Steroids and Major League Baseball

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INTRODUCTION

The crack of the bat, the smell of the grass…there's just something about baseball. Most Americans have grown up with the game, sharing a passion that spans generations, geography and social class. To many of us, baseball, especially its history, is representative of a simpler and purer world. That view has been under assault from the Steroids Era of 1994 to 2004 and its repercussions on the game. As fans, America enjoyed the jump in offensive statistics and Mark McGwire and Sammy Sosa's chase of the great Roger Maris. However, the sudden offensive explosion raised questions about how these numbers were being achieved. The rumors of steroid use among players finally began to explode with the revelation in 1998 that McGwire was taking androstenedione. As baseball finally begins to get serious about its steroid problem, this paper investigates the economic motivations for steroid use in baseball and the expected effects of different anti-doping policies and punishment regimes.

PERFORMANCE ENHANCING DRUGS IN SPORTS

The use of performance enhancing drugs has tracked the rise and fall of mass-entertainment sports. Going back to the ancient Olympics and Roman times, athletes used performance enhancing herbs and mushrooms in order to improve their performance in competition by making them faster, stronger or braver (Osborne 2005). Use of performance enhancing drugs seems to have drastically diminished in the post-Roman, pre-modern era in Europe until the rebirth of spectator sports in the U.K. in the nineteenth century (Osborne 2005). This timeline seems to suggest a correlation between the use of performance enhancing drugs in sports and the presence of commercial or other rewards. In ancient Greece, as in modern times, these rewards went to the athletes or those associated with them (Osborne 2005). If we assume that the role of the Roman circus was to distract the population from strife and bad government, then any improvement in the production of athletes involved in the contests would serve to only enhance the entertainment and distraction (Osborne 2005). By 1928, the IAAF, track and field's international governing body, enacted the first modern anti-doping rules in modern sports (Osborne 2005).

STEROID TESTING IN BASEBALL

Steroids finally made it to baseball's banned substance list in 1991, however testing for major league players did not begin until the 2003 season. Evidence of steroid use was rampant. Offensive numbers were way up. In 1996, the Orioles, Mariners, and A's all broke their single season home run records. 1998 saw Mark McGwire destroy Roger Maris' home run record, closely followed by Cubs slugger Sammy Sosa. Three years later, Barry Bonds broke McGwire's home run record. A change in the nature and frequency of injuries also pointed to increased steroid use. The number of players on the Disabled List (DL) increased 31%, from 266 in 1989 to 349 in 1998, and the average stay on the DL increased 13% over the same period (Assael 2005). Furthermore, the nature of injuries changed to ailments resulting from oversized muscles ripping away from bones that could no longer support them (Assael 2005). Finally, the

admissions began as Ken Caminiti became the first star player to admit using steroids (Assael 2005).

The agreement with the Major League Baseball Player's Association (MLBPA) called for one random test per player per year with no punishments in the first year. If more than 5% of players tested positive in 2003, tougher, punitive testing would be implemented with penalties ranging from counseling for a first offense to a maximum one year suspension for a fifth violation (Assael 2005). If less than 2.5% of players tested positive in two consecutive years, testing would be dropped. Negotiators felt that this would give players who were currently using time to clean up. In November of 2003, however, MLB announced that more than 5% of players had tested positive and that testing would continue in 2004 (Assael 2005).

In January 2005, MLB and the MLBPA announced a new drug testing policy. The new policy, currently in effect, includes year-round testing and stricter penalties for steroid use. Penalties for positive tests remain toothless compared to other sports, starting with a ten day unpaid suspension for the first offense and a potential life ban, at the commissioner's discretion, for the fifth.

On November 15, 2005 the MLBPA's leadership and MLB agreed to new, tougher penalties including a 50 game ban for the first offense, 100 game ban for the second offense and lifetime ban, with the possibility for reinstatement, for the third positive test (Dahlberg 2005). The new penalties were officially approved by the players on December 7th (Dahlberg 2005).

	1st test	2nd test	3rd test	4th test	5th test
Nov '05	50 gms	100 gms	Lifetime ban	--	--
Jan '05	10 days	30 days	60 days	1 year	Commissioner's decision
2002	Counseling	15 days	25 days	50 days	1 year

ECONOMIC RESULTS OF STERIOD USE

The "Game" of Using Steroids

Setting aside moral and ethical issues, the questions of whether a player should use steroids and whether the league should test for steroid use often come down to simple economics. The following analysis looks at the economics of steroid use for both players and the league as a

whole, as represented by the individual franchises. The situation can be concisely represented as a game matrix as shown below.

Players \ Team	Test	Don't Test
Use	? , ?	? , ?
Don't Use	? , ?	0 , 0

The "Don't Use, Don't Test" scenario is the base case and represents a world in which steroids do not exist. As such, we normalize the payouts for this scenario to be (0,0), and the payouts of using steroids and testing for steroids will be calculated with respect to this case.

The next step in the analysis is calculating the payouts to the teams and players in the various scenarios.

