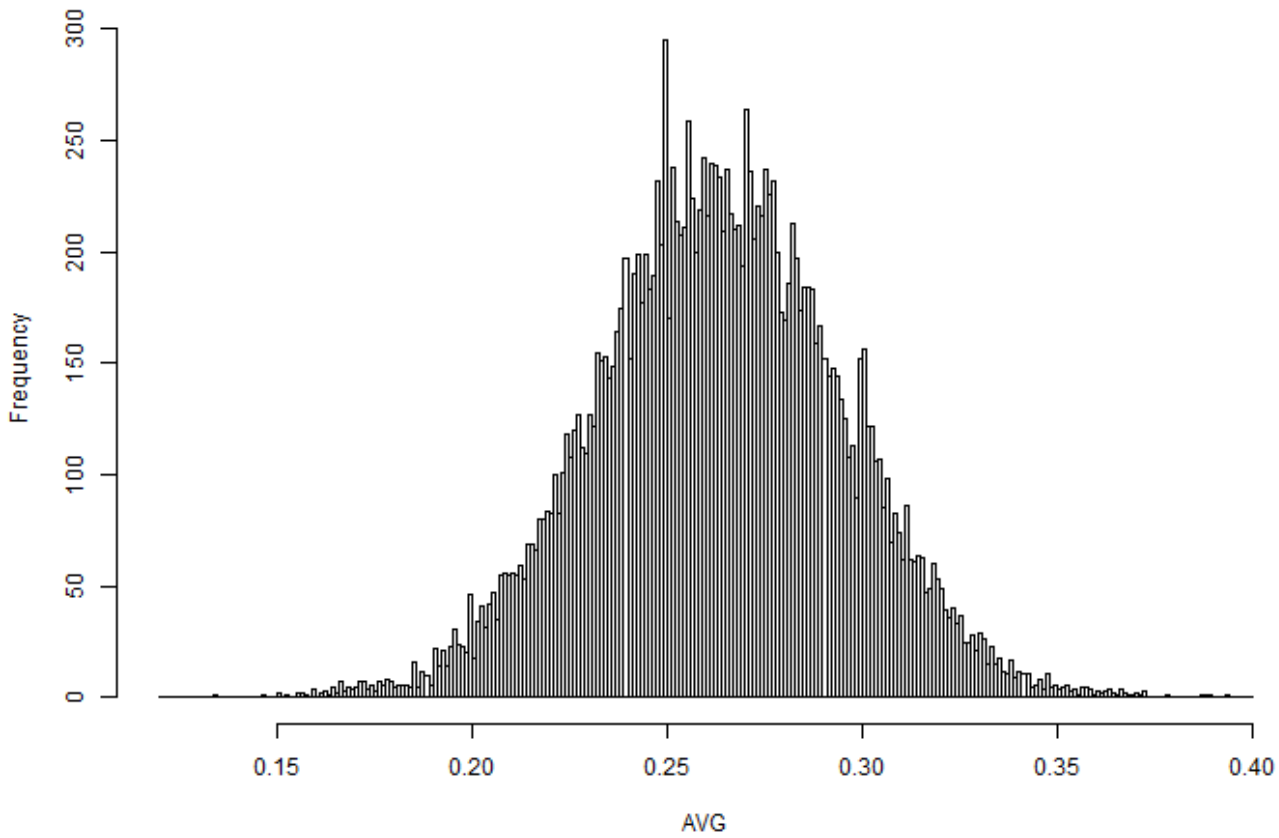

Figure: Discontinuity at .300 of AVG

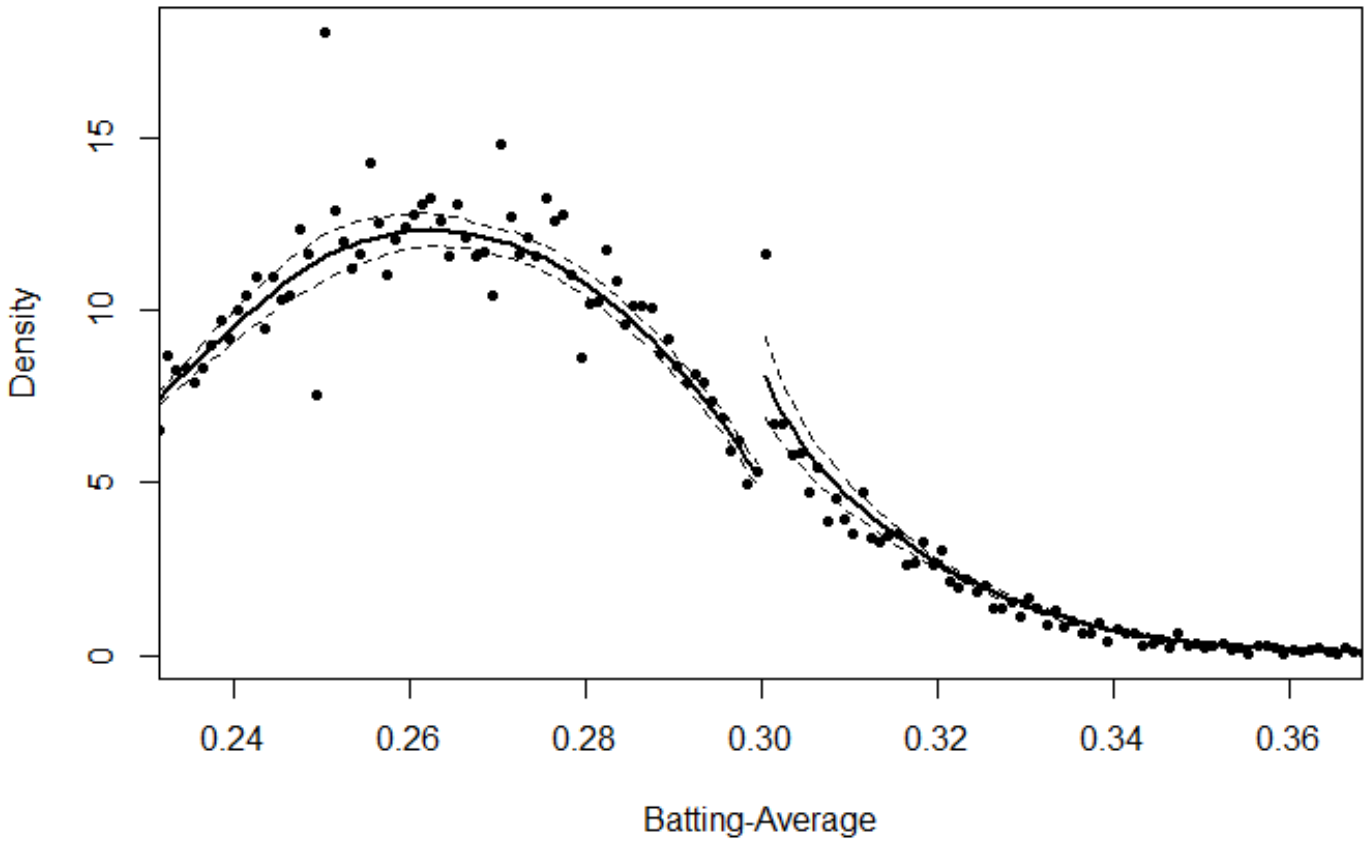

Table: Test for Manipulation, leastPA = 200

index	type	cutpoint	binsize	bandwidth	θ	z
AVG	rate	.300	.001	.019	.499	7.442***
					(.067)	
		.250	.001	.024	.212	5.061***
					(.042)	
OBP	rate	.350	.001	.024	.139	2.854**
					(.049)	
HR	cumulative	20	1	5.309	.259	3.465***
					(.075)	
RBI	cumulative	100	4	15.423	.311	3.295***
					(.094)	
SB	cumulative	30	1	10.000	.529	4.274***
					(.124)	
		40	1	11.505	.481	2.764**
					(.174)	
PA	cumulative	500	1	.003	.160	2.515*
					(.063)	
H	cumulative	200	1	18.922	.453	2.547 *
					(.178)	

Note ***: $p < 0.1\%$, **: $p < 1\%$, *: $p < 5\%$.
Bandwidth is optimized following the method of McCrary(2008).

Results: Contract Design

Table: RDD Test for Monetary Incentives

index,cutpoint	Other Control	bw type	bandwidth	Observations	Estimate	Std. Error	z
AVG, .300	No	LATE	.084	8514	.047	.061	.773
		Half-BW	.042	5599	.088	.075	1.174
		Double-BW	.170	8915	.067	.056	1.184
	Yes	LATE	.045	5930	.034	.056	.615
		Half-BW	.023	3005	.061	.077	.788
		Double-BW	.090	8605	.016	.045	.354
AVG, .250	No	LATE	.036	6110	.019	.068	.286
		Half-BW	.018	3496	.015	.092	.161
		Double-BW	.072	8539	.034	.054	.636
	Yes	LATE	.048	7271	.070	.052	1.340
		Half-BW	.024	4402	.066	.069	.953
