

**Compensation of a Manager:  
The Case of Major League Baseball**

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**Abstract**

In this paper, we are interested in the informational value of Major League Baseball (MLB) managerial compensation on a team's performance. Using data on manager's contracts, team performance, and team and manager characteristics, first, we determine the variables that influence a manager's salary. Then, we use a forecasting-type analysis to study the determinants of a manager's performance, measured by winning percentage, attendance or playoff appearances. We find that a manager's past performance affects his current salary, but his current salary does not affect the team's performance. Our results support the lack of a competitive and efficient market for MLB managers.

## 1. Introduction

The wealth of reliable data and well-defined metrics make sports a fertile ground for testing economic hypotheses. Sports organizations are largely similar to each other and operate in a controlled environment on a regular basis. Each season is similar to the previous season. Consequently, the effects of various competition rules, manager decisions, compensation methods, and other policies can be elicited with confidence.

There is a vast literature exploring the compensation of managers, especially that of CEOs. As pointed out by the survey of Frydman and Jenter (2010), the high level of CEO pay in the U.S. spurred an intense debate about the nature of the compensation process and the outcomes it produces. They report that the median compensation of CEOs increased in real terms by 6.3% annually from 1992-2008. Interestingly, the median compensation of Major League Baseball (MLB) managers in our sample increased, in real terms, by 6.8% annually from 1991-2013. Even though the increase in MLB manager's pay has also been large, there is a lack of papers studying the determinants of MLB managerial compensation and the informational value of managerial compensation on a team's performance.

In this paper, we attempt to fill this gap. We are interested in the impact an MLB manager has on a team's outcome. Unlike the CEO compensation literature, where stock returns are taken to be a measure of performance, there is no clear-cut measure to gauge the impact of a MLB manager. Popular ways to measure a manager's effect on a team's performance include the estimation of expected wins, using James's (1986) "Pythagorean theorem," as in Horowitz (1994a, 1994b); estimation of a production function, as in Scully (1994); the estimation of the impact on player's performance, as in Bradbury (2006); the use of market salaries as in Kahn (1993); and the analysis of the impact of a managerial change, as in Bradbury (2006). In this paper, following Khan (1993), we rely on market salaries as a measure of productivity, since in a competitive market the manager's salary equals the team's value of his productivity. In other words, a manager's salary would be a sufficient statistic for this value.

Since salary information for MLB managers is scarce, we hand-collected from news reports and internet websites a sample of 217 MLB managerial contracts from 1991-2013 with salary information. We extended this sample to include an additional 169 managerial contracts, where salary information was not reported. We match the contracts with several managerial variables, team performance, and economic data, to form a dataset with over 40 potential explanatory variables. Using a general-to-specific model selection approach, we first estimate the determinants of a manager's salary. As expected, we find that measures of a manager's productivity, such as experience which proxies for human capital, and subjective measures of performance which proxy for ability, as well as the team's market size, are significant determinants of a manager's salary. Interestingly, James's (1986) Pythagorean expectation, "wins over expectation" or WOE, has no significant effect on a manager's salary. We also find that a manager's network has a negative, if any, effect on his salary.

Then, using a forecasting-type regression, we turn to study different measures of productivity. We find that the productivity of a manager, as measured by the team's winning percentage, playoff appearances, or attendance, is not affected by the salary of a manager. Rather, the determinants of a manager's productivity are largely the same as those of his salary,

notably, his experience and subjective measures of his performance. Again, WOE plays no role in forecasting a manager's productivity.

Essentially, managers are compensated for past success via two channels: they gain experience -- i.e., they are retained or hired by another team -- and they win awards. Importantly, as in Mirabile and Witte (2012), we find that a manager's past performance influences his current salary, but his current salary, which in efficient markets is a sufficient measure of his expected productivity, is insignificant in predicting any of the three team performance metrics. Such a disconnect renders relative salaries unreliable measures of relative productivities. The results are consistent with a market characterized by extreme barriers to entry and human capital that is relatively easily acquired; equilibrium then has an excess supply of managers who have relatively similar ability.

The paper is organized as follows: Section I is the introduction. Section II discusses the related literature review and models. Section III presents our simple model selection framework. Section IV contains the description of the data and then the results and analysis. Finally, Section V concludes.

## **II. Literature Review and Models**

There are four broad categories of inputs that determine the productivity of a manager: his effort, his ability, the other inputs, and the match quality. Given that it seems safe to regard effort as inelastically supplied,<sup>1</sup> the literature has measured the productivity of a manager by estimating his ability and match quality, given the level of the inputs (player talent) that he can control. There is no consensus measure of a manager's productivity. Popular ways to measure a manager's effect on a team's performance include the estimation of expected wins, using James's (1986) "Pythagorean theorem," as in Horowitz (1994a, 1994b); estimation of a production function, as in Porter and Scully (1982), Chapman and Southwick (1991), Scully (1994) and Goff (2012); the estimation of the impact on player's performance, as in Bradbury (2006); the use of market or implied market salaries as in Kahn (1993), Ohkusa and Ohtake (1994) and Orzag and Isreal (2009); and the analysis of the impact of a managerial change, as in Bradbury (2006) and Hill (2009). The literature largely finds little differences between most MLB managers, particularly those who have experience. This finding is common in other sports: see, for example, (Fort et al. 2008) and Berri et al. (2009) for NBA coaches; Brown et al. (2007), for football college coaches, Heuer et al. (2011) for German soccer, and Goff (2012) for several sports.

Yet, even though managers, on average, have little effect on a team's performance, managers

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<sup>1</sup> The absence of incentive-laden contracts and the public knowledge of the manager's decisions evince that moral hazard is largely absent; career concerns and the desire for historic notoriety support the idea that MLB managers' preferences are largely aligned with those of the general manager (GM) and owner. Moreover, the well-defined and relatively narrow role of the manager implies that multi-tasking issues are not of much consideration.

are frequently fired.<sup>2</sup> Bradbury (2006) shows that MLB teams may fire a manager in order to signal to their fan base that they are serious about winning, even if the team management knows that replacement manager is no better than the replaced manager. If managers, especially experienced managers, are largely equally productive, then even if this signaling effect is true, there should be no difference in manager's compensation. Yet, some managers are paid considerably more than others.