Benefit of Increased Offensive Production to Players

Baseball players must derive some utility, either actual or perceived, from the use of steroids. To players, the added value from the use of steroids comes from the ability to build muscle mass and use the resulting strength to achieve increased production in their game. Since much of the attention around steroids in baseball has focused on more and longer distance home runs, we decided to focus our analysis on offensive production. Pitchers may use steroids to build muscles and increase the velocity of their fastball, but it is offense that really attracts fans to the ballpark. To simplify our analysis, we used a single metric of offensive prowess, OPS. OPS is a statistic which measures both a player's ability to get on-base (On-base percentage) and their ability to hit for power (Slugging percentage). OPS is popular in measuring the offensive contribution of a player because it is easy to calculate and has a strong positive correlation, at the team level, with runs per game (Wikipedia 2005). League leaders in OPS hover around the 1.000 mark, with other elite players closer to the .900 level (Wikipedia 2005).

$$OPS = OBP + SLG$$

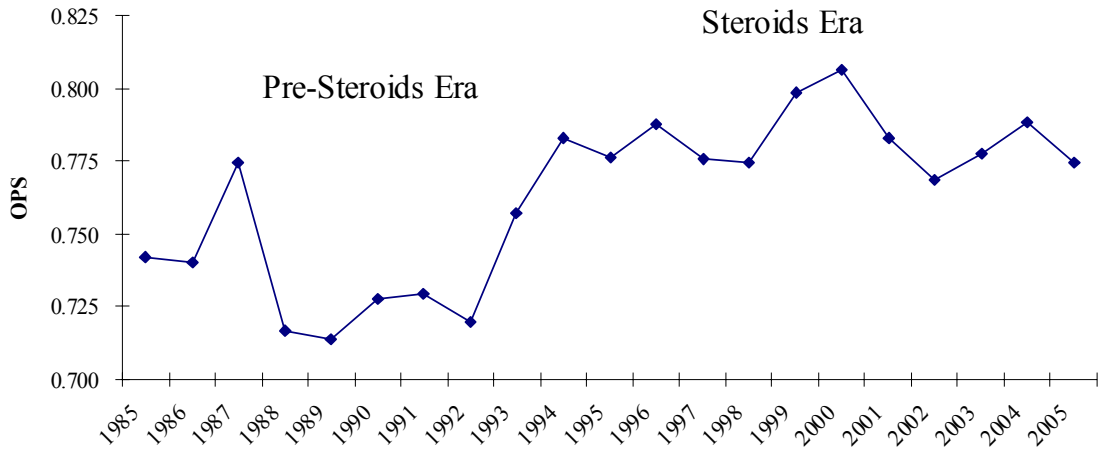
$$OBP = \frac{H + BB + HBP}{AB + BB + SF + HBP}$$

$$SLG = \frac{TotalBases}{AB} = \frac{(1B + 2*2B + 3*3B + 4*HR)}{AB}$$

Increase in OPS with Steroids

We used two methods to determine the effect of steroids on a player's OPS. The first method we call the "All Player" method. Using this method, we compared the OPS for players in the Pre-Steroids Era to the OPS for players in the Steroids Era. We defined the Pre-Steroids Era as 1985 to 1993 and the Steroids Era as 1994 to 2004. While it is hard to choose an exact year that baseball crossed from one era to the next, we felt that steroids had begun to enter baseball in the late 1980s, and by 1994 had spread throughout the league. While few steroids related events were evident prior to 1994, from that point on steroids in the news and allegations of steroids rose dramatically (Assael 2005). 2005 is not included in the Steroids Era, as the league, with pressure from Congress and the public, began to take a harder stance against performance enhancing drugs, and we believe steroid use fell. Or as ESPN's Peter Gammons put it prior to the 2005 season, the "Post-steroids era begins now (Gammons 2005)."

Once we had chosen our two timeframes to compare, we collected the OPS for all players in the major leagues for those years. We omitted players with fewer than 100 at bats in a season so as not to include pitchers or players with limited affect on the game in those years. We found that the average OPS in the Pre-Steroids Era was .736, .048 less than the average OPS in the Steroids Era, .784. Since this comparison includes both users and nonusers, it is systematically biased low.



Source: The Baseball Archive Database (http://www.baseball1.com) and CBS Sportsline (http://www.sportsline.com/mlb/stats)

