CHICAGO BOOTH
The University of Chicago Booth School of Business

PROFESSOR MILENA ALMAGRO (42001) COMPETITIVE STRATEGY

WEEK 1: GUIDE TO CASES AND READINGS

Required reading: the Syllabus

It covers important topics such as schedules, submissions, exams, grades, group work, *et cetera*.

Required case: Moneyball

The case consists of two articles. "The Trading Desk" is a condensed version of Michael Lewis's book, Moneyball. You can substitute "The Trading Desk" article with the movie "Moneyball". Follow by reading "An Economic Evaluation of the Moneyball Hypothesis", which is an empirical study of Lewis's claims. You are not responsible for the nuanced statistical issues in the second article but should try to understand the issues at stake, how Hakes and Sauer investigate them, and what the data shows. Note that although the articles make extensive references to baseball, being unfamiliar with the sport will not put you at any meaningful advantage.[1] Just think of professional sports teams as firms trying to make money. (If you think background information would be helpful, there are several short videos online that describe the basic rules of the sport. See, for example, this one: https://youtu.be/hLaoogq_uiU.)

Use the questions below to help you prepare, and submit your responses to them via Canvas. (If you do not have access to Canvas in the 1st week of the course, access the readings and syllabus at the bottom of the website https://www.milena-almagro.com/, and email your responses to the TAs, whose addresses are in that syllabus.) Be prepared to give clear and concise answers to these questions, but do not confine your preparation to these issues exclusively.

1. Would you rather buy a team like the New York Yankees that wins a lot of games or a team like the Pittsburgh Pirates that don't typically win many games?
2. Do you think the A's owners earned excess returns while Billy Beane was GM?
3. What specific fact did the A's most use to outperform other teams with similar budgets?
4. What broader strategy did they employ to outperform? What assets allow them to do this? How hard would it be for another team to imitate them?
5. (This question requires some thinking outside the confines of the case material. I will not cold call on anyone for it.) Was the broader strategy they used always feasible? Was it possible this opportunity existed since the beginning of baseball? What changes around the 1990s, outside the world of baseball, may have presented the opportunity?
6. (This question is also a stretch. Venture a guess if you are not sure.) Hakes and Sauer argue certain skills were underpriced. Managers—strategic, financial, operational, marketing—take actions to exploit market opportunities, so they frequently make arguments like this one. These arguments typically assume that the market is currently "wrong"—a dangerous assumption! Can you give an alternative explanation for these results that do not imply the market was wrong?

Suggested reading: Cabral Chapters 1, 2.1-2.2, 3.1-3.2

Chapter 1 provides a brief overview of industrial organization, the subfield of economics that focuses on firm behavior. Chapter 2 and 3 review some basic microeconomic ideas. This should be a review of material with which you're already comfortable.

[1] On average, more US than foreign students follow baseball. Typically, more male than female students follow it as well. You should know that I gave these facts careful thought. In the event you are interested, I opted to use this case for several reasons: only a very minimal understanding of baseball is required to grasp the key issues; those issues illustrate Week 1 concepts exceptionally well; students tend to enjoy the case regardless of their demographic; and perhaps most importantly (and most interestingly), familiarity with the game has historically been uncorrelated with how students perform on the case.

1 of 1 DOCUMENT

The New York Times

March 30, 2003 Sunday
Late Edition - Final

The **Trading Desk**

BYLINE: By **Michael Lewis;** **Michael Lewis** is a contributing writer for the magazine. This article is adapted from "**Moneyball:** The Art of Winning an Unfair Game," to be published in May by W.W. Norton & Co.

SECTION: Section 6; Column 1; Magazine Desk; Pg. 34

LENGTH: 8214 words

It was late July of last year, July of last year, which is to say that Mike Magnante had picked a bad time to pitch poorly. Mags, as everyone called him, had come in against Cleveland in the top of the seventh with two runners on and a three-run lead. The first thing he did was to walk Jim Thome -- no one could blame him for that. He then gave up a bloop single to Milton Bradley, and the inherited runners scored -- just plain bad luck, that. But then he threw three straight balls to Lee Stevens. Stevens dutifully took a strike, then waited for Mags to throw his fifth pitch.

After the game the first question the Oakland A's' general manager, Billy Beane, asked his manager, Art Howe, was why he brought in Magnante. Howe's first answer was that he thought that Mags, the lefty, would be effective against a left-handed slugger like Thome. Which was just more conventional baseball nonsense, in Beane's view, since Mags hadn't got anyone out in weeks. Howe's second answer was that Beane put Mags on the team, and if a guy is on the team, you need to use him. Howe won't say this directly to Beane, but he'll probably think it. The coaching staff had grown tired of hearing Beane holler at them for using Magnante. "The guy has got braces on both legs," said Rick Peterson, the pitching coach. "We're not going to use him as a pinch runner. If you don't want us to use him, trade him."

Magnante went into his stretch and looked for the signal. He had recently turned 37 and was four days shy of the 10 full years of big-league service he needed to collect a full pension. Paul DePodesta, Oakland's assistant general manager, often said that "for guys to be available to us, there usually has to be something wrong with them," and it wasn't hard to see what was wrong with Mags, to discern the defect that made him available to a strapped team like Oakland. He was pear-shaped and slack-jawed and looked less like a professional baseball player than most of the beat reporters who covered the team.

Magnante made an almost perfect pitch to Lee Stevens, a fastball low and away. The catcher was set up low and outside. When you see the replay, you understand that he had hit his spot. If he missed, it was only by half an inch. It was the pitch Mike Magnante wanted to make. Good pitch, bad count. The ball caught the fat part of the bat. It rose and rose, and the two runners on base began to circle ahead of the hitter. It was Lee Stevens's first home run as a Cleveland Indian. By the time the ball landed, the first and third basemen were closing in on the mound like bailiffs, and Art Howe was on the top of the dugout steps. Magnante let in five runs and got nobody out. It wasn't the first time that he had been knocked out of a game, but it wasn't often he had been knocked out on his pitch. That's what happens when you're 37 years old: you do the things you always did, but the results are somehow different.

The game was effectively over. The Indians' own left-handed relief pitcher, Ricardo Rincon, struck out David Justice on three pitches and got Eric Chavez to pop out on four. The contrast cast Mags in unflattering light. The A's had the weakest left-handed relief pitching in the league, and the Indians had some of the strongest. To see the difference, Billy Beane didn't even need to watch the game.

The next day, when Billy Beane sits upright in his office, a few yards from Oakland's Coliseum, he faces a wall covered entirely by a white board and, on it, the names of the several hundred players controlled by the Oakland A's. Mike Magnante's name is still on that board. Swiveling around to his rear, he faces another white board with the names

of the nearly 1,200 players on other major league rosters. Ricardo Rincon's name is on that board. At this point in the year Beane doesn't really need to look at these boards to make connections; he knows every player on other teams that he wants, and every player in his own system that he doesn't want. The trick is to persuade other teams to buy his guys for more than they are worth and to sell their guys for less than they are worth. Jermaine Dye, Johnny Damon, Ray Durham, Mark Ellis, CoryLidle, Chad Bradford: in just the past few years Billy Beane acquired an obscene amount of talent at so little cost to himself that he is finding other teams reluctant to do business with him. The Cleveland Indians are not yet one of those teams.

Waiting for the Cleveland general manager, Mark Shapiro, to call him back, Beane distracts himself by paying attention to several things at once. On his television is "Lou Dobbs Moneyline." On his desk is the most recent issue of Harvard Magazine, containing an article about a Harvard professor of statistics named Carl Morris. The article explains how Morris had used statistical theory to determine the number of runs a team could expect to score in the different states of a baseball game. No outs with no one on base: .537. No outs with a runner on first base: .902. And so on for each of the 24 possible states of a baseball game. "We knew this three years ago," Beane says, "and Harvard thinks it's original."

He shoves a wad of tobacco into his upper lip, then turns back to his computer screen. He was made the Oakland G.M. just before the 1998 season. Not long before that, the Oakland A's figured out that they were long-term poor. Their financial disadvantage was not only permanent but growing. Each year they would have less money to spend on players than the Yankees and the Red Sox. They responded by creating, in effect, a research-and-development department inside the organization. Oakland R.&D. at first consisted of applying hidden truths about baseball unearthed by hobbyists -- Harvard statistics professors, research scientists, Wall Street analysts turned amateur baseball analysts -- and ignored by organized baseball. This practice had evolved into something more elaborate and original. The reason Billy Beane, high-school graduate, could condescend to abstruse statistical arguments in Harvard Magazine was that he himself had, for several years, employed graduates of Harvard to make abstruse statistical arguments.

Paul DePodesta was the main one. In the past few years DePodesta helped Beane to put a dollar value on everything from foot speed (almost always overpriced), defense (often overpriced and more often misunderstood) and offense (better understood but still not so well that there wasn't money to be made from a more nuanced understanding of its origins). Batting average wasn't usually worth what it cost, but on-base percentage was usually worth a great deal more. So much more, in fact, that if you set about buying as much of it as you could, you could build a winning team with very little money at all. There were all sorts of ancillary traits in a hitter -- the number of pitches he saw per plate appearance, for instance -- that had concrete value to a baseball offense but that were treated by most baseball people as worthless.

Pitching was another subject. You could make a fair living as a G.M. selling flamethrowers and buying guys who found other, subtler ways to get outs.

At the bottom of the Oakland experiment was a willingness to rethink baseball: how it is managed, how it is played, who is best suited to play it and why. The Oakland front office was on a perpetual search for new baseball knowledge. It had studied everything from the market price of foot speed to the inherent difference between the average major league player and the superior Triple A one. This experiment in bringing science to baseball had some odd consequences.

