

A Study of team performance analysis in 2009 Major League Baseball



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Agenda

I. Introduction

II. Literature review

III. Method

IV. Results and Discussion

V. Conclusion and Suggestion



I. Introduction 1/5

Background problem

- U.S. sports industry - the 2002 Street and Smith's statistics, the sports industry output value reached 196 billion U.S. dollars.
- 2010 has reached 414 billion U.S. dollars, of which professional sports revenues of 21.6 billion, 6.8 billion dollars in revenue up to MLB(Plunkett Research, 2010) ◦
- Makes the people in the sports industry spending amounted to 8.6% of revenue(Mullin, Hardy, & Sutton, 2007) ◦

I. Introduction 2/5

Major U.S. professional sports

- MLB  MAJOR LEAGUE BASEBALL™
- NBA 
- NFL 
- NHL 

- The most populous of Audience is Major League Baseball (Stone & Pantuosco, 2009)

I. Introduction 3/5

- Professional sports organizations, the main revenue comes from ticket sales, broadcast rights, sponsorship revenue, and other merchandise sold on, he broadcast rights and ticket sales as the main source of income(Cheng , 2000) ◦
- Winning team can bring more high income sources(Ajilore & Hendrickson, 2005) ◦

I. Introduction 4/5

- To enhance the team record, strength of spending lots of money to hire a strong team record player can improve and income?

In 2009 -New York Yankees

-208,097,414 USD (103W-59L) AL first.

In 2008 -Tampa Bay Rays

- 43,820,597 USD (97W-65L) AL first.

I. Introduction ^{5/5}

Research purpose

1. evaluating and analyzing the 2009 MLB 30 teams performance.
2. classification of those in poor performance, recommendations for optimal performance.
3. analysis of the important factors in team performance in order to understand the sources of performance.

II. Literature review 1/4

1. performance evaluation

- Performance evaluation is a management tool , Organizational assessment in a meaningful investigation and analysis conducted under (Porter , 2000) .
- With minimum capital investment and be able to get the most output , Universal in the sports field use(Cai , 2009) .
- There are two important core project, the architecture and its evaluation index weights of the decision , Most commonly used tools is DEA(data envelopment analysis) (Lin & Chen , 2005) .

II. Literature review 2/4



2.DEA

- DEA by the Charnes, Cooper and Rhodes in 1978 years, proposed, from its concept proposed by Farrell in 1957.
- The features selected as the evaluation index is not subject to discretion of its weight, can actually analyze the data as the basis of research performance and become more popular (Charnes, Cooper, Lewin, & Seiford, 1994).

II. Literature review 3/4

3. performance evaluation studies in the sports industry

Sport	Literature
Professional Baseball Players	江志坤，1994；黃錦文，1997；林文斌、鄧元湘、陳一進、廖俊欽，2005；Howerd & Miller,1993;; Anderson & Sharp,1997; Olson,2001;Sueyoshi, Ohnishi,& Kinase;Olson, 2001
Professional ice hockey player	Leibenstein & Maital, 1992
NCAA college basketball players	Fizel & D'Itri, 1997
Football players	Scully, 1995
Athlete	Cook, Doyle, Green, & Kress, 1996
Soccer player	Dawson, Dobson, & Gerrard, 2000; Haas, 2003
Professional golf	鄧元湘、林文斌、林進隆，2006；Fried, Lambrinos, & Tyner, 2004
Sydney Olympic Games	廖俊欽，2007；Lozano, Villa,Guerrero, & Cortés,2002
Professional Baseball Team Management	林閔鈞，2003；施致平，2008；Sexton & Lewis, 2003
Professional tennis player	蔡佳惠，2007、蔡佳惠，2009

II. Literature review 4/4

4. Performance Evaluation of the use of professional baseball

年份	作者	研究內容
1993	Howard & Miller	MLB player pay and performance input-output relationship between the garrison
1997	Anderson & Sharp	MLB player performance
1999	Sueyoshi, Ohnishi, & Kinase	NPB player performance
2001	Olson	MLB Player performance and team winning percentage
2003	林閔鈞	MLB球員表現與球隊經營分析
2003	Sexton & Lewis	Performance Evaluation MLB teams
2008	施致平	CPBL team performance evaluation of parent

III. Method ^{1/3}

- **1.Study Object:** This study is based on 2009 U.S. Major League Baseball's 30 teams (Decision Making Units, DMUs).
- 二、 Research tool : In this study, Cooper et al (1999) concept proposed by DEA were divided into two modes, respectively, CRS and VRS models, which can calculate the overall efficiency, technical efficiency and scale efficiency .