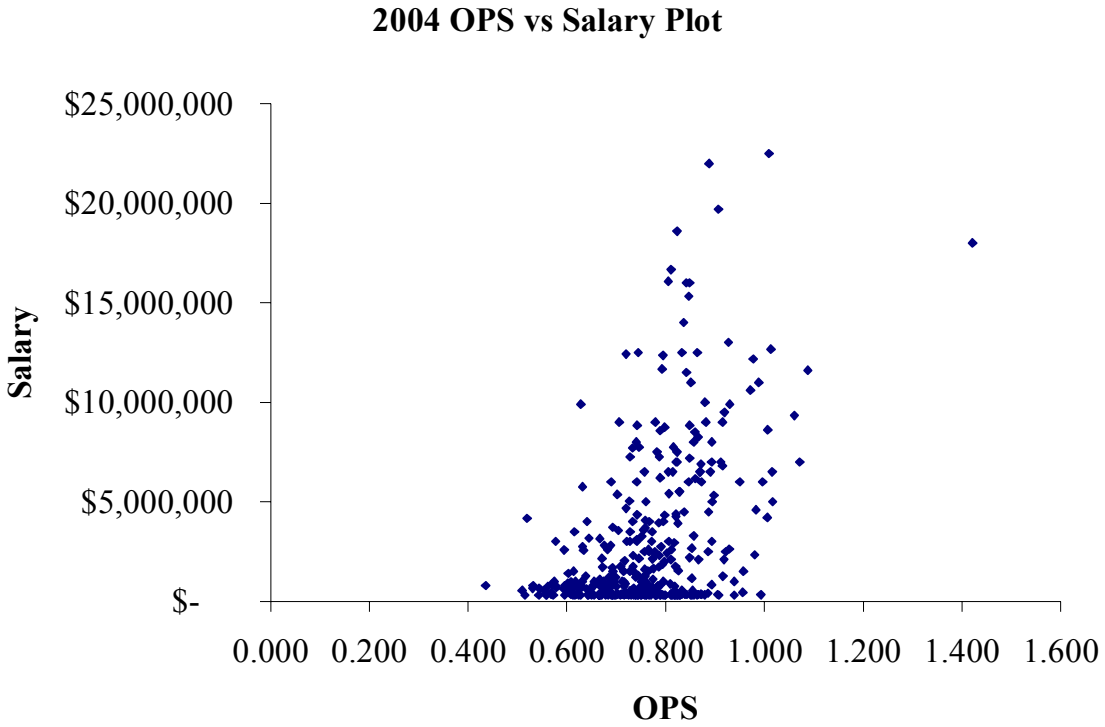
The second method we used to determine the effect of steroids on OPS was what we called the "Steroid Seven" method. We looked at seven players who have either admitted to or been accused of using steroids, or the general perception of them by the general public is of a steroids user. Rather than compare these players' performance in the two eras, we chose to look at their performance during the last few years of the Steroids Era (2001-2004) and compare that to 2005, the first year of the Post-Steroids Era. While not all players saw a significant change in OPS over this time period, the average change in OPS was a decrease of .160.

While there is no exact way to determine the effect of steroids on OPS, we believe that the average of our two methods is a good approximation.

	Change in OPS
All Player Method	.048
Steroid Seven Method	.160
AVERAGE	**.104**

Increase in Salary with Steroids

In order to determine the effect of using steroids on a player's salary, we first needed to determine the effect of increased OPS on a player's salary. We did this by performing a regression of OPS vs. salary for 2004.



Source: The Baseball Archive Database (http://www.baseball1.com)

From this regression we determined that an increase in OPS of .100 leads to an increase in salary of $2 million. Therefore, our average increase in OPS due to steroids of .104 leads to additional annual salary of $2,085,438.

Increase in NPV Over Lifetime Due To Steroids

To determine the value of using steroids over a player's lifetime, we first calculated the increased salary for the player. We used the average length of a Major League Baseball hitter's career, six years (Schall 2000). This leads to a total increase in salary of $12,512,630. Next we determined the cost of actually buying the steroids. Two different sources put the cost of injectable HGH (high end steroids) at $30,000 per year (Cook 2004). We assumed a major leaguer would buy

the very best steroids possible, so as to ensure the maximum benefits, as well as to minimize any chance of detection. We therefore added a 50% premium, bringing the cost up to $45,000.

It is hard to put a price on the costs of the health problems related to steroids. We assumed that any additional medical costs would be covered by the player's health care insurance, which we believe would be high quality given the strength of their employers and their union. However, we did attempt to quantify the financial effect of a shorter lifespan for a player.

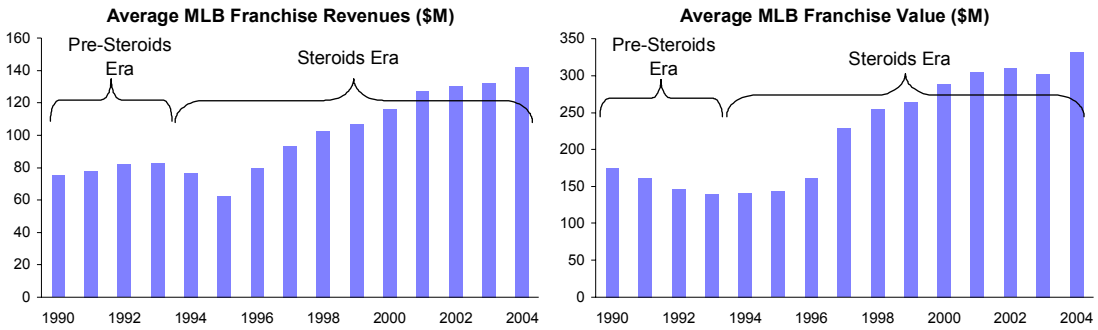
It is not entirely clear how many years steroids take off of your life. "Steroids unquestionably work extremely well--no denying it," says Dr. Harrison Pope of McLean Hospital in Belmont, Mass. "But they will probably shorten your life expectancy. By how much, we still don't know (Baily 2003)." In order to make a guess at this effect, we first attempted to determine the average life expectancy of a Major League Baseball player. Unfortunately, we were not able to attain this data. We were able to determine that the average life expectancy for a football player in the National Football League is only 55 years (Neddenriep 2005). This lower life expectancy is surely due to the rigors of playing football. However, steroids are believed to also be a problem in the NFL, and some of this shortened life expectancy may be due to such drugs. The average life expectancy of an American male is 75 years (Schmid 2005). We therefore felt that a baseball player on steroids would be somewhere in between the average American male and an NFL player. We therefore conservatively chose five years as the effect of steroids on a player's life expectancy. We then multiplied these five years times the pension earnings for a player. While we didn't know exact pension earnings, we did learn that a star player (Cal Ripken, Jr.) will earn $160,000 per year from his pension, so we used this figure as an approximation. Therefore, a player using steroids would lose $800,000 in future pension earnings.