One was to turn the manager in the dugout into a mere functionary and concentrate rare powers in the office of the general manager: everythingof importance, from whether to steal bases to which relief pitchers to use and when, was decided in advance by the G.M. Which was useful. The benefits of bunting and stealing -- and a lot of other tactical decisions that made field managers legends -- usually did not justify their cost.

Maybe the simplest inefficiency of all were the significant shifts that occurred in the prices of players over the course of a season. On July 30, the eve of last season's trading deadline, Billy Beane is still pursuing players, and one of them is the Cleveland Indians' left-hander Ricardo Rincon. At that very moment, Rincon is still just a few yards away, inside the visitors' locker room, dressing to play the second game of a three-game series against the A's. The night before he threw only seven pitches. His arm, no doubt, feels good. The Cleveland Indians have given up any hope of winning this year, and are now busy selling off their parts. "The premier left-handed set- up man is just a luxury we can't afford," Shapiro says, as a way of explaining why he has been shopping Rincon around the league. Beane has found out -- he won't say how -- that the other bidder is the San Francisco Giants and that the Giants' offer may be better than his. All Beane has offered the Indians is a minor-league second baseman named Marshall MacDougal.

For three of the past four years, the Oakland A's have played like a different team after the All-Star break than before it. The previous year, 2001, they had been almost bizarrely better: 44-43 before the break, 58-17 after it. Since the All-Star game was created, in 1933, no other team had ever won so many of its final 75 games. The reason the Oakland A's, as run by Billy Beane, played as if they were a different team in the second half of the season is that they were a different team. As spring turned to summer, the market allowed Beane to do things that he could do at no other time of the year. The bad teams lost hope. With the loss of hope came a desire to cut costs. With the desire to cut costs came the dumping of players. As the supply of players rose, their prices fell.

Halfway through the 2002 season, Billy Beane was able to acquire players he could never have afforded at the start of the season. And by late July, his antennae for bargains quivered. Shopping for players just before the deadline was like shopping for used designer dresses on the day after the Oscars, or for secondhand engagement rings in Reno. His goal at the start of the season was to build a team good enough to remain in contention until the end of June. On the first of July, the A.L. West standings looked like this:

Seattle 52-30

Anaheim 47-33-4GB

Oakland 46-36-6GB

Texas 35-45-16GB

Having kept the team close enough to hope, he could now go out and shop for whatever else he needed to get to the playoffs. When he set off on this shopping spree, he kept in mind five simple rules:

1) No matter how successful you are, change is always good. There can never be a status quo. When you have no money, you can't afford long-term solutions, only short-term ones. You have to always be upgrading.

2) The day you say, "I have to do something," you're in trouble. Because you are going to make a bad deal. You can always recover from the player you didn't sign. You may never recover from the player you signed at the wrong price.

3) Know exactly what every player in baseball is worth to you. You can put a dollar figure on it.

4) Know exactly who you want and go after him. (Never mind whom they say they want to trade.)

5) Every deal you dowill be publicly scrutinized by subjective opinion. If I'm the C.E.O. of I.B.M., I'm not worried that every personnel decision I make is going to wind up on the front page of the business section. Not everyone believes that he knows everything about the personal computer. But everyone who ever picked up a bat thinks he knows baseball. To do this well, you have to ignore the newspapers.

Billy Beane compensated for his complete inability to heed Rule No. 5 by fanatically heeding the other four. Otherwise, his approach to the market for baseball players was by its nature unsystematic. Unsystematic -- and yet incredibly effective.

For more than a decade, the people who run professional baseball have argued that the game was ceasing to be an athletic competition and becoming a financial one. The gap between rich and poor teams in baseball is far greater than in football and basketball, and widening rapidly. In the middle of the 2002 season, the richest team, the New York Yankees, had a payroll of $133.4 million, while two of the poorest teams, the Oakland A's and the Tampa Bay Devil Rays, had payrolls of less than a third of that. A decade before, the highest-payroll team, the New York Mets, spent about $44 million on players, and the lowest-payroll team, the Cleveland Indians, a bit more than $8 million. The growing raw disparities meant that only the rich teams could afford the best players. A poor team could afford only the maimed and the inept, and was almost certain to fail. Or so argued the people who ran baseball.

But when you actually look at what happened over the past few years, you have to wonder. The bottom of each division has been littered with teams -- the Rangers, the Orioles, the Dodgers, the Mets -- that have spent huge sums and failed spectacularly. On the other end of the spectrum is Oakland. For the past four years, working with one of the lowest payrolls in the game, the Oakland A's have won as many regular-season games as any other team except the Atlanta Braves. They've been to the playoffs three years in a row and twice taken the richest team in baseball, the Yankees, to within a few outs of elimination. How on earth did they do it? As early as 2000, Commissioner Bud Selig took to calling the Oakland A's' success "an aberration," but that was less an explanation than an excuse not to grapple with the questions: how did they do it? What was their secret?

And there did, indeed, appear to be a secret. A leading independent authority on baseball finance, a Manhattan lawyer named Doug Pappas, pointed out a quantifiable distinction between Oakland and the rest of baseball. The least you could spend on a 25-man team, if everyone was paid the minimum salary, was $5 million, plus $2 million more for players on the disabled list and the remainder of the 40-man roster. The huge role of luck in any baseball game, and the relatively small difference in ability between most major leaguers and the rookies who might work for the minimum wage, meant that the fewest games a minimum-wage baseball team would win during a 162-game season was something like 49. The Pappas measure of financial efficiency was this: How many dollars over the minimum $7 million does each team pay for each win over its 49th? How many marginal dollars does a team spend for each marginal win? Over the past three years Oakland has paid about half a million dollars per win. The only other team in six figures has been the Minnesota Twins, at $675,000 per win. The most profligate rich franchises -- the Baltimore Orioles, for instance, or the Texas Rangers -- have paid nearly $3 million for each win, or more than six times what Oakland paid. Oakland seemed to be playing a different game from everyone else.

Anyone who really wanted to understand how this team with no money kept winning more and more games would do well to examine the impact of Billy Beane's shopping sprees.

On July 25, he acquired the All-Star second baseman Ray Durham, plus a portion of the money to pay his salary, from the White Sox, who had abandoned all hope for their season. Now he has sights on Ricardo Rincon, and the absence of ready cash is becoming a problem. Rincon is owed about $508,000 for the rest of the season, and that is $508,000 the Oakland A's' owners will not agree to spend. To get Rincon, Beane not only has to persuade Shapiro that his is the highest bid; he also has to find the money to pay Rincon's salary. Where? If he gets Rincon, he won't need Mike Magnante. No one else does, either, so he is unlikely to save money there. No matter what he does, the A's will wind up eating Magnante's salary. But he might well be able to move Mike Venafro, the low-budget left-handed reliever he just sent down to Triple A. Venafro is a lot younger than Magnante. Other teams might be interested in him.

This gives Beane an idea: auction Mike Venafro to teams that might be competing with him for Ricardo Rincon.

He knows that the San Francisco Giants are after Rincon. He knows also that the Giants don't have much to spend and that, if offered a cheaper option, might be less inclined to stretch for Rincon. "Let's make them skinnier," he says, and picks up the phone and calls Brian Sabean, the G.M. of the Giants. He'll offer Venafro to the Giants for almost nothing. In a stroke he'll raise cash he needs to buy Rincon (because he won't have to pay Venafro's salary) and possibly also reduce the Giants' interest in Rincon, as they'll now see they have, in Venafro, an alternative.

Brian Sabean listens to Beane's magnanimous offer of Mike Venafro; all Beane wants in return is a minor-league player. Sabean says he's interested. "Sabes," Beane says, after laying out his proposal. "I'm not asking for much here. Think it over and call me back."

The moment he hangs up, he calls Mark Shapiro, current owner of Ricardo Rincon, and tells him that he has the impression that the market for Rincon is softening. Whoever the other bidder is, he says, Shapiro ought to make sure his offer is firm.

As he puts down the phone, DePodesta pokes his head into the office. "Billy, what about the Mets on Venafro? Just to have options."

"The Mets could be after Rincon," Beane says.

The phone rings. It's Mark Shapiro, calling right back. He tells Beane that, by some amazing coincidence, the other buyer for Rincon has just called to lower his offer. Beane leans forward in his chair, chaw clenched in his upper lip, as if waiting to see if a fly ball hit by an Oakland A will clear the wall. He raises his fist as it does. "I just need to talk to my owner," he says. "Thanks, Mark."

He puts down the phone. "We have a two-hour window on Rincon," he says. He now has a purpose: two hours to find $508,000 from another team, or to somehow sell his owner on the deal. Never mind that his owner, Steve Schott, has already said that he won't spend the money to buy Rincon. He shouts across the hall. "Paul! What's left on Venafro's contract?"

"Two hundred and seventy-five thousand, two hundred and seventy-three dollars."

He does the math. If he unloads Venafro, he'll still need to find another $233,000 to cover Rincon's salary, but he isn't thinking about that just yet. His owners have told him only that they won't eat 508 grand; they've said nothing about eating 233 grand. He has two hours to find someone who will take Venafro off his hands. The Mets are a good

idea. Beane picks up the phone and dials the number for Steve Phillips, the general manager of the Mets. A secretary answers.

"Denise," Beane says, "Billy Beane, vice president and general manager of the Oakland Athletics. Denise, who is the best-looking G.M. in the game?" Pause. "Exactly right, Denise. Is Steve there?"

Steve isn't there, but someone named Jimmy is. "Jimmy," Beane says. "Hey, how you doin'? Got a question for you. You guys looking for a left-handed reliever?"

He raises his fist again. Yes! He tells Jimmy about Venafro. "I can make it real quick for you," he says.

How quick?

"Fifteen minutes?"

Fine.

"I can give you names in 15 minutes," Beane says. "Yeah, look, I'd do this if I were you. And I'm not expletive you here Jimmy. I'm being honest with you."