There is a vast literature exploring the determinants of CEO compensation. In general, the main drivers are company size, company performance, human capital attributes of the CEO, and industry effects--see the survey of Murphy (1999). However, likely due to the lack of comprehensive salary information, there is a dearth of research into the determinants of managerial salaries in sports. Grant et al. (2013) show that, in public schools, NCAA football coaches are mainly compensated for past success (lifetime winning percentage) and size of school.<sup>3</sup> Mirabile and Witte (2012) find a similar result, NCAA football coaches are compensated for past success; however, they also find that a coach's salary has no effect on a team's performance. This result is puzzling and may imply the existence of a market failure in the sports market.

### **III. Salary Determination and Model Selection**

Given the previous discussion, determining the true valuation of a manager to a particular team in a particular year is not an easy task. There are three general categories that affect how much a particular team values a particular manager: the manager's ability, the fit between the team and the manager, which determine the productivity of the manager with that team, and the value of the manager's additional productivity for that team.

Regarding the first, we think of managerial ability as heterogeneous; at the onset of his managerial career, the manager and all teams formulate a belief about his ability. Because whatever factors are used to evaluate a manager's ability are public, and because the manager himself does not have any experience or expertise, this belief is the same for the manager and each team. As he gains experience, the precision of the belief increases. We can think of the belief together with the precision as an assessment of his ability.

Regarding the second, the quality of the match can vary. Some managers are assessed to work well with young and inexperienced players and develop their talent, others are assessed to handle superstars who have egos, and others, as evidenced by the number who are promoted from within the organization, are familiar with the goals and ethos of the team.

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<sup>2</sup> During our sample period 1990-2013, we observed 80 firings during 672 manager-years, including 40 during a season and 10 before a season had begun. The median tenure for a manager is 2.63 years.

<sup>3</sup> In the linear compensation formulation, they also find that in-season rank (BCS rank) is significant at the 5% level.

Lastly, MLB, as with other U.S. sports, is a legalized cartel. Entry is rare and restricted, with new entrants often having to directly compensate the existing teams, and being unable to freely locate. Existing teams face similar restrictions on changing their location.<sup>4</sup> Consequently, teams cannot choose, a la Hotelling, their location and thereby move to an area where additional wins and playoff appearances would generate more additional revenue than in their current location. Another almost immutable team characteristic is its history, which may influence the actual size of the market.

Thus, it is not clear which variables should be included in an MLB manager's salary equation. We expect measures that are correlated with a manager's ability and with the precision of that belief, such as number of seasons as a manager; measures of fitness such as a connection to the team or GM; and measures related to the team's valuation of productivity, such as the market size of the team, to all significantly affect MLB manager's salaries. That is,

Salary = f(assessment of manager's ability, fitness, team's valuation of productivity, other variables) + error term

Because a manager is a sui generis job for which other positions, such as MLB coach or minor league manager, may not be a good predictors of ability as a manager, it is worthwhile distinguishing those managers with MLB managing experience from those with none (rookies). Additionally, the contracting situation is fundamentally different between renegotiating with, or extending the contract of the current manager, versus signing a new manager (new hires).<sup>5</sup>

As mentioned above, the richness of sports data makes the choice of independent variables complicated. There are many potential variables that can be used to assess a manager's ability: years of managerial experience, age, manager's lifetime winning percentage, manager's lifetime number of winning seasons, manager's lifetime playoff record, number of times a manager was voted among the top five for the Manager of the Year (MOY) award, etc. We have 15 variables that a GM can use to assess a manager's ability, which should explain much of a manager's salary. Given the breadth of the data, it is not surprising to see that different papers use different explanatory variables. For example, to measure past managing success, Khan (1993) and Mirabile and Witte (2012) both use the manager's past winning percentage at the time of his hiring; however, the former uses the manager's entire history, the latter uses only the previous five years. A similar difficulty arises when deciding which variables to include to measure

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<sup>4</sup> During our sample period 1990-2013, only one team of the 26 moved; there were no public threats to move. Twice, two teams entered MLB. Given the remarkable increase in mean team valuation, free entry would have induced several more entrants.

<sup>5</sup> Similarly, some firms hire CEOs from without, others promote from within; additionally, the accomplishments of rookie CEOs before their promotion are imperfect predictors of ability as a CEO. One important difference is the presence of moral hazard within firms, so that the potential to become a CEO motivates other senior managers, aligning their actions with those of ownership.

fitness and a team's valuation of productivity. Overall, our data set contains more than 50 potential independent regressors (see Appendix for a list of all the variables available).

To select the best model, we follow a general-to-specific method, see Campos et al., (2005). After some F-testing reductions, using a 10% significance level to drop variables, we have a final model. Given that many variables are highly correlated, we check two multicollinearity indicators: VIF and Condition Index. We follow the usual rules of thumb to determine if multicollinearity is a problem; that is,  $VIF > 5$  and/or Condition index  $> 10$  --see Belsley (1991). If these rules of thumb are violated, we remove the variables that we suspect cause collinearity.

A word about the dating of the data used in the estimation of the salary equation: Taking the time index  $t$  to demarcate the end of the season, a manager's and players' salaries are determined as of the start of the next season; that is, they are variables dated  $t-1$ . A team's GM estimates the expected productivity of a manager (and players) based on information available at  $t-1$  --i.e., at the end of the previous season. Additionally, some managers sign multi-year contracts so that the salary in season  $t$  was set after season  $t-2$  or  $t-3$ . We follow this convention to estimate a salary; that is, we only consider as potential explanatory variables for salary for season  $t$ , variables that are dated up to the contracting date. This approach is also used by Mirabile and Witte (2012).

#### **IV. Data**

We consider all MLB managers from 1991 onward who were hired by a team. Unlike for players, and for CEOs of public corporations, there is neither a single reliable source for MLB manager salaries nor are they consistently reported. Some teams routinely disclose manager's salaries, while others seldom do it. Additionally, a manager's agent may leak the information to the press, likely as a marketing tool, and sometimes, after a manager is fired, the value of the remaining years in the contract is reported by the press. It is rare to see the publication of the complete distribution of MLB managerial salaries for one specific year. One of the few published salary distributions by *Sports Illustrated* for the year 1987 is used by Khan (1993). He relies on the 1987 *Sports Illustrated* dataset, also mentioned in Chapman and Southwick (1991), to estimate market salaries from 1969-1987. For this paper, we hand-collected salaries and contract duration from newspapers and internet websites. Our starting point was the Baseball Prospectus Cot's Baseball Salaries website.<sup>6</sup> Then, we checked managing hiring and firing announcements from local and national newspapers, which usually cited AP reports, along with several other websites.