Using the data we collected, we then determined the NPV of using steroids. This included the increase in salary over the player's career, the cost of steroids, and the loss of future pension earnings. Discounted back to today, we computed an NPV of approximately $8.9 million (See Exhibit A).

Benefit of Increased Offensive Production to League

Average Team Revenue Increases

Along with player performance and salary increases, the Steroids Era also saw significant improvement in league franchise finances. While franchise values fell during the early 90's, they increased dramatically during the Steroids Era, with the average MLB franchise value rising from $140 million in 1994 to $332 million in 2004. More applicable to our analysis, franchise revenues accelerated from a Pre-Steroid Era CAGR of 3.4% to a Steroid Era growth rate of 5.0%.



Using these growth rates and the 2004 median franchise profit margin of 4.7%, we calculate that the NPV of the profit stream for the average MLB franchise has increased by $52.2 million.

It appears, therefore, that steroids produce positive results not just for players, but for leagues, owners and even for consumers who get to witness more offense in games. However, the costs of steroid use to leagues must also be factored into the payoffs.

Economic Punishment for Steroid Use

Steroids, like good nutrition, weight training, watching game film and sports psychology, are inputs which help baseball players to produce better statistical numbers, especially the offensive numbers that fans enjoy. The question then becomes, why are steroids reviled for their effects on professional baseball, but these other inputs are not? One possible answer, which is addressed in our player calculations, is that steroids harm the athlete and that we are trying to protect the health of these athletes (Osborne 2005). However, considering the violent nature of other sports, such as rugby or boxing, this seems unlikely – fans enjoy, or at least accept, that sports are physical endeavors that sometimes cause pain (Osborne 2005). A second, related argument is that society is trying to protect the health of children who look at these athletes as role models.

A more plausible explanation, though, is that steroids represent a form of shirking – that while they may improve a player's output, the gains are not made through the necessary effort by the player. Steroids' value comes from their ability to improve athletic performance, ceteris paribus (Osborne 2005). Assuming that there is some sort of cost to the extra effort needed to accomplish the same results without drugs, steroids are a way to achieve the same ends at a lower cost (Osborne 2005). They are a form of cheating, allowing players to reach a level of productivity that they would not have been able to reach through their own natural abilities and efforts based on those abilities. If fans value the individual's drug-free effort, they will reward it through their loyalty to an athlete, team or sport. Conversely, they will punish those who "take the easy way out (Osborne 2005)." This may explain why individual endurance sports, such as running and cycling, and now baseball, with its rich history and strong culture, have been the focus of doping – either through a strong stance against such behavior or a lack thereof. Fans can not directly impact the salaries of players who use steroids. However, they can express their displeasure against teams by not buying tickets to games or purchasing team merchandise.

Average Team Revenue Losses Due To Scandal

To estimate the impact of the scandal on team revenue, we analyzed the expected impact of the scandal on the five individual revenue streams for a franchise: game receipts, local media, post-season, other local, and national (Exhibit B). We then used these expected impacts to forecast the 2005 post-scandal revenue, which was calculated to be $111.9 million (Exhibit C).

Don't Test Scenarios

The payouts for the scenarios where MLB chooses not to test are the same regardless of whether players keep using steroids or not, making the assumption that the public will assume they are using regardless of whether they are or not. Assuming the reduced 2005 revenue of $111.9 million and a return to the Pre-Steroids Era growth rate of 3.4%, the profit stream NPV for the average franchise is expected to fall to $79.7 million.

Test & Use Scenario

The scandal has already impacted 2005 profits and testing cannot improve them. However, testing should improve the growth rate even if players continue to use. Making the assumption that the growth rate will improve slightly to 4.0%, the profit stream NPV under this scenario is expected to fall to $87.7 million from pre-scandal levels, yielding a payoff of $8.0 million to the average MLB franchise under the Test & Use Scenario.