Paul sees what is happening and walks out the door before Beane is finished. "I gotta find some more prospects," he says. He needs to find who they want from the Mets in exchange for Venafro.

Beane hangs up. "Paul! We got 15 minutes to get names." Paul's already in his office flipping through various handbooks that list all the players owned by the Mets. Beane takes the seat across from him and grabs one of the books; together they rifle through the entire Mets farm system, stat by stat. It's a new game: maximize what you get from the Mets farm system inside of 15 minutes. They're like a pair of shoppers who have been allowed into Costco before the official opening time and told that anything they can cart out the door in the next 15 minutes they can have free. The A's' president, Michael Crowley, walks by and laughs. "What's the rush?" he says. "We don't need Rincon until the sixth or seventh inning."

"What about Bennett?" DePodesta asks.

"How old is he?" Beane asks.

"Twenty-six."

"He's 26 and in Double A? Forget it."

Beane stops at a name and laughs. "Virgil Chevalier? Who is that?"

"How about Eckert," Paul says. "But he's 25."

"How about this guy?" Beane says and laughs. "Just for his name alone. Furbush!"

Anyone older than about 23 who is desirable will be too obviously desirable for the Mets to give up. They're looking for a player whose promise they have a better view of than the Mets have. Someone very young. It will be someone they do not know and have never seen, and have researched for 30 seconds.

"How about Garcia?" Paul DePodesta asks.

"What's Garcia? Twenty-two?"

"Twenty-two," DePodesta says.

He shows Beane the stats for Garcia, and Beane says: "Garcia's good. I'll ask for Garcia." He gets up and walks back to his office cursing. "I know what I'll do. Why don't we go back to them and say, 'Give us cash too!'? What's the difference between Rincon and Venafro?"

Paul punches numbers into his calculator: "232,923."

"I'll ask him for 233 grand plus the prospect," Beane says. "The money doesn't mean anything to the Mets."

Being poor means treating rich teams as petty cash dispensers. If he can get the Mets to give him the 233, he doesn't even need to call his owner. He can just make the deal himself.

He pauses before he picks up the phone. "Should I call Sabean first?" he's asking himself; the answer, also provided by himself, is no. As Beane calls Steve Phillips, Paul reappears. "Billy," he says, "you might also ask for Duncan. What can they say? He's hitting .217."

"Who would we rather have, Garcia or Duncan?" Beaneasks.

The Mets' secretary answers before DePodesta. Beane leans back and smiles. "Denise," he says, "Billy Beane, vice president and general manager of the Oakland Athletics. Denise, who is the coolest G.M. in the game?" Pause. "Right again, Denise."

When he was a young man, Billy Beane could beat anyone at anything, and often did. As a freshman in high school, Beane was the quarterback on the football team and later the high scorer on the basketball team; but it was on the baseball field that he truly excelled. By his junior year he was 6-foot-4, 180 pounds, and his high-school diamond was infested with major league scouts. In the first big game after Beane came to the attention of baseball scouts, he pitched a two-hitter, stole four bases and hit three triples. He encouraged strong feelings in the older men who were paid to imagine what kind of pro ballplayer a young man might become.

The boy had a body you could dream on: ramrod straight and lean but not so lean you couldn't imagine him filling out. And that face! Beneath an unruly mop of dark brown hair, the boy had the sharp features that the scouts loved. In the late 1970's, when Beane was coming of age, some scouts still believed they could tell by the structure of a young man's face not only his character but also his future in pro ball. They had a phrase they used: "the Good Face." Beane had the Good Face.

What the scouts failed to notice is what happened when things did not go well for Beane on the field: a wall came down between him and his talent, and he didn't know any other way to get through the wall than to try to smash a hole in it. The moment Billy failed, he went looking for something to break. It wasn't merely that he didn't like to fail; it was as if he didn't know how to fail. The scouts never considered this. By the end of Beane's senior year the only question they had about Beane was, Can I get him? And the answer was a firm no. Beane insisted that he didn't want to play pro ball; he wanted to go to Stanford on a joint football and baseball scholarship. But the New York Mets took him in the first round anyway, one thing led to another and Beane took the $125,000 offered by the Mets. He appeased his mother (and his conscience) by telling her (and himself) he would attend classes at Stanford during the off-season.

Stanford disagreed. When the admissions office learned that Beane would not be playing sports for Stanford, they told him that he was no longer welcome in Stanford's classrooms. "Dear Mrs. Beane," read the letter from the Stanford dean of admissions, Fred A. Hargadon, "we are withdrawing Billy's admission. . . . I do wish him every success, both with his professional career in baseball and with his alternate plans for continuing his education."

Only there were no plans. One day Beane could have been anything; the next he was just another minor-league baseball player, and not even a rich one. On the advice of a family friend, Billy's parents invested on their son's behalf his entire $125,000 bonus in a real-estate partnership that promptly went bust.

It got worse. In his first year of pro ball, Billy Beane hit .210. He didn't know how to think of himself if he couldn't think of himself as a success. His second full season, in the Double A Texas League, he played alongside Darryl Strawberry and hit .220; Strawberry was named the league's most valuable player. Beane spent a lot of hours in the outfield dwelling on Strawberry's heroics and on his own failure. "That was the first year I really questioned if I'd made the right decision to sign,"Beane says.

Strawberry presented one kind of problem for Billy; Lenny Dykstra presented another. Beane and Dykstra lived together and played side by side in minor-league outfields for nearly two years, beginning in 1984. That year both were invited to the Mets' big-league spring training camp. Dykstra thought of himself and Beane as two buddies racing together down the same track, but Beane sensed fundamental differences between them. Physically, Dykstra didn't belong in the same league with him. He was half Beane's size and had a fraction of Beane's promise. But mentally, Dykstra was superior. Beane remembers sitting with Dykstra in a Mets dugout watching the opposing pitcher warm up. "Lenny says, 'So who's that big dummy out there on the hill?' And I say: 'Lenny, you're kidding me, right? That's Steve Carlton. He's maybe the greatest left-hander in the history of the game.' Lenny says: 'Oh, yeah! I knew that!' He sits there for a minute and says, 'So, what's he got?' And I say: 'Lenny, come on. Steve Carlton. He's got heat and also maybe the nastiest slider ever.' And Lenny sits there for a while longer as if he's taking that in. Finally he just says, 'I'll stick him.' "

The point about Dykstra, at least to Billy, was clear: Dykstra didn't let his mind mess him up. Only a psychological freak could approach a 100-m.p.h. fastball aimed not all that far from his head with total confidence. "Lenny was so

perfectly designed, emotionally, to play the game of baseball," Beane said. "He was able to instantly forget any failure and draw strength from every success. He had no concept of failure. I was the opposite."

Dykstra went on to be a star with the Mets; Beane was traded to Minnesota, which eventually passed him on to Detroit. After leaving the Tigers, he signed with Oakland. No matter how often he moved, his problem never changed: he couldn't hit. By the end of 1989, after six seasons in the major leagues, his career stat line (301 at bats, .219 batting average, .246 on-base percentage, .296 slugging percentage, 11 walks against 80 strikeouts) told an eloquent tale of suffering. You didn't need to know Billy Beane at all -- you only needed to read his stats -- to sense that he left every on-deck circle in trouble. That he had developed neither discipline nor composure. That he had never learned to lay off a bad pitch. That he was easily fooled. That, fooled so often, he came to expect that he would be fooled. That he hit with fear. That his fear masqueraded as aggression. That the aggression enabled him to exit the batter's box as quickly as possible.

During spring training of 1990, Beane walked out of the Oakland dugout and into the front office and said be wanted a job as an advance scout. An advance scout traveled ahead of the big- league team and analyzed the strengths and weaknesses of future opponents. Beane was 27, entering what was meant to be his prime as a baseball player, and he had decided he would rather watch than play. Baseball had rendered him unfit for anything but itself.

Denise, who is the coolest G.M. in the game?" The New York Mets' secretary is charmed. Her laughter reaches the far end of Billy Beane's office. "Billy has the gift of making people like him," said the man who made Beane a general manager, Oakland's former G.M. Sandy Alderson. "It's a dangerous gift to have."

This time Steve Phillips is present and ready to talk. "Look, I'm not going to ask you for a lot for Venafro," Beane says, generously, as if acquiring Venafro had been Phillips's idea. "I need a player and 233 grand. I'm not going to ask you for anyone really good. I have a couple of names I want to run by you. Garcia, the second baseman, and Duncan, the outfielder, who hit .217 last year."

Phillips, like every other G.M. who has just received a call from Billy Beane, assumes there must be some angle he isn't seeing. He asks why Beane sent Venafro down to Triple A. He's worried about Venafro's health. He wonders why Beane is now asking for money too.

"Venafro's fine, Steve," Beane says. He's back to selling used cars. "This is just a situation for us. . . . I need the money for something else I want to do later."

Phillips says he still wonders what's up with Venafro. The last few times he pitched he was hammered. Beane sighs: it's harder turning Mike Venafro into a New York Met than he supposed. "Steve, me and you both know that you don't judge a pitcher by the last nine innings he threw. Art misused him. You should use him for a whole inning. He's good against righties too!"

For whatever reason, the fish refuses the bait. At that moment Beane realizes: the Mets are hemming and hawing about Venafro because they think they are going to get Rincon. "Look," Beane says. "Here's the deal, Steve." He's no longer selling used cars. He's organizing a high-school fire drill and tolerating no cutups. "I'm going to get Rincon. It's a done deal. Yeah. It's done. The Giants want Venafro. I've told them they can have him for a player: Luke Robertson."

"Anderson," DePodesta whispers.