We were able to collect 217 manager-contracts with salary information. Bonuses and incentives are, in general, not available. That is, we are forced to focus on a manager's base salary compensation. As previously discussed, this is not likely problematic due to the absence of moral hazard. Given that contracts are, in general, reported as an aggregate number for the total duration of the contract, we focus on the contract's annual average salary.

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<sup>6</sup> See <http://www.baseballprospectus.com/compensation/cots/>

We augment our data with an additional 169 manager-contracts, without salary information, for a total of 386 contracts. Of the 386 contracts, 172 are for newly hired managers and 214 are extensions or renegotiations. Of the 172 contracts for newly hired managers, three have no disclosed duration and 86 were rookies. Ten newly hired managers appear in our dataset more than once, forming what the baseball sports writers call "the musical chairs" group. Also, of the 217 manager-contracts with salary information, 99 are for newly hired managers. There is at least one observation for each of the 30 teams. Only two managers were hired from another team while they were still under contract with an existing team.

Managers' and teams' stats, payrolls and attendances are taken from Baseball Reference ([www.baseball-reference.com](http://www.baseball-reference.com)) and The Baseball Cube ([www.thebaseballcube.com](http://www.thebaseballcube.com)). Annual team valuation, revenue, and operating income information are taken from *Forbes* annual baseball valuation study, usually reported in April. Table 1 presents the distribution of annual mean manager salaries, along with the annual means of team valuation, team revenue, and player salary. Table 1 shows a large increase in manager's salaries, with the mean growing at an average annual rate of 9.7% from 1991-2013. This annual increase in managerial salaries is slightly higher than the average annual increase in team's mean valuations (8.6%), revenues (6.9%) and payroll (7.8%) over our sample.

#### **IV.1 Descriptive Statistics**

Table 2 provides characteristics of the data. The second column describes the characteristics of all the manager-contracts in the sample, while the third column describes the characteristics of the new hires. Around 70% of the newly hired managers have previous managerial experience in the minor leagues. Fourteen newly hired managers were initially hired as interim managers. The average initial contract duration for all managers is 2.00 seasons, while for new managers is 2.41 seasons; however, on average, a manager only serves a little bit more than 80% of the duration of the contract. Overall, 25% of all managers and 30% of all newly hired managers are fired. The catcher position is over-represented, more that 30% of the managers were catchers as a players.<sup>7</sup>

Table 3 provides the descriptive statistics for both the 217 contracts with salary information, and the contract duration for all 383 contracts. Table 3 also contains some descriptive statistics of the managers' experience and the teams.

Consistent with the theory, on average, non-rookie newly hired managers make significantly more (142%) than newly hired rookie managers. A non-rookie newly hired manager is paid a competitive salary, similar to the average contract of all contracts in the sample. Also,

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<sup>7</sup> This contrasts with approximately 10% of a team's active roster as being a catcher. Moreover, catchers, like pitchers and First Basemen, rarely play multiple positions, though some move to First Base later in their careers. Other position players do play in multiple positions, and some do play First Base, but only injuries and ejections prompt a manager to play a non-catcher as a catcher.

experienced –i.e., non-rookie– new hires have a significantly longer duration for their initial contract, longer than the duration of the average contract, which may be the result that many well-established older managers, such as Jim Leyland or Bobby Cox, at the end of their managing careers work with very short contracts.

Experienced new managers are significantly older than rookie managers (55 years old vs 46 years old) and tend to have managed more time in the Minor League system (4.85 seasons vs. 4.35 seasons). Teams with higher payroll and higher attendance tend to hire non-rookie managers.

Looking at the team data, we find that new managers are hired by teams with losing records, as expected. Teams with higher value, payroll and attendance --likely teams in larger markets-- tend to hire new managers with experience. Payroll and attendance have grown over the past 30 years. But, not surprising, new managers are brought to teams that had a negative change in attendance and a lower than average increase in payroll during the season prior to the new appointment.

Table 4 presents some statistics that describe the change in the team's performance and outcomes during the first full season a new manager is hired. We look at the changes in: team performance variables -- winning percentage, total runs scored, and total runs against; player characteristics --average batting and pitching ages; and team characteristics --franchise value and attendance. We also look at a team's wins-over-expectation (WOE), defined by James (1986); this is a commonly used indicator of managerial performance --see, Horowitz (1994a). Under the WOE measure, expected win-loss percentage is measured using the Pythagorean expectation -- i.e., expected win-loss percentage in a season are equal to the square of total runs scored in that season, divided by the sum of the squares of the total runs scored and total runs allowed.<sup>8</sup>

The simple correlations indicate that a new manager increases the winning percentage, increases runs scored and decreases runs against. However, none of these changes is statistically significant. The lack of a significant immediate impact of a new manager is consistent with the findings in Bradbury (2006). We also compare the effects of new managers, distinguishing between rookies and experienced managers. Each of the effects of rookies versus experienced managers in their first full season is statistically insignificantly different from each other, and from zero, with one exception, WOE. Whereas an experienced manager's change in WOE is positive but insignificant (0.38 wins over expectation), a rookie manager's change in WOE is negative and significant (-1.1 wins over expectation); nevertheless, this difference becomes statistically insignificant during the second full season, indicating a quick learning curve.

We also tend to see a lower than average change in franchise value and attendance for

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<sup>8</sup> Under the assumption that runs scored follow an independent Weibull distribution, Miller (2007) derives the Pythagorean Expectation formula for wins. Davenport and Woolner (1999) argue for a Pythagorean exponent of 1.86.

franchises that hire new managers. These are not too surprising since a vast majority of hires of new managers follow seasons of poor absolute performance and poor attendance. But, again, the changes are not statistically significant.

Given the potential for multicollinearity in some of the variables, we also rely in factor analysis to try to reduce the number of variables use. We divide some of the variables into two groups: 11 variables are designated as part of a managerial group and 12 variables are designated as part of a team's characteristic group.

For the management group, we were able to find a clear, three-factor structure. Unfortunately, for the team's characteristic group, we were not able to find a clear factor structure. The three managerial factors are defined in Table 5. The first factor, MF1, is heavily influenced by variables that can be interpreted as indicators of a manager's ability and the precision of that belief (MOY, MOY\_top5, number of MLB seasons as a manager and career playoff appearance and pennants won); the second factor, MF2, loads mainly on past season's performance, as measured by winning percentage and divisional finish; and the third factor, MF3, mainly loads on a manager's age and the number of seasons managed in the minor leagues. Since we are particularly interested in analyzing the role of WOE, we recreate the first factor MF1 by imposing the factor loading for WOE to be equal to zero. We call this reformulated factor MF1\_WOE.