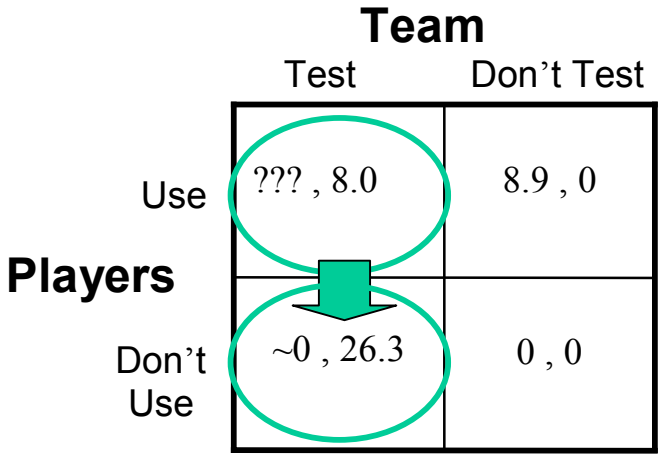
Test & Don't Use Scenario

Again, we make the assumption that 2005 profits will fall to $111.9 million. However, should players choose not to use steroids, we make the assumption that the growth rate will return to 5.0%. Under these assumptions, we calculate that the NPV of the profit stream for the average MLB franchise will fall to $106.0 million from pre-scandal levels, yielding a payoff of $26.3 million to the average MLB franchise under the Test & Don't Use Scenario.

The calculations for these scenarios are shown in Exhibit D.

CRIME AND PUNISHMENT

Given the economics described above, the league is clearly motivated to prevent players from using steroids. This is shown in the game table below.



To inhibit steroid use, the league must institute penalties sufficient to make the players' payoff in the "Use, Test" scenario less than zero. This will shift the equilibrium to the "Don't Use, Test" scenario.

Given various punishment scenarios from the league, we can adjust the players' payoff to account for the existence of penalties. We want to know the NPV of the difference between using steroids and not using steroids.

Let: S = average salary without steroids
B = extra salary associated with using steroids = $2.08 million
E(penalty) = expected value of getting caught
= probability of getting caught * punishment at that time

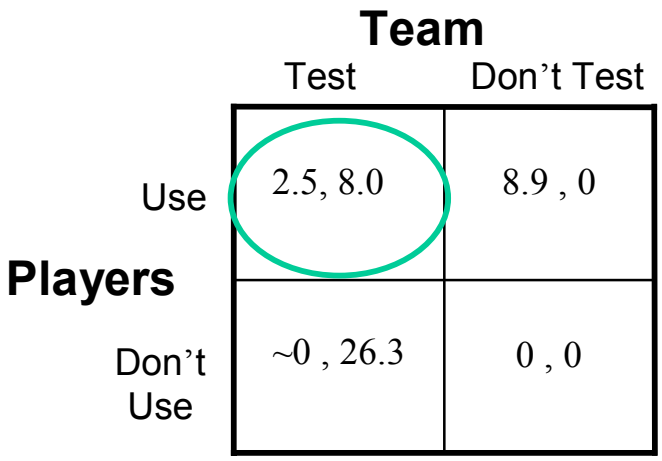
Each year's payout for a non-using player = S
Each year's payout for a using player = S + B – E(penalty)
Thus each year the difference = B – E(penalty)

Therefore we seek to calculate NPV(B – E(penalty)).

The value of NPV(B) has already been calculated above to be $8.9 million. The value of NPV(E(penalty)) is calculated by examining all possible test result scenarios over the 6-year career of a player. The result of these calculations is shown in Exhibit E.

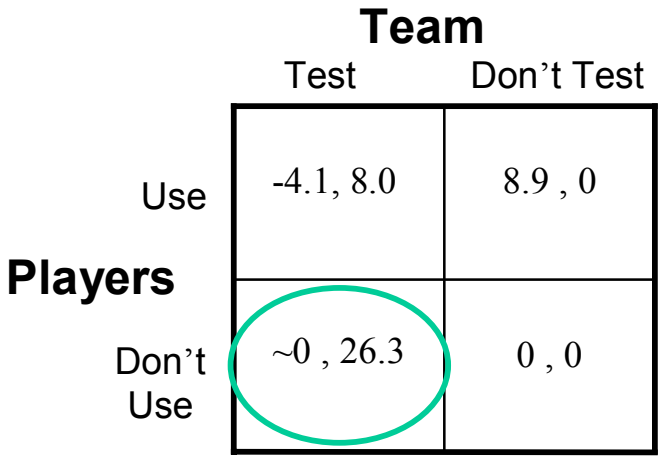
Game Under Current Punishment Scheme

We begin by assuming that a player will decide to either use or not use steroids for his entire career. In this situation, under the current punishment scheme, the NPV of using steroids is $2.5 million. Thus a player is clearly motivated to use steroids even in the face of punishment, and we predict that the punishment scheme will not be effective. It is simply not harsh enough to make up for the $2.08 million in additional annual salary a player can expect for using steroids. The equilibrium remains "Use, Test."



Game Under New Punishment Scheme

We can recalculate the equilibrium under the harsher new punishment scheme. In this case, the NPV to the player of using steroids is reduced to -$4.1 million. Now the player is clearly motivated to not use steroids, and the punishment should prove much more effective in curbing steroid use.



Sensitivity to the Probability of Being Caught

One critical assumption made in the calculations above is that the probability of a player using steroids and failing a drug test is 75%, meaning a false negative will occur 25% of the time (Perry 1997). This assumption is very important, as the NPV calculations are quite sensitive to this probability. Furthermore, this probability is hotly contested. There is a constant battle between improved drug testing technology on the side of the league, and improved masking agents and more difficult to detect drugs on the part of using players. For these reasons, it is important to know how sensitive our conclusions are to this probability.