"Luke Anderson," Beane says, easing off. "We like Anderson. We think he's going to be in the big leagues. But I'd like to deal with you because Sabes doesn't have any money. You can win this because you can give me 233 grand in cash, and he can't. I don't have to have the 233 grand in cash. But it makes enough of a difference to me that I'll work with you." He has ceased to be the fire drill instructor and become the personal trainer. You can do it, Steve! You can win!

Beane likes whatever place he has reached in the conversation. "Yeah," he says. "It doesn't have to be Garcia or Duncan. I'll find a player with you. If it makes you feel better." (I want you, and only you, to have Venafro). "O.K., Steve. Whoever calls me back first gets Venafro." (But if you drag your heels, you'll regret it for the rest of your life.) "Watching Billy do a deal," said his best friend, the Toronto Blue Jays' G.M., J.P. Ricciardi, "is like watching the wolf talk to Little Red Riding Hood."

When Beane hangs up, his assistant tells him that Peter Gammons, the ESPN reporter, is on the line. In the hours leading up to the trade deadline, Beane refuses to take calls from several newspaper reporters. One will get through to him by accident, and he'll make her regret that she did. Most reporters, in Billy's experience, are simply trying to be the

first to find out something they'll all learn anyway before their deadlines. "They all want scoops," he complains. "There are no scoops. Whatever we do will be in every paper tomorrow. There's no such thing as a paper that comes out in an hour."

It's different when Gammons calls. Gammons might actually tell him something he doesn't know. "Let's get some info," he says and picks up the phone. Gammons asks about Rincon, and Beane says, casually, "Yeah, I'm just finishing up Rincon," as if it's a done deal, which clearly it is not. He knows Gammons will tell others what he tells him. Then the quid pro quo: Gammons tells Beane that the Montreal Expos have decided to trade their slugging outfielder, Cliff Floyd, to the Boston Red Sox. Beane quickly promises Gammons that he'll be the first to know whatever he does.

"Billy, Steve's still waiting to talk!" Mike Crowley again. His owner, Steve Schott, keeps calling. Beane looks around as if he has forgotten something. Money! He goes back to his phone and calls Steve Phillips, the Mets G.M., one last time. "Steve, here's the deal. I don't want Rincon pitching against me tonight." He listens for a bit and hears nothing that makes him happy. When he hangs up, he says, "He has no money."

The Mets have no money to waste. This is new. The market for baseball players, like the market for stocks and bonds, is always changing. To trade it well, you need to be adaptable.

Every minute that passes is a minute Brian Sabean -- or even Steve Phillips! -- has to talk Mark Shapiro into closing the two-hour window on Rincon he has opened for Beane. Beane hollers to Mike Crowley: "Tell Schott that if we don't move Venafro, I'll sell Rincon for twice the price next year. No. Tell him that I'll make him a deal. If I don't do it, I'll cover it. But I keep anything over twice the savings."

The A's' president doesn't know what to do with this. His G.M., who earns 400 grand a year, is telling his owner that he'll take an equity stake in a single player. Billy Beane could make himself a very rich man, simply by dealing players as well as he has done. No reply comes back from the owner, and Beane assumes he is free to do what he wants with Rincon (and hold on to Venafro). He gives the Mets and Giants 15 minutes more. Finally, he decides. He'll take the risk. He picks up the phone to call Mark Shapiro to acquire Rincon.

When he trades players, Billy Beane always operates with total certainty. He doesn't know it yet, but that is the real edge he has in his quest for Ricardo Rincon: he is more decisive than the other G.M.'s. From the others Mark Shapiro hears only vagueness and uncertainty; from Billy Beane he hears the most alarmingly concrete and rapid proposals. This is odd. In any ruthlessly competitive market for complex assets -- stocks and bonds or baseball players -- it isn't normal for any one trader to act with perfect confidence. Those who do are either deluded or have some brief informational edge.

Beane has an edge, but it isn't brief. He has been dealing in players in this manner for five years, and never made a trade he regretted. The market for baseball players is inefficient, and he knows it. He knows in his bones how completely a seemingly efficient market can misvalue a human being -- because it so completely misvalued him. With Paul DePodesta's help, he is able to put fairly exact numbers on the value of any given baseball player. And those numbers are often shocking.

That is another strange consequence of the Oakland experiment: to undermine a lot of old prejudices about who, and who was not, meant to play pro ball. Constantly looking beneath the surface of a player's performance to discern its underlying value, the Oakland A's became a magnet for guys who didn't look all that good on the surface. Guys who were too fat, too skinny, too short, too slow or too old. The inability to envision a certain kind of person doing a certain kind of thing because you've never seen someone who looks like him do it before is not just a vice. It's a luxury; and the Oakland A's couldn't afford luxuries. They needed to find ballplayers, as cheaply as possible. On the team's current roster there is hardly a player who wasn't dismissed at one point in his career as ill designed to play big league baseball. Tim Hudson, Barry Zito, Miguel Tejada, Scott Hatteberg, Chad Bradford: most of the players knew what it felt like to be on the receiving end of professional baseball's irrational scorn. Oakland R.&D. liberated many players from unthinking prejudice and allowed them to demonstrate their true worth. A baseball team, of all things, was at the center of a story about the possibilities -- and the limits -- of science in human affairs.

The A's' left-handed reliever Mike Magnante had once been the beneficiary of baseball science; now he was its victim. Beane acquired Mags on the down slope of his career, when most other teams thought he was washed up, and milked a hundred or so useful innings of relief pitching out of him. But now Mags was done, and someone needed to tell him. And so, phone in hand, almost casually, Beane says to DePodesta, now seated on Billy's sofa, "Do you want to go down and release Magnante?"

"Do I want to?" DePodesta says. He looks right, then left, as if Beane must be talking to some other person who enjoys telling a 37-year-old relief pitcher that he's washed up. When he looks left he can see the Coliseum a few yards away, through Billy's office window. It wasn't that Mags was just four days short of his 10-year goal. He'd get his pension. It was that, in all likelihood, Mags was finished in the big leagues.

"Someone's got to talk to him," Beane says. Now, suddenly, there is a difference between trading stocks and bonds and trading human beings. Beane never lets it affect what he does. He is able to think of players as pieces in a board game. That's why he traded them so well.

"Call Art," DePodesta says. "That's his job."

Beane picks up his phone to call Art Howe and then remembers that he hasn't actually made the trade, and so reverses himself and calls Mark Shapiro in Cleveland. It's 6:30. The game against the Indians starts in 35 minutes.

"Mike Magnante has just thrown his last pitch in the big leagues," DePodesta says.

"Sorry I took so long, Mark," Beane says.

No problem. But since you did, do you want to wait until after the game to take Rincon?

"No, we want him now. We want to get him in our dugout tonight."

Why the rush?

"By and large Magnante cost us the game last night, and Rincon won the game."

O.K. No big deal. We'll do it now.

"You feel comfortable with Ricardo's health, right?"

Right.

Beane hangs up and dials Art Howe's number. The A's' manager has just returned to his office beside the clubhouse.

"Art. It's Billy. I have some good news and some bad news."

Art gives a little nervous chuckle. "O.K."

"The good news is you've got Rincon."

"Do I?!"

"The bad news is you gotta release Magnante."

Silence on the other end of the line. "O.K.," Art finally says.

"And you've got to do it before the game."

"O.K."

Beane makes several quick calls. He calls the A's' equipment manager, Steve Vucinich. "Voos. We gotta get rid of Mags by game time. Yeah. You have 25 minutes to get him out of there." He calls the Mets' Steve Phillips. "Steve, I got the guy I wanted. Rincon." (For you, it's Venafro or nothing.) He calls the Giants' Brian Sabean. "Brian. Hey Brian. Hey, it's Billy. I've made a deal for Rincon right now." (So don't think you can wait me out.) He calls Peter Gammons and tells him what he has done, and that he's not doing anything else.

After the final call, his phone rings. He looks at his caller ID and sees it's from the visitors' clubhouse. He picks it up.

"Oh, hi, Ricardo." It's Ricardo Rincon, whose English skills are rudimentary.

"Ricardo, I know it's a little bit shocking for you," Beane says. His syntax changes slightly; he's groping fora Mexican mode of expression and winds up saying whatever he can think of that Ricardo might understand. "But we have been trying to get you for a long time. You're going to love the guys on the team. They're fun."

Ricardo is trying to get it clear in his head that he's supposed to do what he has just been asked to do, take off his Cleveland Indians uniform, gather his personal belongings, walk down the hall into the Oakland clubhouse and put on an Oakland uniform. He can't quite get his mind around it.

"Yes! Yes!" Beane says. "I don't know if you'll pitch tonight. But you're on our team tonight."

Whatever Ricardo says, he means: Oh, my God, I might actually have to pitch tonight?

"Yes. Yes. Possibly you'll punch out Jim Thome!" Possibly you will punch out Jim Thome. Beane is becoming, quickly, a Mexican immigrant.

"We'll have a uniform and everything ready for you." And everything. He's had just about enough touchy-feely for one evening. He tries to lead the conversation to a not horribly unnatural conclusion. "Where are you from, Ricardo?"

Ricardo says he's from Veracruz, Mexico.

"Well, Veracruz is closer to here than to Cleveland. You're closer to home!"

He finishes that one, hangs up and says, "It's gotten to be a longer road trip for Ricardo than he expected." He looks absolutely spent. The wad of tobacco is gone from his upper lip, and his mouth is dry. He gargles with the glass of water on his desk and spits. "I've got to work out," he says.

At that moment, Mike Magnante was removing his Oakland uniform, and Ricardo Rincon was removing his Cleveland one. Mags left the Oakland clubhouse quickly; he would come back for his things later when no one was around. His wife had brought the kids to the game, so he couldn't just leave. Magnante watched the game with his family until the sixth inning and then left so that he wouldn't have to answer questions from the media. He had no desire to call further attention to his situation. In his youth he might have mouthed off. He would certainly have borne a grudge. But he was no longer young; the numbness had long since set in. He thought of himself the way the market thought of him, as an asset to be bought and sold. He'd long ago forgotten whatever it was he was meant to feel.