## **IV.2 Estimation of Salary Equation**

In this section, we estimate salary equations for baseball managers. For each, we estimate a salary equation following the general-to-specific method discussed in Section III. As usual in the labor literature, we use as the dependent variable log annual salary. We estimate salary equations for all managers, for all experienced managers, and for all new hires.

Theoretically, we expect that variables that measure a manager's ability also affect a manager's salary. Note that some of these measures are subjective, for example winning a Manager of the Year Award, used by Hill (2009) and some measures are objective, for example, a manager's WOE, used by Horwitz (1994a).

We also expect that variables that make this belief more precise will affect a manager's salary. For example, consider two managers who have the same WOE or winning percentage but differ in their experience. The belief about the manager's ability is increasing in this experience. Moreover, survivorship bias implies that managers about whom the assessment is low, are not re-signed or re-hired. Lastly, remuneration for more experience is consistent with the acquisition of human capital, particularly general human capital.

In the second column of Table 6, we report the results for log salaries. The general-to-specific approach produces eight explanatory variables, with an  $R^2$  equal to .82. The results largely confirm intuition regarding the role of measures of quality and experience. The number of years as an MLB manager (MLB\_seas) and winning and being voted in the top 5 of the MOY award are significant at the 5% level.

The results also echo a similar result in the CEO compensation literature. Much as CEOs who receive awards subsequently realize greater compensation (see Malmendier and Tate, 2009), both winning (Award) and finishing in the top five of MOY balloting (Aw\_top5), at least once, result in the manager receiving a larger salary. Interestingly, the number of seasons for which a manager finished in the top five of the MOY balloting (MOY\_top5) is also significant, which may indicate the presence of some non-linear effects of the MOY vote on salary.

There is one other variable related to the assessment of a manager that is significant, the number of seasons he managed in the minor leagues. Perhaps more interesting is its significance and negative sign. This could reflect the presence of private information or the acquisition of firm-specific human capital, both of which would seem to reduce his bargaining power, or the manager's career concerns. Although much information is public to the manager and all teams, some information, especially for those who were minor league managers is private to the manager and the particular team. Alternatively, having managed in the minor league system of a team is consistent with the acquisition of firm-specific human capital, which makes the manager less valuable to other teams. Additionally, a minor league manager may be willing to accept a lower salary than otherwise in order to enhance his prospects of becoming an MLB manager, particularly if there is an implicit contract of progressing to the major league level where their ability becomes learned.

Aside from the manager's age, which is only selected in the log salary regression where it is only significant at the 5% level, there are two variables related to the team's valuation of productivity, a time trend and the log of payroll. The other variables related to a manager's ability is the square of his age. However, this is only selected in the log salary regression and is only significant at the 10% level.

The time trend is highly significant, which is expected given the trend shown in Graph 1 and Table 1. Casual observation of the growth of baseball franchise values indicates that managers have reaped some of the gains in popularity and consumer expenditures. A time trend though applies uniformly.

So-called large-market teams have larger payrolls and, as discussed above, place a higher value on the productivity of a manager. Moreover, during our sample period, their payrolls have increased much more rapidly than those of the remaining teams. Payroll (in logs) also enters the log salary regression with a positive sign.

As Table 1 and Graph 1 clearly show, managerial salaries have increased over time. Given this feature of the salary data and the fact that nominal variables seem correlated with a team's size, in order to check the robustness our estimation, we also estimate the manager's salary standardized by the team's payroll. The results of this estimation are in the third column of Table 6. The reduction in the  $R^2$  to .5152, is likely due to the lack of a time trend to explain the log of the ratio of a manager's salary to a team's payroll. Nevertheless, overall, the signs and magnitudes of the coefficients of the managerial variables are similar to those reported for log

salaries. This is not a surprising result, given that managerial variables are not expected to be correlated with a team's payroll. The time trend is also not significant, which is to be expected given the standardization used. Instead of team's payroll, change in payroll (Dpay) appears in the regression, though it is not significant.

There is one additional explanatory variable in the log salary payroll-standardized regression, the team's winning percentage in the previous season, which is significant and negative. That is, a higher winning percentage in the previous season is correlated with a lower manager salary relative to team's payroll. Thus, assuming that as a team's winning percentage increases, so does a team's revenue, it seems that a team's payroll increases more (less) than a manager's salary when a team is winning (losing). This indicates that payroll is more sensitive to past team performance than is a manager's salary.

Since we are particularly interested in the effect of the managing specific variables on salary, we run many specification tests of the selected models. We perform several LM tests to check for the inclusion of a manager's previous winning percentage, number of winning seasons, other manager factors as determined by factor analysis, and a manager's lifetime WOE. None of these tests is significant at the usual significance levels. In particular, Horowitz's (1994a) WOE plays no role in the determination of a manager's salary--an LM test for the inclusion of a manager's WOE has a value of 0.9328, which is not significant at the usual significance levels. That is, the evidence suggests that the general managers, who hire the managers, assess the abilities and productivities of managers using the more subjective metrics such as winning awards, not, directly or implicitly, objective metrics.

Much of the previous analysis suggests that the determinants of a manager's salary may differ depending upon whether the team is re-signing or extending the contract of its current manager, or hiring a new manager who has experience. These differences reflect the differences in bargaining power.

#### **IV.2.1 Experienced and New Hired Managers**

Given that the determinants of extending or renegotiating a contract may be different from the determinants of hiring a new manager, which may differ from hiring a rookie manager, we estimate two separate salary equations: one for all experienced managers and one for all experienced. Table 7 presents the results for log salary of experienced MLB managers.

For the salary equation for all experienced managers, the results are shown in the second column of Table 7. The general-to-specific process selects 10 explanatory variables with an R2 equal to .8059. The managerial variables selected are the same as in Table 6: minor league seasons (Min\_sea), finishing in the top five of the MOY vote (MOY\_top5), MLB seasons as a manager, and the dummy variables for winning at least one MOY (Award) and for finishing at least once in the top five of the MOY vote (Aw\_Top5).