With our model, we can calculate the point at which the player's NPV of using drugs is zero, i.e. when the player will be indifferent to using vs. not using steroids. Under the current punishment scheme, we have seen that the player's NPV is positive. The probability of being caught would have to rise to 89% for a player to be indifferent to using.

Under the new punishment scheme, however, a player's NPV of using steroids is negative. In this case, the probability of being caught can drop to 54% before a player is indifferent to using steroids.

This predictive capability is very powerful. It helps the league understand how accurate its testing must be under a given punishment scheme to motivate players not to use steroids. Conversely, the league can estimate how accurate its testing program is, and then can calculate how harsh a punishment scheme needs to be implemented to curb steroid use.

Accounting for Dynamic Player Strategy

So far, we have assumed that if a player chooses to use steroids, he will unfailingly use steroids for his entire career even if he is caught. The game changes if we allow a player to change his decision to use steroids after being caught. Now the player has the option to stop using steroids after he is caught once or twice.

As shown in Exhibit E, under this assumption the NPV of using steroids becomes:

NPV(stop using after 1st time caught) = \$1.5 million
NPV(stop using after 2nd time caught) = \$1.4 million

Thus the player will keep using steroids until he is caught once, and then will stop. (The player is roughly indifferent towards stopping after being caught once or twice.) Under the old assumption that a player must keep using steroids, it is the lifetime ban after the 3rd offense that really drives the player's NPV negative. Now, with a dynamic strategy, a player is motivated to use steroids until being caught.

This is simple to understand. A player makes an additional \$2.08 million per season by using steroids, and the punishment for a 1st offense is only \$1.4 million. The punishment for a 2nd offense is \$2.7 million, but after accounting for the only 75% chance of getting caught, it

becomes only $2 million, making the player roughly indifferent to using vs. not using after being caught once.

THE ROLE OF CONGRESS

Baseball's inability to enact and enforce tough punishments for steroid use led to Congress' involvement in the issue. In 2004, Senator John McCain informed baseball officials that Congress would intervene unless tougher testing is instituted (Bodley 2004). In March 2005, players and representatives of the League and the MLBPA were called to testify before the House Government Reform Committee (Dahlberg 2005). Sluggers Rafael Palmeiro, Mark McGwire, Frank Thomas, Sammy Sosa and Jose Canseco and pitcher Curt Schilling testified to varying degrees on their use of steroids and use by their teammates. Former commissioner Fay Vincent, commissioner Bud Selig and Player's Association leader Donald Fehr were also subpoenaed to appear (AP 3/18/2005). In May, Palmeiro tested positive for steroid use and was given a ten day suspension, although Congress declined to charge him with perjury (Fendrich 11/10/2005).

The pressure from the Capital was likely a driving force behind the two increasingly strict new policies of 2004-2005. In fact, Donald Fehr acknowledged that the pressure from politicians played a role in getting the deal done (Dahlberg 2005). With its legislative power, Congress is able to obtain leverage over both the League and the Players, for example by revoking baseball's anti-trust exemption or instituting tough new anti-doping policies through legislation.

In making these threats, Congress faced a need to establish its credibility to the point where both MLB and the players believed Congress would act if a deal could not be reached. One way Congress did this was through reputation. Two of the most outspoken legislators in the past two years have been Senators John McCain and Jim Bunning. Senator McCain has a strong reputation as a reformer and enjoys fairly widespread public popularity. Senator Bunning is a Hall of Fame pitcher (AP 9/28/2005).

Congress also moved in small steps to earn its credibility. It began by first making public announcements as early as 2004. The House followed up by holding hearings in March 2005 and the Senate held hearings in September (AP 9/28/2005). At these hearings, Senator McCain turned up the pressure by telling Donald Fehr:

We're at the end here, and I don't want to do it, but we need an agreement soon. It's not complicated. It's not complicated. All sports fans understand it, I suggest you act and you act soon (AP 9/28/2005).

Finally, Congress increased its commitment by introducing legislation. Senator McCain proposed the Clean Sports Act, a companion to a similar House bill. Senator Bunning, a Kentucky Republican, sponsored the Professional Sports and Integrity Act. The two Senate Acts were later consolidated behind one united front (Fendrich 11/2/2005). A spokesman for one legislator stated that, "If pro sports leagues don't get a handle on this problem on their own, members of Congress will be more than willing to do it for them (Fendrich 11/2/2005)."

CONCLUSION

While it is unlikely that major league players and their agents explicitly calculate NPV as has been done here, open markets nevertheless show a tendency to optimize economic outcomes even in the absence of explicit analysis. Certainly this has been the case in MLB, where the rampant increase in steroid use can be predicted by our model

Unfortunately, our model also predicts that, given a player's ability to stop using steroids at any point in his career, even the harsher new punishment scheme will not curb steroid use until a player has already been caught once. If the league wants to inhibit steroid use completely, it will need to tighten its policies along at least one of three dimensions:

- Increase the punishment for the first offense;
- Increase the probability of a steroid-using player failing a drug test (i.e. make the test better);
- Reduce the economic incentive for performance by either reducing salaries in general or reducing the correlation of salary with performance

Only then can steroid use in baseball be eliminated completely. Our model is, to our knowledge, the only means by which the league can quantitatively estimate the efficacy of a proposed scheme to eliminate steroid use.