The main thing was that Mags was gone from the clubhouse before Beane walked across to change into his sweats. As Beane headed in, however, he bumped into Ricardo Rincon heading out, in street clothes. Ricardo remained confused. He had heard he was going to the San Francisco Giants, or maybe the Los Angeles Dodgers. He never imagined he might be an Oakland A. And he still didn't understand the full implications of what happened. The Oakland A's' primary left-handed relief pitcher was going out to find a seat in the stands to watch the game. Beane led him back into the clubhouse where the staff had just finished steaming RINCON onto the back of an Oakland A's jersey. "You're on our team now," Beane says.

Ricardo Rincon walked back into his new clubhouse, put on his new uniform and sat down and watched the entire game on television. "I was not ready," he said. "I couldn't concentrate." His left arm, however, felt great.

No matter how you look at it, the season was a miracle. Ricardo Rincon and Ray Durham helped to turn the 2002 Oakland A's into one of the top 10 second-half teams in the past 50 years. All but written off when they could not afford to prevent Jason Giambi from signing with the Yankees, the A's won 103 games, one more than they had the year before, tied for the most in all of baseball.Maybe more astonishingly, at least for economic determinists, the teams in baseball's best division, the American League West, finished in inverse order to their payrolls.

Oakland 103-59 -$41,942,665

Anaheim 99-63-4 -$62,757,041

Seattle 93-69-10 -$86,084,710

Texas 72-90-31 -$106,915,180

Then they did a favor for everyone who wanted to ignore or dismiss their importance: they lost in the first round of the playoffs to the Minnesota Twins. That was all right, Beane said, because the playoffs were a crap shoot, impervious to baseball science. He could control what happened over a 162-game season; in a 5-game series, his magic didn't work. There were no secret recipes for the post-season, except maybe having three great starting pitchers, and he had that.

His objective spirit survived his team's playoff exit for a week. The fact that his team had lost to the clearly inferior Minnesota Twins festered. He never said it, but it was nonetheless evident that he could not quite believe how little appreciation there was for what they had achieved. Even his owner, who was getting multiples more for his money than

any owner in baseball, complained. The public reaction to the thing ate at Beane. In these situations, when his mind was disturbed, he often went looking to make a trade. But there was no player on whom his mind naturally fixed; the only person in the organization whose riddance would make him happier was his manager, Art Howe. It wasn't long before he had a novel idea: trade Art.

It took him about a week to do it. He called Steve Phillips and told him that Howe was a superb manager, but his latest one-year contract called for a big raise, and Oakland couldn't really afford to pay it. The Mets had just fired their own manager, Bobby Valentine, and Phillips was in a bit of a fix. Beane had thought he might even get a player from the Mets for Howe, but in the end settled on moving Howe's salary. Howe signed a four-year deal for more than $2 million a year to manage the New York Mets. In Howe's place Beane installed Ken Macha, the A's' bench coach.

That made him feel better for a bit. Then it didn't. He had the feeling he had come to the end of some line. Here they had run this low-budget franchise as efficiently as a low-budget franchise could be run, and no one had even noticed. No one cared if you found radically better ways to run a big-league baseball team. All anyone cared about was how you fared in the post-season crap shoot. For his work he had been paid about as well as a third-year relief pitcher. He was worth, easily, more than any player; his services were more substantially undervalued than those of any player he'd ever acquired. He could see only one way to exploit this grotesque market inefficiency: trade himself.

That superior management armed with science could be had so cheaply was easily the greatest inefficiency in all of baseball. John Henry, a Wall Street billionaire who had recently purchased the Boston Red Sox, understood this. Henry knew all about how to exploit market inefficiencies; he had long since decided that he wanted to reinvent his franchise in the image of the Oakland A's. The trouble was, how? Only one guy had ever actually proved he could impose reason on a big-league clubhouse, and that guy, two weeks after his team had been bounced from the playoffs, was now dissatisfied with his job. One thing led to another, and before long Billy Beane had agreed to run the Boston Red Sox. He would be guaranteed $12.5 million over five years, the most anyone had ever been paid to run a baseball team.

All that remained was for Beane to sign the Red Sox contract. And he couldn't do it. In the 24 hours after he accepted the Red Sox' job offer, Beane became as manic and irrational and incapable of sleep as he was back in May, after the A's were swept by the Blue Jays. As decisive as he was about most things, he was paralyzed when the decision involved himself. He had convinced himself that he wasn't taking the job just for the money. Since it was pretty clear he wasn't doing it for the love of the Red Sox, it raised a question of why he was doing it at all. He decided he was doing it just to show that he could do it. To prove that his own peculiar talents had concrete value. Dollar value. And that in any sane world he'd be paid a fortune for them.

Now he had a problem: he'd just proved that. Baseball columns everywhere were abuzz with the news that Billy Beane was about to become the highest-paid general manager in the history of the game. Now that everyone knew his true value, Beane didn't need to prove it anymore. Now the only reason to take the job was the money.

The next morning he called Henry and told him he couldn't do it. A few hours later he blurted to a reporter something he wished he hadn't said but was nevertheless the truth: "I made one decision based on money in my life -- when I signed with the Mets rather than go to Stanford -- and I promised I'd never do it again." After that Beane confined himself to the usual blather about personal reasons. None of what he said was terribly rational or "objective" -- but then neither was he.

Within a week, he was back to scheming how to get the Oakland A's back to the playoffs, and DePodesta was back to being on his side. And he was left with his single greatest fear: that no one would ever really know. He and Paul might find ever more clever ways to build great ball clubs with no money, but unless they brought home a World Series ring or two, no one would know. And even then -- even if they did win a ring -- where did that leave him? He'd be just one more general manager among many who were celebrated for a day, then forgotten. People would never know that, for a brief moment, he was right and the world was wrong.

URL: http://www.nytimes.com

LOAD-DATE: March 30, 2003

LANGUAGE: ENGLISH

GRAPHIC: Photo: Billy Beane (Andrew Eccles); The Deal Ricardo Rincon, far right, was the prize that Beane sought, and the Indians, who had fallen out of contention, were willing to let him go. To land him, Beane would have to dangle

Mike Venafro, middle, to a few different teams, and get rid of Mike Magnante, near right, a war-horse reliever four days short of his pension. Beane would also have to come up with half a million dollars out of somebody else's pocket.; The G.M. and His Sidekick:Beane, front, executes deals with the confidence he never had as a ballplayer. Paul DePodesta, the A's' assistant G.M. and a Harvard graduate, helped Beane devise his system of evaluating players, and is sometimes called on to do Beane's dirty work.; The Submariner: Chad Bradford's bizarre motion and lack of velocity left him stranded in the White Sox system, but Beane trusted his solid stats more than he trusted the dubious scouts.; The Little Guy: Tim Hudson's slight build left the scouts unimpressed, but Beane saw his excellent numbers at Auburn as a better bet than the athletic high-schoolers most teams draft.; The New New Closer: According to Beane most any pitcher can be a competent closer, so he brought in the inconsistent Keith Foulke as the A's' closer, their third in three years.; The Selective Slugger: Erubiel Durazo can't hit left-handed pitching at all, but Beane acquired him for his power and his ability to draw walks.; The Convert: A former catcher, Scott Hatteberg was a potential hazard at first base last year, but to Beane, his patience at the plate more than made up for that.; The Captive: Miguel Tejada was the American League M.V.P. last year, but Beane can only afford players of his caliber in the years before they are eligible for free agency. (MAGNANTE: EZRA SHAW/GETTY IMAGES. VENAFRO: JUSTIN KASE CONDER/ICON. RINCON: ANDREW ECCLES FOR THE NEW YORK TIMES; Bradford: John Cordes/Icon. Hudson: Jed Jacobsohn/Getty Images. Foulke: Eric Risberg/Associated Press. Durazo: Tom Hood/Associated Press. Hatteberg: Julie Jacobson/Associated Press. Tejada: Dave Kennedy/Associated Press.)

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An Economic Evaluation of the *Moneyball* Hypothesis

Jahn K. Hakes and Raymond D. Sauer

In his 2003 book *Moneyball,* financial reporter Michael Lewis made a striking claim: the valuation of skills in the market for baseball players was grossly inefficient. The discrepancy was so large that when the Oakland Athletics hired an unlikely management group consisting of Billy Beane, a former player with mediocre talent, and two quantitative analysts, the team was able to exploit this inefficiency and outproduce most of the competition, while operating on a shoestring budget.

The publication of *Moneyball* triggered a firestorm of criticism from baseball insiders (Lewis, 2004), and it raised the eyebrows of many economists as well. Basic price theory implies a tight correspondence between pay and productivity when markets are competitive and rich in information, as would seem to be the case in baseball. The market for baseball players receives daily attention from the print and broadcast media, along with periodic in-depth analysis from lifelong baseball experts and academic economists. Indeed, a case can be made that more is known about pay and quantified performance in this market than in any other labor market in the American economy.

In this paper, we test the central portion of Lewis's (2003) argument with elementary econometric tools and confirm his claims. In particular, we find that hitters' salaries during this period did not accurately reflect the contribution of various batting skills to winning games. This inefficiency was sufficiently large that knowledge of its existence, and the ability to exploit it, enabled the Oakland Athletics to gain a substantial advantage over their competition. Further, we find

■ *Jahn K. Hakes is Assistant Professor of Economics and Management, Albion College, Albion, Michigan. Raymond D. Sauer is Professor of Economics, Clemson University, Clemson, South Carolina. Their e-mail addresses are ⟨jhakes@albion.edu⟩ and ⟨sauerr@clemson.edu⟩, respectively.*

that, even while various baseball interests denounced Beane and Lewis as charlatans in a stream of media reports, market adjustments were in motion (for discussion, see Lewis, 2004; Craggs, 2005). These adjustments took place around the time Lewis's book was published, and with sufficient force that baseball's labor market no longer exhibits the *Moneyball* anomaly.