CRS– overall efficiency .

VRS– technical efficiency and scale efficiency .

III. Method ^{2/3}

- 3. statistical software : EMS 1.3 vision
- 4. Evaluation index selection : According to Sexton and Lewis (2003) and Ajilore and Hendrickson (2005) of the proposed results, the total team salary for the option to input indicators, the team winning percentage, ranking and average attendance per match for the output indicators.

III. Method 3/3

- By Pearson and Spearman correlation analysis to understand the professional baseball organizations, with the team winning percentage and payroll relationship between audience and found that sports organizations and teams pay a correlation between wins there ($p < .01$)

	Salary	rank	Average attendance	Winning
Salary	1			
rank	-.620**	1		
Average attendance	.635**	-.664**	1	
Winning	.523**	-.518**	.666**	1

** $p < .01$

IV. Results and Discussion 1/13

- 2009 MLB official site provides information in the United States Major League Baseball teams total payroll to the highest paid New York Yankees, reached 208,097,414 U.S. dollars.
- The lowest total team salary for the Pittsburgh Pirates team of 25,197,000 U.S. dollars.
- Major League Baseball team, the average salary of 88,267,551 dollars.

IV. Results and Discussion 2/13

Salary Rank	team	Win -lose	Total salary	Salary Rank	team	Win -lose	Total salary
1	NY Yankees	103-59	208,097,414	16	Milwaukee	80-82	80,182,502
2	NY Mets	70-92	145,367,987	17	Cincinnati	78-84	73,558,500
3	Chicago Cubs	83-78	134,058,500	18	Arizona	70-92	73,516,666
4	Boston	95-67	122,435,399	19	Texas	87-75	73,439,238
5	Detroit	86-77	119,160,145	20	Toronto	75-87	72,563,200
6	LA Angels	97-65	118,964,000	21	Colorado	92-70	72,428,000
7	Seattle	85-77	112,053,666	22	Tampa Bay	84-78	68,230,934
8	Philadelphia	93-69	111,209,046	23	Minnesota	87-76	67,634,766
9	Houston	74-88	102,996,414	24	Cleveland	65-97	66,757,366
10	Chicago Sox	79-83	100,598,500	25	Washington	59-103	62,001,000
11	LA Dodgers	95-67	100,008,592	26	Baltimore	64-98	61,885,566
12	Atlanta	86-76	94,313,666	27	Oakland	75-87	56,089,250
13	St. Louis	91-71	87,703,409	28	San Diego	75-87	37,800,800
14	San Francisco	88-74	82,616,450	29	Florida	87-75	35,774,000
15	Kansas City	65-97	81,384,553	30	Pittsburgh	62-99	25,197,000

IV. Results and Discussion 3/13

- 2009 New York Yankees team record (103 wins 59 lost) and best record, winning .636; record the worst team for the Washington Nationals (59 wins 103 lost), winning .364.
- The average number of audience to approach the largest Los Angeles Dodgers, a total of 39,987 people; the number for the Oakland Athletics for at least a total of 22,995 people.
- New York Yankees was rank 1, Washington Nationals was rank 30.