EXHIBITS

Exhibit A: Calculation of Player's NPV of Using Steroids

Year	Age	Increase in Salary	Costs	Net Change	Present Value	Description
1	26	$ 2,085,438	$ (45,000)	$ 2,040,438	$ 1,854,944	Inc. in salary less cost of steroids
2	27	2,085,438	(45,000)	2,040,438	1,686,313	Inc. in salary less cost of steroids
3	28	2,085,438	(45,000)	2,040,438	1,533,011	Inc. in salary less cost of steroids
4	29	2,085,438	(45,000)	2,040,438	1,393,647	Inc. in salary less cost of steroids
5	30	2,085,438	(45,000)	2,040,438	1,266,952	Inc. in salary less cost of steroids
6	31	2,085,438	(45,000)	2,040,438	1,151,774	Inc. in salary less cost of steroids
46	71	-	(160,000)	(160,000)	(1,996)	Lost pension from early death
47	72	-	(160,000)	(160,000)	(1,814)	Lost pension from early death
48	73	-	(160,000)	(160,000)	(1,649)	Lost pension from early death
49	74	-	(160,000)	(160,000)	(1,499)	Lost pension from early death
50	75	-	(160,000)	(160,000)	(1,363)	Lost pension from early death
				TOTAL	**$ 8,878,320**	

Exhibit B: 2001 MLB Franchise Revenues ($ Thousands)

Team	Game Receipts	Local Media	Post-Season	Other Local	National	Total
Anaheim	$ 30,208	$ 10,927	—	$ 26,195	$ 24,401	$ 91,731
Arizona	$ 46,509	$ 14,174	$ 13,000	$ 32,970	$ 18,479	$ 125,132
Atlanta	$ 62,141	$ 19,988	$ 2,629	$ 37,692	$ 24,401	$ 146,851
Baltimore	$ 53,216	$ 20,994	—	$ 29,691	$ 24,401	$ 128,302
Boston	$ 89,743	$ 33,353	—	$ 29,485	$ 24,401	$ 176,982
Chic. Cubs	$ 51,189	$ 23,559	$ (17)	$ 30,642	$ 24,401	$ 129,774
Chic. White Sox	$ 30,898	$ 30,092	—	$ 26,291	$ 24,401	$ 111,682
Cincinnati	$ 32,102	$ 7,861	—	$ 6,523	$ 24,401	$ 70,887
Cleveland	$ 69,470	$ 21,076	$ 2,000	$ 45,295	$ 24,401	$ 162,242
Colorado	$ 54,015	$ 18,200	—	$ 35,197	$ 24,401	$ 131,813
Detroit	$ 42,299	$ 19,073	—	$ 21,018	$ 24,401	$ 106,791
Florida	$ 16,756	$ 15,353	—	$ 4,037	$ 24,401	$ 60,547
Houston	$ 49,161	$ 13,722	$ 519	$ 36,826	$ 24,401	$ 124,629
Kansas City	$ 19,520	$ 6,505	—	$ 13,270	$ 24,401	$ 63,696
Los Angeles	$ 50,764	$ 27,342	—	$ 41,100	$ 24,401	$ 143,607
Milwaukee	$ 46,021	$ 5,918	—	$ 37,010	$ 24,401	$ 113,350
Minnesota	$ 17,605	$ 7,273	—	$ 6,987	$ 24,401	$ 56,266
Montreal	$ 6,405	$ 536	—	$ 2,829	$ 24,401	$ 34,171
N.Y. Mets	$ 73,971	$ 46,251	$ (154)	$ 38,162	$ 24,401	$ 182,631
N.Y. Yankees	$ 98,000	$ 56,750	$ 16,000	$ 47,057	$ 24,401	$ 242,208
Oakland	$ 24,992	$ 9,458	$ 2,686	$ 13,932	$ 24,401	$ 75,469
Philadelphia	$ 30,435	$ 18,940	—	$ 7,739	$ 24,401	$ 81,515
Pittsburgh	$ 48,610	$ 9,097	—	$ 26,598	$ 24,401	$ 108,706
St. Louis	$ 67,084	$ 11,905	$ 1,488	$ 27,581	$ 24,401	$ 132,459
San Diego	$ 34,381	$ 12,436	—	$ 8,504	$ 24,401	$ 79,722
San Francisco	$ 67,173	$ 17,197	—	$ 61,524	$ 24,401	$ 170,295
Seattle	$ 76,570	$ 37,860	$ 7,392	$ 56,211	$ 24,401	$ 202,434
Tampa Bay	$ 18,193	$ 15,511	—	$ 28,633	$ 18,258	$ 80,595
Texas	$ 50,664	$ 25,284	—	$ 34,561	$ 24,401	$ 134,910
Toronto	$ 25,363	$ 14,460	—	$ 14,255	$ 24,401	$ 78,479
Consolidation	$ 1,383,458	$ 571,095	$ 45,543	$ 827,815	$ 719,965	$ 3,547,876
Average	$ 46,115	$ 19,037	$ 1,518	$ 27,594	$ 23,999	$ 118,263
Percentage	39%	16%	1%	23%	20%	100%