Because sports often embody situations where choices are clear and performance and rewards are measurable, they generate useful conditions for studying the behavior of market participants. There are many examples. McCormick and Tollison (1986) use variation in fouls from basketball games to illustrate how the likelihood of punishment affects crime. Brown and Sauer (1993a, 1993b) used point spreads for professional basketball games to consider the influence of psychology and information on market prices. Studies find that the behavior of soccer players conforms well with game-theoretic predictions of equilibrium behavior in penalty kick situations (Chiappori, Levitt and Groseclose, 2002). Moreover, in laboratory experiments that are analytically similar to penalty-kick situations (but not described in a soccer context) soccer players act as predicted, whereas students from the general population do not, highlighting the relevance of experience in natural settings to results in the lab (Palacios-Huerta and Volij, 2006).

The present paper depicts a particularly clear case of mispricing in the baseball labor market, accompanied by successful innovation and subsequent adjustment in market prices. Although reasons for the failure of efficient pricing are not fully understood, it seems clear that the correction in market prices was tied to the diffusion of knowledge, as competing franchises mimicked the Athletics' strategy, in part by hiring Beane's chief assistants away from the Oakland organization.

Measures of Offensive Productivity in Baseball and their Contribution to Winning

Measures of Batting Skill

A Major League Baseball game consists of nine scheduled innings, in which each team has an opportunity to score runs on offense in its half of each inning. The team on offense is limited to three outs per inning, after which play and scoring cease. Play then resumes with the opponent taking its turn at bat. The limit on outs is crucial. Scoring runs is the objective of the team at bat, and this is accomplished by a combination of skills: in particular, skill at hitting the ball and the ability to avoid making an out.

The most common measure of batting skill is the *batting average*, which is the ratio of hits to total at-bats. The batting average is a crude index. By weighting singles and home runs the same, it ignores the added productivity from hits of more than a single base. Much better is the *slugging percentage*, which is total bases divided by at-bats, so that doubles count twice as much as singles, and home runs twice as much as doubles.

Nevertheless, both the batting average and slugging percentage ignore potentially relevant dimensions of batter productivity. When baseball statistics are calculated, sacrifices and walks are not counted as official at-bats, and so they do not figure into either batting average or slugging percentage. In particular, since a fundamental element of batting skill is the ability to avoid making an out, the failure to account for walks is a serious omission. Hitting a single leads to a higher batting average, and receiving a walk doesn't show up in batting average, but in both cases the batter ends up at first base. The statistic that takes walks into account is called *on-base percentage*, which is defined as the fraction of plate appearances (including both official at-bats as well as walks) in which the player reached base successfully through either a hit or a walk.

Members of the Society for American Baseball Research (SABR) have studied a variety of combinations of on-base percentage and slugging percentage in the hope of generating a single statistic that will capture a batter's contribution. It has long been known among this group, dubbed sabermetricians, that linear combinations of these two percentages are very highly correlated with runs scored, the primary objective of an offense. The essence of the *Moneyball* hypothesis is that the ability to get on base was undervalued in the baseball labor market.

Contribution to Winning

We use linear regression analysis to confirm that on-base percentage is a powerful indicator of how much a batter contributes to winning games. In Table 1, the dependent variable in the regression is the team's winning percentage. The data for these calculations are performance data over five seasons from 1999 to 2003. Column 1 of Table 1 shows that looking only at a team's own on-base percentage and the on-base percentage of its opponent can explain 82.5 percent of the variation in winning percentage. Column 2 shows that looking only at a team's own slugging percentage and the opponent's slugging percentage can explain 78.7 percent of the variation in winning percentage. Column 3 incorporates both measures of batting skill, which improves the explanatory power of the regression to 88.5 percent of variance. The coefficients on skills for a team and its opponents are quite close to each other, as would be expected in a two-sided symmetric game.[1] This is to be expected given the well-documented high correlation between runs scored and linear combinations of on-base and slugging percentage.

The final column of Table 1 is used to assess *Moneyball's* claim (Lewis, 2003, p. 128) that, contrary to then-conventional wisdom, on-base percentage makes a more important contribution to winning games than slugging percentage. To facilitate the comparison, the "on-base" and "on-base against" coefficients are restricted to be the same, as are the "slugging" and "slugging against" coefficients. The coefficients in this regression for on-base percentage are more than twice as large as the coefficients for slugging, which supports Lewis's claim. A one-point

[1] Similar results are obtained using a team's Earned Run Average, a measure of the runs given up by a team's pitchers, as a measure of the quality of a team's pitching and its defensive ability.

Table 1
The Impact of On-Base and Slugging Percentage on Winning

	Model			
	1	*2*	*3*	*4*
Constant	0.508	0.612	0.502	0.500
	(0.114)	(0.073)	(0.099)	(0.005)
On-Base	3.294		2.141	2.032
	(0.221)		(0.296)	(0.183)
On-Base against	−3.317		−1.892	-2.032^{R}
	(0.196)		(0.291)	
Slugging		1.731	0.802	0.900
		(0.122)	(0.149)	(0.106)
Slugging against		−1.999	−1.005	-0.900^{R}
		(0.112)	(0.152)	
Number of observations	150	150	150	150
R^2	.825	.787	.885	.884

Hypothesis test of model 4, H^0: On-Base = Slugging
$F(1, 147) = 16.74$, p-value = 0.0001

Source: Retrosheet Game Logs, ⟨http://www.retrosheet.org⟩. The data were obtained free of charge from, and are copyrighted by, Retrosheet, 20 Sunset Rd., Newark, DE 19711.
Notes: Data are aggregate statistics for all 30 teams from 1999–2003. Coefficient estimates were obtained using ordinary least squares. Coefficients for annual 0/1 dummy variables are suppressed. Standard errors are in parentheses. Superscript "R" indicates that the coefficient was restricted to equal its counterpart in the regression. The p-value for the null hypothesis that restrictions are valid is 0.406 ($F = 0.52$).

change in a team's on-base percentage makes a significantly larger contribution to team winning percentage than a one-point change in team slugging percentage.

The Labor Market's Valuation of Skill and the Athletics' Management Strategy

Wages in Major League Baseball

We now turn to the question of the labor market's valuation of batting skills. Table 2 presents summary statistics on wages for position players (nonpitchers) during the five seasons spanning 2000–2004. The average wage for position players increased over the sample period, from $2.56 million to $3.32 million, with the figure for 2004 slightly lower than the prior year. Home run hitters, defined as those with more than 25 homers in a season (roughly one standard deviation above the mean), earn $3 million to $4 million more than the average player.

Valuation of Batting Skill in Baseball

An efficient labor market for baseball players would, all other factors held constant, reward on-base percentage and slugging percentage in the same propor-

Table 2
Major League Baseball Salaries 2000–2004
(millions of current dollars)

Summary Statistic	2000		2001		2002		2003		2004	
	Salaries	*N*	*Salaries*	*N*	*Salaries*	*N*	*Salaries*	*N*	*Salaries*	*N*
Mean	2.56	354	3.02	358	3.16	346	3.46	344	3.32	340
10th percentile	0.25		0.25		0.26		0.32		0.32	
Median	1.45		1.61		1.80		1.56		1.25	
90th percentile	6.40		7.50		8.00		9.12		9.00	
Sample Means	*Salaries*	*N*	*Salaries*	*N*	*Salaries*	*N*	*Salaries*	*N*	*Salaries*	*N*
HR > 25	5.57	60	6.43	62	7.34	53	8.12	50	7.96	53
HR < 14	1.46	202	1.53	200	1.77	211	1.96	204	1.78	197
Catchers	1.88	46	2.13	48	2.16	50	2.73	45	2.46	48
Infielders	2.19	126	2.69	130	2.67	126	2.78	120	2.61	116
First basemen/ DHs	3.15	55	3.94	48	4.65	50	4.44	50	4.00	52
Outfielders	2.93	127	3.34	132	3.48	120	3.98	129	4.03	124

Source: Performance and position from the Lahman database v. 5.1, ⟨http://www.baseball1.com⟩. Salaries and labor market status from Doug Pappas, ⟨http://roadsidephotos.sabr.org/baseball/data.htm⟩.
Notes: Salary data for all position players with more than 130 at-bats in a season. HR stands for home runs, thus 60 players hit more than 25 home runs in 2000. DHs stands for designated hitters.

tions that those statistics contribute to winning. We assess this proposition by estimating earnings equations for position players (which means that we exclude pitchers) for the 2000–2004 seasons. The dependent variable is the logarithm of annual salary. All productivity variables are calculated based on performance in the prior year, because salary is generally determined prior to performance, and based on expected productivity given observed performance in previous years.[2]

All players with more than 130 at-bats in the previous season are included in the regressions, which is a fairly low hurdle since during a 162-game season, many players will have at least 500 official at-bats (not counting plate appearances that lead to walks and sacrifices).[3] The regression specification holds a number of other

[2] This approach economizes on data collection at the potential expense of precision. Since salary is a function of expected performance, variation in performance from the expected level is likely to increase as time passes from the contract date. Not knowing the date at which long-term contracts were signed is problematic when performance varies from its expected level. This concern is reduced to the extent that good hitters, sluggers and so on perform similarly from year to year. Note also that as long-term contracts introduce inertia to salary corrections, our regressions will tend to understate shifts in the returns to skill. Changes in returns to a particular skill dimension across time would occur more slowly in our sample than in a counterfactual sample populated exclusively with one-year contracts.