IV. Results and Discussion 4/13

rank	team	winning	average Audience	rank	team	winning	average Audience
1	NY Yankees	0.636	39923	16	Chicago Cubs	0.516	37026
2	LA Angels	0.599	33261	17	Milwaukee	0.494	33956
3	Boston	0.586	35840	18	Chicago Sox	0.488	28608
4	LA Dodgers	0.586	39987	19	Cincinnati	0.481	26535
5	Philadelphia	0.574	37773	20	Toronto	0.463	25154
6	Colorado	0.568	31853	21	Oakland	0.463	22995
7	St. Louis	0.562	36545	22	San Diego	0.463	27631
8	San Francisco	0.543	33683	23	Houston	0.457	30895
9	Texas	0.537	27441	24	NY Mets	0.432	35375
10	Florida	0.537	24567	25	Arizona	0.432	28270
11	Minnesota	0.534	28815	26	Kansas City	0.401	25145
12	Atlanta	0.531	30458	27	Cleveland	0.401	25140
13	Detroit	0.528	30840	28	Baltimore	0.395	25826
14	Seattle	0.525	27449	29	Pittsburgh	0.385	24971
15	Tampa Bay	0.519	25895	30	Washington	0.364	26993

IV. Results and Discussion 5/13



MLB30 support pellet performance summary table

	OE	TE	SE	TE sort
Max	1	1	1	
Min	0.36	0.46	0.38	11E's(TE=1)
Ave	0.59	0.82	0.65	4F's(.90<TE<1)
S. d	0.21	0.15	0.14	15G's(TE<.90)
C. V	0.33	0.17	0.22	

By Norman and Stocker (1991) The intensity of technical efficiency according to (TE values) into E (TE = 1), F (.90 <TE<1),G(TE<.90)

IV. Results and Discussion 6/13

Relatively efficient in 2009 the United States Professional Baseball Group Summary Table

Efficiency Category	OE	TE	SE
List efficient pellet	1. NY Yankees 11. LA Dodgers 29. Florida	1. NY Yankees 6. LA Angels 11. LA Dodgers 13. St. Louis 14. San Francisco 16. Milwaukee 29. Florida	1. NY Yankees 11. LA Dodgers 13. St. Louis 14. San Francisco 29. Florida

Note: Number of total payroll for the team ranking.

IV. Results and Discussion 7/13

VRS mode F class technical efficiency of pellet
Texas(TE=98.62%)

TE value	salary	rank	Audience	winning
Old value	73,439,238	10	27441	0.537
Proposed Value	69,106,322	10	31282	0.537
Adjustment Scale	-5.90%	--	14%	--

• Arizona(TE=92.00%)

TE value	salary	rank	Audience	winning
Old value	73,516,666	24	28270	0.432
Proposed Value	56,740,162	24	33358	0.449
Adjustment Scale	-22.82%	--	18%	4%

IV. Results and Discussion 8/13

VRS mode G Class technical efficiency of pellet

index Statistics	TE value	Adjust the ratio of the evaluation index(%)			
		salary	rank	audience	winning
Max	0.89	-41.71	20.07	15.02	21
Min	0.46	-02.13	1.16	4.00	0
Ave	0.65	-18.18	8.27	6.71	5
S. D	0.08	2.6	1.36	0.7	1.56

IV. Results and Discussion 9/13

VRS mode G class technical efficiency of pellet

•Philadelphia(TE=89.93%)

TE value	salary	rank	Audience	winning
Old value	111,209,046	5	37773	0.574
Proposed Value	107,750,444	5	39283	0.574
Adjustment Scale	-3.11%	-	4%	-

•Kansas City(TE=46.45%)

TE value	salary	rank	Audience	winning
Old value	81,384,553	27	25145	0.401
Proposed Value	47,439,055	21	28921	0.485
Adjustment Scale	-41.71%	20.07%	15.02%	21%

IV. Results and Discussion 10/13

VRS mode, sensitivity analysis table

Order excluded the evaluation index	the ratio of the average TE Change%	STATUS
Rank	-0.03	Changes in the efficiency of the team about the value of 9, in which the biggest change for the New York Yankees.
Audience	-5.84	More than half of the team will change the efficiency value, and are all negative effects, the maximum reduction of -26.78% for the Royals.
Winning	-2.32	More than half of the team will change the efficiency value, and are all negative effects, whereas, the Los Angeles Dodgers are not affected.