Source : http://roadsidephotos.com/baseball/mlbsez.htm

Exhibit C: MLB Average Franchise Post-Scandal Revenue Calculation

Revenue Category	Pre-Scandal Revenue		2005 Non-Scandal Revenue		Scandal Impact	2005 Post-Scandal Revenue	
	%	$(M)	%	$(M)		%	$(M)
Game Receipts	39%	$ 41.5	39%	$ 58.3	-20%	42%	$ 46.6
Local Media	16%	$ 17.1	16%	$ 24.1	-40%	13%	$ 14.4
Post-Season	1%	$ 1.4	1%	$ 1.9	-10%	2%	$ 1.7
Other Local	23%	$ 24.8	23%	$ 34.9	-20%	25%	$ 27.9
National	20%	$ 21.6	20%	$ 30.3	-30%	19%	$ 21.2
Total	100%	$ 106	100%	$ 149.5		100%	$ 111.9

Source : Ozanian

Exhibit D: Payouts for Average MLB Franchises

Year	Inflation Adjusted Revenues	CAGR
1990	74.9	3.4%
1991	77.8	
1992	82.0	
1993	82.9	
1994	76.9	5.0%
1995	62.5	
1996	79.5	
1997	93.1	
1998	102.9	
1999	106.9	
2000	116.2	
2001	127.0	
2002	130.2	
2003	132.4	
2004	142.3	

Pre-Scandal Steroid-Use Payoff for Average MLB Franchise

(In millions of dollars)

	CAGR	2005 rev	NPV	Profits
Without Steroids	3.4%	$ 124.5	$ 1,900.0	$ 89.3
With Steroids	5.0%	$ 149.5	$ 3,011.4	$ 141.5

NPV Increase: $ 52.2

Post-Scandal Testing Payoff for Average MLB Franchise

(In millions of dollars)

	CAGR	2005 rev	NPV	Profits
Post Scandal - Don't Test	3.4%	$ 111.9	$ 1,695.8	$ 79.7
Test & Use	4.0%	$ 111.9	$ 1,865.3	$ 87.7

Test & Use - NPV Payoff: $ 8.0

	CAGR	2005 rev	NPV	Profits
Post Scandal - Don't Test	3.4%	$ 111.9	$ 1,695.8	$ 79.7
Test & Don't Use	5.0%	$ 111.9	$ 2,255.0	$ 106.0

Test & Don't Use - NPV Payoff: $ 26.3

Assumptions:

Discount rate	10.0%
Profit Margin	4.7%

Source: SABR

Exhibit E: Player NPV Calculations

Case 1: Current Punishment Scheme – Player Always Uses Steroids

Average salary w/ steroids	$4,385,000	**NPV - Downside of getting caught**
Average career length	6 years	**$6,251,722**
Assumed discount rate	10%	
NPV of playing	$19,097,818	**NPV - Upside of not getting caught**
Incremental salary of usings steroids	$2,085,000	**$8,800,000**
Discount rate	10%	
Probability of getting caught	75%	**Net NPV of Using**
Probability of not caught	25%	**$2,548,278**

Penalties:

1st Time	2nd Time	3rd Time	4th Time
10 days	30 days	60 days	1 year
$216,543	$649,630	$1,299,259	$4,385,000

Case 2: New Punishment Scheme – Player Always Uses Steroids

Average salary w/ steroids	$4,385,000	**NPV - Downside of getting caught**
Average career length	6 years	**$12,891,165**
Assumed discount rate	10%	
NPV of playing	$19,097,818	**NPV - Upside of not getting caught**
Incremental salary of usings steroids	$2,085,000	**$8,800,000**
Discount rate	10%	
Probability of getting caught	75%	**Net NPV of Using**
Probability of not caught	25%	**($4,091,165)**

Penalties:

1st Time	2nd Time	3rd Time
50 games	100 games	(every year, i.e. lifetime ban)
$1,353,395	$2,706,790	$4,385,000

Case 3: New Punishment Scheme – Player Stops Using After Being Caught Once

Average salary w/ steroids	$4,385,000	**Net NPV of Using**
Average career length	6 years	**$1,521,023**
Assumed discount rate	10%	
NPV of playing	$19,097,818	
Incremental salary of usings steroids	$2,085,000	
Discount rate	10%	
Probability of getting caught	75%	
Probability of not caught	25%	

Penalties:		
1st Time	2nd Time	3rd Time
50 games	100 games	(every year, i.e. lifetime ban)
$1,353,395	$2,706,790	$4,385,000

Case 4: New Punishment Scheme – Player Stops Using After Being Caught Twice

Average salary w/ steroids	$4,385,000	**NPV of Using**
Average career length	6 years	**$1,446,967**
Assumed discount rate	10%	
NPV of playing	$19,097,818	
Incremental salary of usings steroids	$2,085,000	
Discount rate	10%	
Probability of getting caught	75%	
Probability of not caught	25%	

Penalties:		
1st Time	2nd Time	3rd Time
50 games	100 games	(every year, i.e. lifetime ban)
$1,353,395	$2,706,790	$4,385,000

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