[3] A minimum of 130 at-bats is required for a player to qualify for honors as rookie of the year. This provides an objective cutoff so that we employ productivity measures exclusively for players with a relatively large sample of at-bats.

factors constant, following the categories used by Kahn (1993). The base category is for younger players who have limited power to negotiate for higher salaries under the collective bargaining agreement that governs baseball, and effectively face a monopsony employer of their labor. Players with more experience become eligible for salary arbitration, in which the team and player each propose a salary and the arbitrator must choose one of the positions, without splitting the difference. Players also eventually become eligible for free agency, which allows them to offer their services to all teams. The regression also includes a variable for playing time, as measured by plate appearances. It also adjusts for the fact that defensive skills are more important at certain positions by including indicator variables for players at the more demanding defensive positions of catcher and infielder (by which we mean second base, third base, or shortstop).[4]

The first column of results in Table 3 reports coefficient estimates from the log salary regression when all five years of data are pooled. All significant coefficients have the expected signs. Relative to younger players who have limited ability to negotiate their pay, players who are eligible for arbitration earn more, with an additional increment for players eligible to become free agents. We also obtain positive and statistically significant returns to expected playing time. The returns to on-base percentage and slugging are both positive, as expected. However, the coefficient for slugging on the income of a player is considerably larger than the coefficient for on-base percentage, which is the reverse of their importance to team success. This is consistent with *Moneyball's* claim that on-base percentage is undervalued in the labor market.

Columns 3 through 7 of Table 3 display parameter estimates for the same equation for each individual season. These results indicate that pooling is inappropriate, as labor market returns to player attributes differ across seasons. Figure 1 shows how the estimated returns to on-base percentage and slugging percentage evolve over this period. In the first four years of data, the slugging coefficients are all statistically significant and of similar magnitude, ranging between 2.05 and 3.10. In contrast, the on-base percentage coefficients are smaller than their slugging counterparts in each of these years, ranging between −0.13 and 1.36, and are not statistically significant.

Column 2 of Table 3 presents coefficient estimates when the first four seasons are pooled. The coefficient for slugging percentage is 2.45 and statistically significant, and the coefficient for on-base percentage is 0.84, and not statistically significant. A sense of the absolute magnitude of the premium for sluggers can be obtained for each year by evaluating the effect on salary of one-standard-deviation

[4] Productivity and positional data were obtained from the Lahman baseball database at the Baseball Archive at ⟨http://baseball1.com⟩. Data on salaries and labor market status were obtained from Doug Pappas' Business of Baseball data archive at ⟨http://roadsidephotos.sabr.org/baseball/data.htm⟩. We lack measures such as speed and fielding ability in our data. These are likely relevant in specific cases, but prior research results imply that our set of regressors accounts for the bulk of salary variation that can be systematically explained.

Table 3
The Baseball Labor Market's Valuation of On-Base and Slugging Percentage

	All Years	*2000–2003*	*2000*	*2001*	*2002*	*2003*	*2004*
On-Base	1.360	0.842	1.334	−0.132	0.965	1.351	3.681
	(0.625)	(0.678)	(1.237)	(1.230)	(1.489)	(1.596)	(1.598)
Slugging	2.392	2.453	2.754	3.102	2.080	2.047	2.175
	(0.311)	(0.338)	(0.628)	(0.613)	(0.686)	(0.850)	(0.788)
Plate appearances	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Arbitration eligible	1.255	1.242	1.293	1.106	1.323	1.249	1.323
	(0.047)	(0.048)	(0.102)	(0.100)	(0.100)	(0.111)	(0.115)
Free agency	1.683	1.711	1.764	1.684	1.729	1.663	1.575
	(0.044)	(0.185)	(0.096)	(0.092)	(0.097)	(0.107)	(0.105)
Catcher dummy	0.152	0.185	0.137	0.065	0.208	0.343	0.059
	(0.056)	(0.061)	(0.124)	(0.116)	(0.122)	(0.134)	(0.133)
Infielder dummy	−0.029	−0.007	0.060	0.069	−0.087	−0.054	−0.100
	(0.040)	(0.044)	(0.087)	(0.083)	(0.086)	(0.095)	(0.098)
Intercept	10.083	10.429	10.078	10.347	10.490	10.289	9.782
	(0.170)	(0.178)	(0.360)	(0.321)	(0.358)	(0.387)	(0.414)
Observations	1736	1402	353	357	344	342	340
R^2	0.675	0.687	0.676	0.728	0.695	0.655	0.635
Value of one-standard-deviation increase (in millions of dollars)							
On-Base			0.14	0.16	0.17	0.19	0.49
Slugging			0.52	0.61	0.64	0.70	0.61

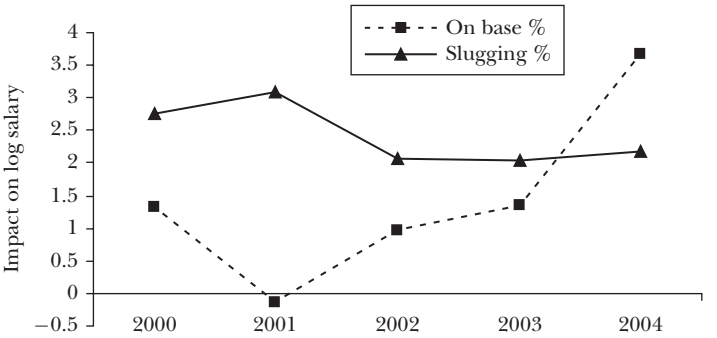
Source: Same as Table 2.
Notes: The dependent variable is ln(Salary) for year t, and performance variables are from year $t - 1$. 0/1 dummies for each year are included in the pooled regressions. Standard errors in parentheses. The sample includes all players with at least 130 plate appearances during the relevant season.

increases in slugging percentage and on-base percentage. These figures are listed in the last two rows of Table 3. The incremental salary impacts for slugging percentage in the first four years range from $0.52 million to $0.70 million and are three to four times as large as the incremental impact of a standard deviation increase in on-base percentage.

This finding contrasts with the evidence from Table 1, which indicates that swapping a small increment of slugging percentage in return for a small increment of on-base percentage would increase a team's winning percentage. The lack of a market premium for hitters with superior skill at the patient art of reaching base through walks validates the systematic approach taken by the Oakland Athletics in identifying such players, and thereby winning games at a discount relative to their competition.

The relative valuation of on-base and slugging percentage is abruptly reversed for the year 2004—and this result exists despite the inertia produced by long-term contracts. The salary returns to slugging are similar in 2004 to prior years, but 2004

Figure 1
Labor Market Returns to On-Base and Slugging Percentage Over Time



Source: Coefficient estimates from Table 2.

is the first year in which on-base percentage becomes statistically significant. The labor market in 2004 appears to have substantially corrected the apparent inefficiency in prior years, as the coefficient of on-base percentage jumps to 3.68, and the ratio of the monetary returns to reaching base and slugging is very close to the ratio of the statistics' contributions to team win percentage.

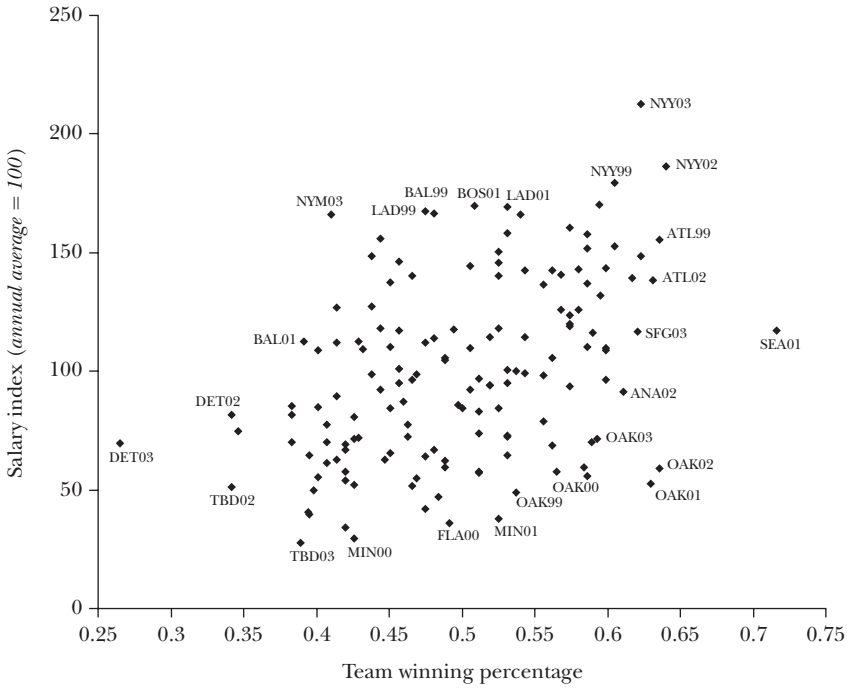
We have thus verified a central claim in *Moneyball* by showing that on-base percentage was undervalued at the beginning of the 2000–2004 period in Major League Baseball. There are two obvious caveats which should be addressed before accepting Lewis's argument completely. First, it might be that fans prefer watching sluggers, and that the allegation of mispricing confuses the ability to "win ugly," but unprofitably, with profit maximization. Second, the analysis thus far does not link the Oakland A's success to an explicit strategy capitalizing on the alleged mispricing of skill. We turn to these questions now.