Rather than team payroll, change in payroll (Dpay) is selected in the regression/survives the model selection method. A team characteristic variable is also selected: age of the batting lineup

at (or season)  $t-1$  (Bage\_1). The matching hypothesis may explain the effect of a team's age on a manager's salary. Consider a team that is successful. The GM is likely to retain many of the same personnel, including the manager, who now has a stronger assessment and, perhaps, a better fitness with that team. The player personnel, largely unchanged, is also older.

A network variable (Interim) is selected in the model, showing up with a negative effect on salaries. A large percentage of the firings or separations (50% or 40 out of 80 in our sample period) occurred during the season; the individual who assumed the role of manager for the remainder of the season was sometimes subsequently re-hired. Half of these managers (Interim) had previous MLB managerial experience. The coefficient on this Interim variable is negative, probably reflecting a lack of alternatives or "limited choices," as described in Loury (2006).

Our final salary regression is for experienced managers who are new hires; the sample size (95) is smaller. The results of the general-to-specific approach are presented in the last column of Table 7. The model selection strategy selects similar managerial assessment variables, except that MOY\_top5 is removed because it causes multicollinearity. The age of the batting lineup, change in payroll and the dummy variable Aw\_top5 are not selected by the general-to-specific model selection strategy. A network variable, having a previous relation to the team's GM (Connection), is also selected, again with a negative sign, but it is not statistically significant at the 5% level. Overall, the signs are the same for all experienced managers, but some coefficients are larger (MLB\_seas and Award), likely picking up the effect of the variables excluded (MOY\_top5 and Aw\_top5, respectively).

Again, we check the model specification with a set of LM tests. We test for the inclusion of a manager's WOE (LM-M\_WOE); a manager's previous winning percentage (LM-M\_WL); three managerial factors as determined by common factor analysis (LM-M-Factors); and three variables that describe a team's previous record: runs scored, runs against, and team's winning percentage at  $t-1$  (LM-Team Rec). None of these tests is significant at the usual significance levels.

Overall, we find that MLB manager salaries are positively affected by very simple managerial measures that reflect past perceived good performance in the form of awards (MOY votes). Experience as a manager also plays a role; the number of seasons as an MLB coach (manager?) has a positive effect on managerial salary, whereas the number of seasons as a minor league manager has a negative effect on managerial salary. Market size, in the form of payroll, also has a positive effect on a manager's salary, a similar result to the CEO compensation literature, where company size is a main determinant of CEO compensation--see Rosen (1982) and Kostiuk (1990).

If the path to becoming an MLB manager resulted in a lower salaries by being a minor league manager than not, we would not expect individuals to choose this path. However, the barriers to entry of new teams restricts the quantity of MLB coaching positions so that many would-be MLB managers believe that becoming a minor league manager is the best path available to becoming a a major league manager. Additionally, it is likely that being a minor league manager

results in greater probability of becoming an MLB manager than does being a major league coach. This lack of entry highlights a key difference with the market for CEOs, and one that may be a source of the market inefficiency.

### **IV.3 Managing and Winning Percentage**

We have shown that measures of managerial ability are significant factors that explain a manager's salary --i.e., past successful performance may imply greater ability, which increases a manager's salary. We now, in a sense, reverse the forecasting exercise. If better managers are remunerated more, then their ability ought to manifest itself through superior performance.

As pointed out by Khan (1993), in a competitive market, salaries represent the marginal productivity of a manager. Moreover, a manager's salary should be a sufficient statistic of a manager's productivity --i.e., all other indicators of managerial ability and precision, as well as fitness, should be subsumed into the market salary. Thus, we expect both a positive correlation between a manager's salary and a team's winning percentage, and all other managerial variables, including years of experience and manager's WOE, to be uncorrelated with a team's winning percentage.

Winning percentage is, of course, not only determined by managerial skills, but also by other factors, including players' performance and luck. In general, players' performance during the season can be influenced by managerial decisions. Thus, including in a regression measures of managerial ability and players' performance will create simultaneity problems.<sup>9</sup>

To avoid this problem, we take a slightly different approach from the one taken in Khan (1993). Since salaries for managers and players are determined before the start of the season, but winning percentage is determined at the end of the season, estimating a regression relating a manager's salary to the ex-post winning percentage of a team is similar to estimating a forecasting equation. That is, we try to determine if a manager's salary, determined before the start of season  $t$ , can be used to explain the winning percentage at the end of the season  $t$ . However, there are many potential variables that can be used to forecast winning percentage at  $t$ .

Again, we start by using a general-to-specific model selection approach to determine the explanatory variables. In addition to the managerial and team variables employed to determine a manager's salary, we include the manager's log salary. All variables used to predict a team's winning percentage in  $t$  are those  $t-1$  variables. We also included a dummy for whether the manager was a new hire or not, and a dummy for whether the manager had signed an extension prior to  $t$ . In order to be parsimonious and to reduce potential collinearity, we include as potential explanatory variables the three managerial common factors as determined by factor analysis. Then, we perform a series of LM tests to check the specification of the model.

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<sup>9</sup> Many previous studies that assessed the managerial ability using the "Pythagorean theorem" suffer from this same criticism--they use the current season's runs scored and runs against variables as exogenous regressors to formulate an expected winning percentage and then compare the actual winning percentage.

We estimate three forecasting equations: one for the winning percentage during the first season of a manager's contract ( $T\_WL\_0$ ), another one for the second season of a manager's contract ( $T\_WL+1$ ); and the last one for the average of the first two seasons of a manager's contract ( $T\_WL\_av$ ). We only consider the winning percentage at  $t$  and at  $t+1$ , since the mean duration of a manager's contract is two years.

Table 8 shows the results for winning percentage during the first season, the second season, and the average of the first two seasons of a manager's contract. The main drivers at  $t-1$  are the modified first managerial factor ( $MF1\_WOE$ ), change in payroll, and previous season winning percentage. All of these variables enter with a positive impact on winning percentage.

$MF1\_WOE$  measures managerial ability and precision; importantly, it includes variables that previous studies have not considered, namely, having made the playoffs and playoff performance. We do not dispute that win-maximization is a major objective of teams, and of managers; rather, having made the playoffs and having achieved success therein, are additional factors for which managers are compensated. It could be that these factors lead to an updated assessment of the manager that is stronger, or give the manager more bargaining power, especially considering a loss of fan support for a team that fires or fails to re-sign a manager whose team made the playoffs and was successful.