IV. Results and Discussion 11/13

1. Discuss MLB teams' performance and strength of each classification

The results demonstrated the overall efficiency of the team were three teams were the Yankees, Dodgers and Marlins, Marlins team in which the total salary for the last two league

- That performance pay is not absolutely one of the reasons of the team, but also with the Sexton and Lewis (2003) findings, we must consider management model to measure.

IV. Results and Discussion 12/13

2. the most suitable size and performance of the game

- According to the results, F and G class club team has reducing salary and increase number of audience and winning, the technology efficiency can be achieved
- DEA main function is to reduce the input variables, and increase output efficiency, provide methods to improve efficiency, not absolute values (Lin et al., 2005) ◦

IV. Results and Discussion 13/13

3. Discussion of team performance factors

- In the sensitivity analysis, on behalf of any one item to delete, this means the output of the shortage, but also represents the value of the reduced efficiency of the overall ranking in terms of value for the degree of influence the overall efficiency of 30%, among which the greatest impact on the Yankees ;
- In the "audience" and "winning" the cut will cause -5.84% and -2.32% of average technical efficiency change, also on behalf of these two indicators are the two most important factors. But from the study found that "winning" the removal of the Los Angeles Dodgers, the efficiency value is not affected, the estimate may be on the Dodgers local people to cultivate long-term loyalty.

V. Conclusion and Suggestion 1/3



Conclusion

- ❑ From the performance point of view, MLB30 teams of the total efficiency of the team has 4, the ratio is only 13%; technical efficiency, 11, a ratio of 37%; scale efficiency of 5, the ratio was 17%, if professional point of view, due to space.
- ❑ Performance evaluation of the most important factor is "winning" and "audience."
- ❑ Salary were significantly associated with the team winning percentage, can be used to measure the performance of the control variables, is also a professional team is most commonly used method to master the team's future.

V. Conclusion and Suggestion 2/3



Suggestion

- On the part of the team salary budget for the team to have a positive effect but the effect is not absolute, terms of career management perspective, the proposed use of the research team can increase or decrease the budget to do.

V. Conclusion and Suggestion 3/3



Follow-up study

- ❑ Income and not with the team to do the total number of links to the local population, we suggest that future research can increase the information and use of statistical methods to understand the variables of the relationship between the input and output.
- ❑ The only information to be collected for analysis, the proposed increase in research on this subject, but also establish a set of measurable indicators.



Thanks for your Attention



Q&A Time



2010大聯盟球季A咖後援投手評分前16名

選手(球隊)	2010年成績	2010年薪美元(台幣)	評分
索瑞安諾Rafael Soriano(光芒)	3-2-0-45,1.73	725萬(約2.23億)	91.771
貝利Andrew Bailey(運動家)	1-3-0-25,1.47	43.5萬(約1343萬)	88.933
李維拉Mariano Rivera(洋基)	3-3-0-33,1.80	1500萬(約4.63億)	88.609
貝爾Heath Bell(教士)	6-1-0-47,1.93	400萬(約1.24億)	86.476
索頓Matt Thornton(白襪)	5-4-21-8,2.67	225萬(約6949萬)	86.054
威爾森Brian Wilson(巨人)	3-3-0-48,1.81	443.75萬(約1.37億)	85.839
葛瑞格森Luke Gregerson(教士)	4-7-40-2,3.22	41.65萬(約1286萬)	84.476
索瑞亞Joakim Soria(皇家)	1-2-0-43,1.78	300萬(約9266萬)	84.082
梅德森Ryan Madson(費城人)	6-2-15-5,2.55	450萬(約1.39億)	83.895
華格納Billy Wagner(勇士)	7-2-0-37,1.43	675萬(約2.08億)	83.650
史崔特Huston Street(落磯)	4-4-0-20,3.61	720萬(約2.22億)	83.099
梅塞特Nick Masset(紅人)	4-4-20-2,3.40	103.5萬(約3197萬)	82.884
貝坦寇特Rafael Betancourt(落磯)	5-1-23-1,3.61	377.5萬(約1.17億)	82.088
布拉瑟頓Jonathan Broxton(道奇)	5-6-3-22,4.04	400萬(約1.24億)	81.874
亞當斯Mike Adams(教士)	4-1-38-0,1.76	100萬(約3089萬)	81.813
郭泓志(道奇)	3-2-21-12,1.20	95萬(約2934萬)	81.598