Efficiency and Management Strategy in the Oakland A's Personnel Decisions

The Oakland Athletics' management strategy, as reported by Lewis (2003, p. 124) was to minimize the payroll required to build a team which would successfully contend for a playoff spot. Figure 2 is a scatterplot of team salaries and winning percentage which demonstrates the Athletics' ability to win "on the cheap." Because Major League Baseball salaries were increasing rapidly during this period, each team payroll is indexed to the league-wide average for that season. The points in the scatterplot which represent the Athletics teams (OAK99–OAK03) are tightly clustered in the bottom right corner of Figure 2, which is consistent with the Athletics' stated optimal combination of high winning percentage and low indexed team salaries.[5] Other teams along the "frontier" of efficiently converting payroll

[5] As discussed in Lewis (2003, xiii), the late Doug Pappas (at that time chairman of SABR's Business of Baseball Committee) was one of the first to examine the efficiency with which the Oakland A's went

Figure 2
Frontier for Efficient Conversion of Team Salary into Team Winning Percentage, 1999–2003



Source: Won-loss records from www.baseball-reference.com. Team salaries from SABR, ⟨http://businessofbaseball.com/data.htm⟩.
Notes: Teams near the frontiers of efficient and inefficient conversion are given a team–year label, with the last two digits indicating the year. Teams near the frontiers are Atlanta (ATL), Anaheim (ANA), Baltimore (BAL), Boston (BOS), Detroit (DET), Florida (FLA), Los Angeles Dodgers (LAD), Minnesota (MIN), Oakland (OAK), New York Mets (NYM), New York Yankees (NYY), Seattle (SEA), San Francisco Giants (SFG), and Tampa Bay Devil Rays (TBD). All years for Oakland are included.

into wins usually either failed to have enough on-field success to make the playoffs (like the 2003 Tampa Bay Devil Rays, 2000 Florida Marlins and 2001 Minnesota Twins), or, like the 2001 Seattle Mariners, were far better on the field than their nearest competition during the regular season. As the baseball labor market corrected in 2004, the Athletics remained near the frontier of salary efficiency, but their advantage was narrowed. Despite increasing their payroll to 86 percent of league average, they finished just behind the California Angels (now called the Los

about their business. Pappas calculated the incremental cost of winning a game during this period. Only two teams spent less than $1 million to win a game. The A's cost of about half a million dollars was the lowest, and about one-sixth the cost of the least efficient teams. Pappas (2002) discusses the calculation and provides cost estimates for all teams during the 2001 season.

Angeles Angels of Anaheim) in 2004, missing the playoffs for the first time since 1999.

In effect, the A's were able to purchase a successful team less expensively by focusing on players with a higher on-base percentage, chiefly players who excelled at receiving walks. Disciplined hitters avoid swinging at balls, forcing a pitcher to throw strikes to get an out. A team of disciplined hitters is rewarded in several ways. More walks occur, raising on-base percentage. A reputation for discipline causes pitchers on the other team to throw more pitches in the strike zone, which are easier to hit. Finally, patient hitters cause pitchers to throw a greater quantity of pitches, which raises the chance that a tiring pitcher will start to throw pitches that are easier to hit successfully.

The emphasis on taking walks is apparent in the Oakland A's aggregate batting statistics. They led the American League in walks in 1999 and 2001, were second or third in 2000, 2002 and 2004, and fifth in 2003 (as shown at ⟨http://www.baseball-reference.com/leagues/AL.shtml⟩). Coupled with the emphasis on walks in player development, this success suggests that an explicit strategy was being followed.[6]

Although the interpretation of the regression coefficients in Table 3 treats player skills as strictly fixed, observed skill is a combination of innate skill with team investment in player development. The A's strategy was carried out both in signing players and in coaching. In signing position players, Oakland looked for hitters who did not appear outstanding in batting average or slugging percentage, and thus who commanded only moderate salaries, but who made a substantial contribution to winning baseball games when on-base percentage and the ability to draw walks were taken into account. At the same time, the Oakland coaching staff preached the virtues of disciplined hitting and not swinging at bad pitches (or even at certain strikes that cross the plate in a way that would be hard to hit solidly). Third baseman Eric Chavez said: "The A's started showing me these numbers . . . how guys' on-base percentages are important. It was like they didn't want me to hit for average or for home runs, but walks would get me to the big leagues" (Lewis, 2003, p. 151). Miguel Tejada, who won the 2002 American League Most Valuable Player Award, was quoted as saying (presumably half-joking): "If I don't take twenty walks, Billy Beane send me to Mexico."

Personnel movements during these years illustrate that the Athletics were able to substitute new players to maintain team success when individual players became too expensive to keep. As one example, the A's had a player named Jason Giambi who won the Most Valuable Player award in the American League in 2000 for his hitting prowess. After the 2001 season, Giambi had enough major league experi-

[6] Although this article focuses on the valuation of batting talent, Oakland's quantitative strategy extended to pitchers as well. The current ace of the Oakland staff, Barry Zito, was passed over by both the Texas Rangers and San Diego Padres, who told him that he "didn't throw hard enough to make it in the big leagues" (Lewis, 2003, p. 221). Oakland's scouting department agreed, but Beane drafted Zito anyway, obtaining six years of excellent work at a bargain price from a pitcher who would win the Cy Young award as the best pitcher in the league.

Table 4
Records, Attendance and Ticket Prices of the Oakland Athletics, 1997–2004

			attendance		*Ticket Prices*	
Year	*Win–Loss record*	*League rank*	*Total attendance*	*Ratio to league avg.*	*$ per seat*	*Ratio to league avg.*
1997	65–97	14	1,264,218	0.566	10.53	0.805
1998	74–88	10	1,232,343	0.536	10.58	0.713
1999	87–75	5	1,434,610	0.627	10.10	0.623
2000	91–70	2	1,603,744	0.764	11.35	0.631
2001	102–60	2	2,133,277	0.909	14.07	0.754
2002	103–59	2	2,169,811	0.983	14.94	0.779
2003	96–66	2	2,216,596	1.011	15.65	0.780
2004	91–71	5	2,201,516	0.941	16.49	0.804

Source: Attendance data from ⟨http://businessofbaseball.com⟩; ticket price data from ⟨http://teammarketingreport.com⟩.
Notes: Four teams make the playoffs each season: the division winners and the team with the next best record. The Oakland A's won the Western Division in 2000, 2002 and 2003, automatically qualifying for the playoffs.

ence to qualify for free agency. After making $4.1 million in 2001, Giambi signed a seven-year contract with the New York Yankees for $120 million dollars. Oakland made no serious effort to match this offer. However, by signing inexpensive players to replace the lost superstar with incremental improvements across several positions, the Athletics repeated as division champions in 2002, actually improving their season record by one win. The replacement of offensive production from a now-expensive Jason Giambi with an array of undervalued talent—notably high on-base percentage hitters Scott Hatteberg and David Justice—neatly encapsulates Lewis's argument, and ours.

Winning the Oakland A's Way and Profit Maximization

Although a comprehensive analysis of revenues and costs for the Oakland franchise is beyond the scope of this paper, suggestive evidence is readily available that is consistent with the Athletics' strategy being both an on-field and financial success. Table 4 presents data on the Athletics' performance, attendance and ticket prices relative to the rest of the league from 1997 to 2004. In 1995, new ownership dismantled the team roster to cut costs, and performance declined. The low-budget strategy centering on on-base percentage was put in place at this time (Lewis, p. 58), and performance began to improve in 1999. The table makes it clear that the A's revenues were sensitive to performance: attendance increased sharply while average ticket prices rose as on-field success improved. Thus, while the Oakland organization focused on winning games cheaply, their improved performance increased demand. The evidence in Table 4 is fully consistent with our view that the Oakland strategy for winning games was a successful exploitation of a profit opportunity.

Concluding Remarks

Our analysis supports the hypothesis that baseball's labor market was inefficient at the turn of the twenty-first century. Arguably, this mispricing of skill had been present for a sustained period of time, perhaps decades. Dodgers General Manager Branch Rickey—perhaps best-known for breaking the color barrier in baseball with Jackie Robinson—argued in print for the importance of on-base percentage during the 1950s, but he failed to win converts (Rickey, 1954; Schwartz, 2004, p. 59). Bill James, a pioneer among sabermetricians, published a series of statistical analyses of scoring beginning in the late 1970s, and came to a similar conclusion (Lewis, 2003, pp. 76–77; James, 1982).

Consistent with the vociferous objections of baseball insiders to the possibility that quantitative analysis could help guide team management, the sabermetric insights of Rickey, James and others were apparently ignored. James in particular grew frustrated that his careful work was dismissed by the game that was his passion: "'When I started writing I thought if I proved X was a stupid thing to do that people would stop doing X,' he said. 'I was wrong'" (Lewis, 2003, p. 93).

Apparently only Oakland executive Sandy Alderson read, absorbed and incorporated Bill James's analysis into an explicit organizational strategy (Lewis, 2003, p. 63, p. 142). To execute the strategy, Oakland reached outside baseball circles and hired two young Ivy League graduates with quantitative backgrounds to evaluate personnel.

Oakland's on-field performance, combined with their radical low-budget approach, exposed a flaw in the way personnel decisions were made in baseball. Once exposed (with the help of Lewis's best-seller), competitive forces were set in motion as teams sought to replicate or improve upon the A's formula. Oakland's competitors sought success by attempting to hire the personnel management team assembled by Alderson. The two Ivy Leaguers mentioned above were hired as General Managers (that is, as executives with authority over personnel decisions) by the Toronto Blue Jays and the Los Angeles Dodgers during and after the 2003 season (Saraceno, 2004). Although the Boston Red Sox failed in their attempt to hire both the Athletics' General Manager (Billy Beane) and Assistant General Manager, they followed Beane's advice by hiring the similarly inclined Theo Epstein, making him the youngest General Manager in baseball history (Shaughnessy, 2003). In addition, the Red Sox hired the dean of sabermetrics, Bill James himself, in an advisory capacity. The Red Sox proceeded to win the World Series in 2004.

This diffusion of statistical knowledge across a handful of decision-making units in baseball was apparently sufficient to correct the mispricing of skill. The underpayment of the ability to get on base was substantially if not completely eroded within a year of *Moneyball's* publication.

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