For the first season's winning percentage, a manager who was a catcher performed significantly better (two more wins out of 162) though this dummy is only significant at the 10% level. However for the second season, this variable disappears as an explanatory variable, indicating that whatever human capital that a player who had been a major league catcher as a player had, was acquired with one year of MLB managing experience. To the extent that this is true, that having been a major league catcher affords an understanding of the game superior to having been a pitcher or another position player, it is also consistent with the over-representation of former major league catchers as MLB managers.

For the second season's winning percentage, a different variable, the age of the batting lineup ( $Bage\_1$ ), survives the model selection process --a team with an older position-player roster is expected to have a lower winning percentage. However, the effect is only significant at the 10% level and economically small (one less win out of 162) for a team that is one year older. It could be that a team that has had success, retains more of its roster, ages, and either regresses to the mean or incurs more injuries, which are often age-related.

Five LM specification tests are reported in the bottom of Table 8. We test for the inclusion of a manager's  $WOE$ ; a manager's previous lifetime and previous season winning percentage; log salary; log salary scaled by payroll; and other managerial factors. None of the LM tests is significant. In particular, the LM-log Pay and LM\_log Pay\_P, confirm the findings in Orszag and Israel (2009), Zimbalist (2010), and Mirabile and Witte (2012), where they were unable to find evidence that salaries had a positive and significant impact on winning percentage. A similar result appears in the recent CEO compensation literature. Cooper et al. (2013) find that CEO pay

is negatively related to future stock returns for periods of up to 3 years, with the higher paid CEO having a more negative impact on future stock returns..

#### **IV.4 Managing and Playoffs**

It can be argued that good teams are willing to pay, not just for regular season performance, but for making the playoffs. Making the playoffs brings significant extra revenue to a team.<sup>10</sup> Thus, a winning percentage per se may not be the relevant metric of marginal productivity for managers who are hired by teams expected to go to the playoffs.

In order to test this potential non-linearity in the relation between a team's performance and a manager's productivity, as measured by salary, we estimate a probit model (where 1=team makes the playoffs) using maximum likelihood. As before, we estimate the probability of making the playoffs in t with information available at t-1 and use the same general-to-specific approach to select from 40 potential explanatory variables. Since we also want to reduce the potential for multicollinearity, we try to be as parsimonious as possible. We use a 7.5% significance level in the model selection strategy, instead of the previous 10% level.

Table 9 shows the results of the probit estimation. There are only three explanatory variables that survive the general-to-specific selection method: years of experience as an MLB manager, appearing in the playoffs the previous season (Playoff\_1), and the previous season's winning percentage.

We run several specification tests; in particular we check if a salary variable (log salary or log salary scaled by team's payroll) should be included in the final model. A Wald test strongly rejects the inclusion of salary information in the probit model. We also reject the inclusion in the final model of several other variables: the ability variables--manager's WOE, manager's lifetime winning percentage, MOY, MOY\_top5, and rookie dummy--the age of the batting lineup, and the connection dummy. That is, neither the manager's salary nor the various managerial variables, especially those related to ability and match quality, that affect his salary, have any effect on the probability that the manager's team makes the playoffs.

#### **IV.5 Managing and Attendance**

Bradbury (2006) argues that firing a manager following poor results may be seen as a positive signal by the fans. He finds that attendance increases immediately after the firing of a manager. It is possible that firing a manager has no effect on winning percentage. Nevertheless, it may increase a team's revenue by increasing attendance, which is a major component of local revenues, which themselves comprise nearly 80% of a team's revenue --see, Levin et al. (2000). The cost of firing a manager is relatively minor: the compensation to the newly hired manager that covers the fired manager's remaining contract term, and the opportunity cost of the GM's time.

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<sup>10</sup> See article in Fangraphs.com, "Estimating Postseason Revenue For Players And Teams," by Wendy Thurm, November 2, 2012. <http://www.fangraphs.com/blogs/estimating-postseason-revenue-for-players-and-teams/>

Previous studies of sports attendance find that many factors play a role in team's attendance: a city's weather, month, day of the week, a team's location, lagged team's performance, promotions, strikes, etc. Briefly, positive and significant effects have been found for: a team's current and previous season's performance, see Scully (1974), McDonald and Rascher (2000), and Zygmunt and Leadley (2005), among many others; the market size (income and population), see Winfree et al. (2004); National League, see McDonald and Rascher (2000); and higher opening day payroll, see Barilla et al. (2008). Additionally, annual attendance is found to be highly autocorrelated, see Barilla et al. (2008).

In this section, we attempt to measure the effect of an MLB manager on annual (log) attendance. We follow the general-to-specific model selection strategy used in the previous sections, we select the determinants, known at the start of the season ( $t-1$  variables), of time  $t$  attendance.

Table 10, in the second column, shows the results for log attendance. Given the strong autocorrelation of attendance, we also present in the third column, the results for changes in attendance. Consistent with the papers cited above, we find that a National League dummy, runs scored, a team's change in payroll, making the playoffs, and previous attendance can be used to forecast attendance. In addition, all of these variables have a positive effect on the forecast of next season's attendance.<sup>11</sup> We also find that a managerial variable, namely, experience has a positive effect on the forecast of next season's attendance.

We perform several specification tests for the inclusion of several variables in the forecasting of attendance. We test for the inclusion of a manager's lifetime WOE, lifetime winning percentage, current salary, rookie status, and the MOY votes, as well as our three managerial factors, and a manager's network (connection, interim status, promotion from within); we also test for the team's age, payroll, previous runs against, and previous and current winning percentage. All these tests cannot reject the hypothesis that these variables does not belong in the forecasting equation of a team's attendance. In particular, we find that a manager's salary seems to plays no role in attendance. Finally, in the spirit of Bradbury (2006), we test if a new manager (New Hire variable) plays a role in annual attendance. The last LM (LM\_New\_Hire) tests this hypothesis. Again, we find no support for the inclusion of a dummy for a change in managing in the forecast of next season's attendance.

#### **IV.6 Managing and Experience: Discussion**

The experience of a manager, measured in seasons managed at the MLB level, has a positive and significant effect on a manager's salary as well as on forecasting winning percentage, playoff appearances and attendance. It is puzzling that experience, though priced in the determination of a manager's salary, plays a more important role than other variables that

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<sup>11</sup> Attendance is strongly correlated, with an AR(1) coefficient of .755, but it is not an I(1), as the negative coefficient and t-stats (DF test) in the regression in changes shows.

measure the manager's productivity. In this sense, it seems that teams think of experience as a sufficient statistic for a manager's productivity. However, we generally think of experience as possibly signaling inherent ability and, possibly, the acquisition of human capital; that the more direct measures of ability and productivity seem not to forecast performance is puzzling.