註：成績為勝-敗-中繼-救援,防禦率



2010年大聯盟季後A咖自由球員表

選手(球隊)	位置	2010年成績	2010年新美元(台幣)	評分
普霍斯Abert Fujols(紅雀)	一壘	0.312-42-118-14	1600萬(約4.94億)	96.667
渥斯Jayson Werth(費城人)	外野	0.296-27-65-13	700萬(約2.16億)	92.000
索瑞安諾Rafael Soriano(光芒)	後援投手	3-2-0-45,1.73	725萬(約2.23億)	91.771
吉特Derek Jeter(洋基)	游擊	0.270-10-67-18	2100萬(約6.49億)	91.304
李維拉Mariano Rivera(洋基)	後援投手	3-3-0-33,1.80	1500萬(約4.63億)	88.609
馬丁尼茲Victor Martinez(紅襪)	捕手	0.302-20-79-1	700萬(約2.16億)	87.054
克里夫李Diff Lee(遊騎兵)	先發投手	12-9-0-0,3.18	800萬(約2.47億)	86.932
索頓Matt Thornton(白襪)	後援投手	5-4-21-8,2.67	225萬(約6949萬)	86.054
克勞佛Carl Crawford(光芒)	外野	0.307-19-90-47	1000萬(約3.09億)	84.615
華格納Billy Wagner(勇士)	後援投手	7-2-0-37,1.43	675萬(約2.08億)	83.650
貝爾鄒Adrian Beltre(紅襪)	三壘	0.321-28-102-2	900萬(約2.78億)	82.313
普辛斯基A.J.Perzyski(白襪)	捕手	0.270-9-56-3	625萬(1.93億)	80.804
佩提特Andy Pettitte(洋基)	先發投手	11-3-0-0,3.28	1175萬(約3.63億)	80.682
葛雷諾Vladimir Guerrero(遊騎兵)	指定打擊	0.300-29-115-4	650萬(約2億)	80.000
李利Ted Lilly(道奇)	先發投手	10-12-0-0,3.62	1200萬(約3.71億)	79.950
庫柏Jason Kubel(雙城)	外野	0.249-21-92-0	410萬(約1.27億)	79.744
阿若尤Bronson Arroyo(紅人)	先發投手	17-10-0-0,3.88	1100萬(約3.40億)	79.538
古雪耶Matt Guerrier(雙城)	後援投手	5-7-23-1,3.17	315萬(約9729萬)	79.483
柯納寇Paul Konerko(白襪)	一壘	0.312-39-110-0	1200萬(約3.71億)	78.095
歐多涅茲Miguel Odronez(老虎)	外野	0.303-12-59-1	1800萬(約5.56億)	77.436
塔哈達Miguel Tejada(教士)	游擊	0.269-15-71-2	600萬(約1.85億)	76.720
拉米瑞茲Manny Ramirez(白襪)	外野	0.293-9-42-1	2000萬(約6.18億)	76.154
鄧斯Scott Downs(藍鳥)	後援投手	5-5-26-2,2.64	400萬(約1.24億)	76.069
帕瓦諾Carl Pavano(雙城)	先發投手	17-11-0-0,3.75	700萬(約2.16億)	75.000

CRS-OE

$$\text{Min} \quad E_k = \theta - \varepsilon \left(\sum_{i=1}^m S_{ik}^- + \sum_{r=1}^s S_{rk}^+ \right)$$

$$\text{s.t.} \quad \sum_{k=1}^n \lambda_k x_{ik} - \theta x_{ik} + s_{ik}^- = 0, \quad i = 1, \dots, m$$

$$\sum_{k=1}^n \lambda_k y_{rk} - s_{rk}^+ = y_{rk}, \quad r = 1, \dots, s$$

$$\lambda_k, s_{ik}^-, s_{rk}^+ \geq 0, \quad k = 1, \dots, n$$

VRS-TE

$$\text{CRS-OE} + \sum_{j=1}^n \lambda_j = 1$$