		Double-BW	.096	8810	.075	.044	1.713
HR, 20	No	LATE	3.32	1315	.071	.175	.406
		Half-BW	1.66	562	.073	.127	.576
		Double-BW	6.64	2582	-.004	.109	-.034
	Yes	LATE	3.30	1307	-.002	.141	-.015
		Half-BW	1.65	560	.030	.102	.299
		Double-BW	6.61	2558	-.032	.088	-.364
OBP, .350	No	LATE	.044	6440	-.038	.065	-.592
		Half-BW	.021	3542	-.076	.089	-.849
		Double-BW	.087	8656	-.029	.051	-.570
	Yes	LATE	.045	6525	-.013	.049	-.272
		Half-BW	.022	3673	-.055	.069	-.807
		Double-BW	.089	8637	.004	.039	.107
RBI, 100	No	LATE	4.08	393	.072	.289	.250

Summary

Discussion

- By-Time analysis
  - Replicate the same examination, but now we devide the sample by histrical terms:
    - Before the system of free agency regulated (-1975)
    - Before the Strike of Players Association (-1994)
    - Before *Moneyball* (Lewis) was published (-2003)
    - Afterward (2004-)

Conclusion

Main Findings

1. Players manipulate their performance indexes to meet them with some round numbers.
2. There exist no monetary incentives in their contracts that makes players to do so.
3. Tendency of the manipulation changes through the history of baseball.
   - Among them, especially, .300 of AVG shows consistent results, which shows it is solid benchmarks for the players.

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