In order to understand the role of experience, we study the joint distribution of experience with several team and managerial variables. Table 11 shows this joint distribution, dividing experience into four categories: "Rookie," "Less than 5 years," "Between 5 to 9 years," and "More than 9 years." A bold number indicates statistically significant difference from the corresponding value in the preceding column. We find that those managers who survive and accumulate more seasons, have a higher lifetime winning percentage, a higher WOE (lifetime and per season), and higher likelihoods of having both won awards and made the playoffs. Thus, experience, especially in the last group, is correlated with all the variables teams are likely to associate with a manager's productivity.

It is perhaps surprising the lack of support for a manager's lifetime WOE as a measure of a manager's salary and especially productivity; after all, lifetime winning percentage and lifetime WOE are highly correlated in the unconditional distribution. In an unconditional analysis, Horowitz (1994a, 1994b) strongly argues for the use of WOE as a measure of a manager's performance, with the caveat that his analysis uses managers that have managed for at least 10 seasons. Our analysis is slightly different in the sense that we do have a conditional model and our sample is not restricted to the most-experienced managers. Our results show that the inclusion of other variables that measure productivity and experience renders WOE entirely uninformative for forecasting productivity.

Not surprisingly, managers who gain experience realize greater salary; e.g., the average salary for a manager with more than nine years of experience is \$1.5 million (242%) more than that for a manager with less than five years of experience. That is, unconditionally, experience is positively correlated with lifetime winning percentage, which itself is positively correlated with salary; yet, surprisingly, in the conditional regression framework this correlation disappears.

Some managers moved into that role from being a minor league manager, a path that resulted in a lower salary than managers who entered from elsewhere. Yet, interestingly, the most experienced managers who did manage in the minor leagues, had a significantly higher winning percentage. This may reflect the fact that managers who do very well in the minors are identified and promoted quickly to the majors. As a result of this quick promotion, they accumulate more MLB managerial experience than those MLB managers with longer stays in the minors. It is also possible that a very successful short stint in the minors signals superior ability, which is reflected in better performance realizations, renewed employment, and higher salaries.

Lastly, we note that many experienced managers do move to other teams, often voluntarily. More-experienced managers work for teams with greater value, higher attendance, and higher quality, as proxied by payroll and past winning percentage. The positive correlation between

experience and these team variables may be evidence of efficient matching, where the most productive managers are paired with the teams that have the highest value of productivity.<sup>12</sup>

## V. Conclusions

In this paper, we first estimate salary equations for MLB managers. Overall, we find that MLB managing salaries are positively affected by very simple managerial measures that reflect past perceived good performance (notably, voting for the Manager of the Year). The number of MLB seasons managed has a positive effect on salaries, but the number of minor league seasons as a manager has a negative effect on salaries. Size, through team's payroll, also is a driver of MLB manager salaries. For the whole sample, a manager's network has a negative, but insignificant impact on a manager's salary.

We then test if a manager's salary is a predictor of a team's performance. We found/find that a manager's current salary has no impact on that season's winning percentage, attendance, or playoff appearance; moreover, a manager's previous performance, measured as past winning percentage and lifetime WOE, has no effect on a team's performance. The lack of a relation between a manager's salary and a team's performance is an indicator of market inefficiency.

Our results suggest that the market for MLB managers is neither competitive nor efficient. In perfectly competitive labor markets with complete information, a worker is paid her marginal revenue product; relative wages reflect relative productivities. As with the market for CEOs, there is a disconnection between a manager's salary and his expected productivity. This situation may reflect the characteristics of the market for MLB managers where monopsony power and the value of signaling to fans a commitment to winning can distort salaries.

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<sup>12</sup> We make this statement with extreme caution. Several large-market, high payroll, and successful teams have recently replaced extremely experienced managers with rookies or inexperienced managers--notably, New York Yankees (2008), Los Angeles Dodgers (2011), St. Louis Cardinals (2013), Detroit Tigers (2014).

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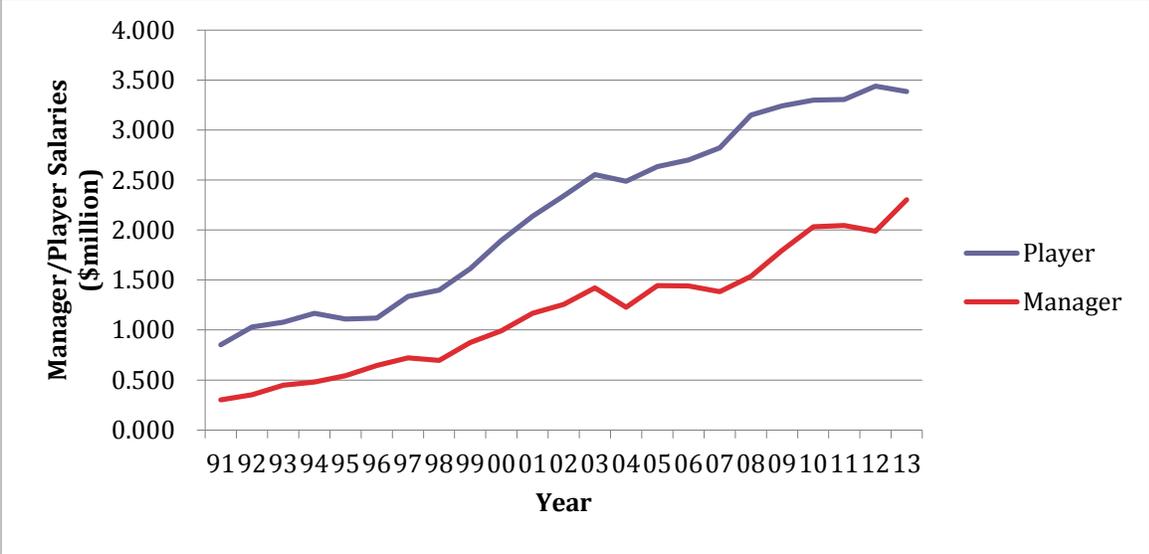
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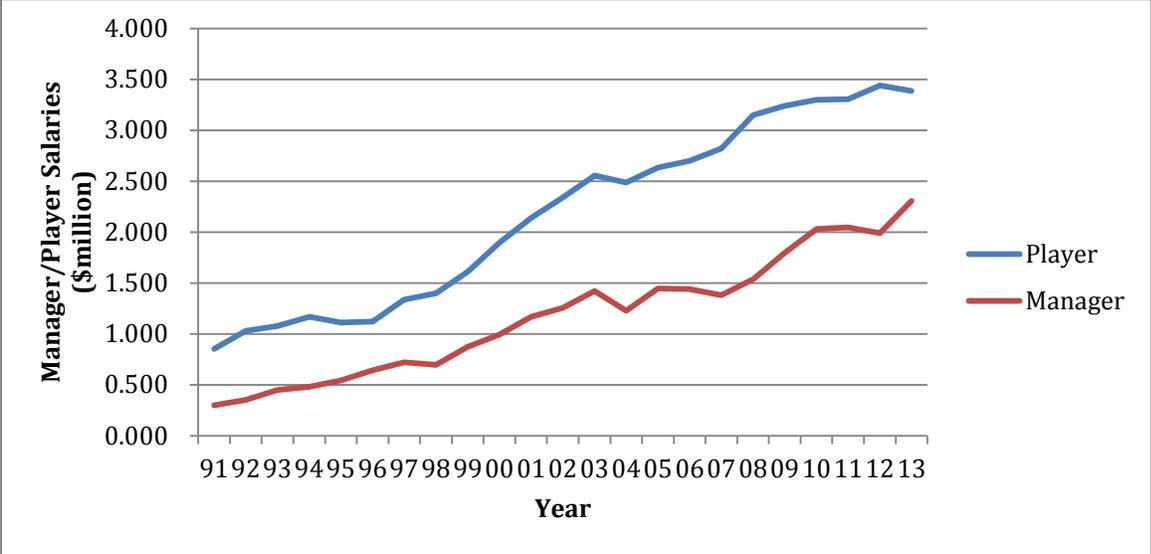
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**Graph 1 – MLB Managers: Annual Salary and Average Player Salary (1991-2013)**



**Graph 1. MLB Managers: Annual Salary and Average Player Salary (1991-2013)**



**Table 1. MLB Manager's Salary and Economic Data (1991-2013)**

Year	Manager's Salaries - Distribution						Team's Economic Data (USD millions)		
	Mean	St Dev	MIN	MED	MAX	N	Value	Revenue	Average Player Salary
1991	0.30	0.13	0.16	0.28	0.58	8	121.15	51.773	0.5975
1992	0.35	0.19	0.16	0.27	0.81	12	116.19	56.119	0.8514
1993	0.45	0.23	0.23	0.34	0.83	12	108.85	60.908	1.0287
1994	0.48	0.24	0.25	0.35	0.83	7	107.00	63.375	1.0761
1995	0.54	0.37	0.18	0.35	1.50	14	110.50	60.250	1.1682
1996	0.64	0.46	0.20	0.51	1.50	12	115.39	50.375	1.1108
1997	0.72	0.47	0.27	0.60	1.50	12	134.46	65.971	1.1200
1998	0.72	0.47	0.27	0.60	1.50	13	194.00	79.136	1.3366
1998	0.69	0.31	0.30	0.63	1.40	14	220.23	88.777	1.3988
1999	0.88	0.51	0.33	0.67	2.00	17	233.40	94.263	1.6113
2000	0.99	0.57	0.33	0.75	2.00	21	262.87	105.920	1.8956
2001	1.17	0.73	0.33	1.00	2.65	25	286.30	119.433	2.1389
2002	1.26	1.12	0.33	1.00	5.33	23	294.53	123.717	2.3409
2003	1.42	1.20	0.40	1.00	5.33	27	295.33	129.267	2.5554
2004	1.23	1.25	0.35	0.63	5.33	19	332.00	142.300	2.4867
2005	1.44	1.34	0.50	0.90	6.40	23	376.47	157.767	2.6327
2006	1.44	1.27	0.50	0.92	6.40	29	431.47	170.367	2.6992
2007	1.38	1.15	0.45	1.00	6.40	35	471.63	182.967	2.8200
2008	1.53	1.12	0.45	1.08	4.33	30	481.90	193.967	3.1500
2009	1.80	1.21	0.50	1.50	4.33	25	491.33	196.600	3.2402
2010	2.03	1.40	0.60	1.50	5.00	23	522.70	204.567	3.2979
2011	2.05	1.39	0.60	1.50	5.00	19	605.10	211.967	3.3053
2012	1.99	1.30	0.70	1.48	5.00	16	743.57	226.933	3.4400
2013	2.30	1.27	0.75	2.00	5.00	13	-	-	3.3862

**Table 2. Descriptive Statistics for Total Sample**

	ALL Contracts	New Hires Contracts
Total Contracts	386	172
Interim	37 (9%)	34 (20%)
Rookie	86 (22%)	86 (50%)
MLB experience	290 (77%)	86 (50%)
Minor League experience	269 (71%)	113 (68%)
MLB Manager of the Year	117(30%)	31 (18%)
Top 5 vote in MLB Manager of Year	239 (57%)	67 (39%)
Fired	93 (26%)	47 (28%)
Extended	229 (65%)	96 (57%)
Catcher	131 (34%)	52 (31%)
Duration of Contract (Seasons)	2.01 (.99)	2.41 (0.84)
Actual Number of Seasons	1.63 (0.83)	2.01 (0.73)

Notes:

Interim: New Hired manager was initially named Interim Manager.

Rookie: Inexperienced Manager (No previous MLB experienced)

MLB experience: If hired manager had previous MLB experience as manager.

Minor League experience: If hired manager had previous Minor League experience as manager.

Fired: New Hired manager was fired during his initial contract.

Extended: Manager had contract extended.

Catcher: Played as catcher at MLB level.

Duration of Contract: Duration of initial contract. Standard deviation in parentheses.

Actual Number of Seasons: Average effective duration of initial contract. Standard deviation in parentheses.

**Table 3. Descriptive Statistics**

	ALL	ALL New Hires	Non-Rookies New Hires	Rookies New Hires
<b>Salary (in millions)</b>				
Mean	1.22	0.961	<b>1.282</b>	<b>0.507</b>
Std Dev	1.100	0.836	0.957	0.218
Min	0.16	0.16	0.25	0.16
Median	0.80	0.67	1	0.50
Max	6.40	4.33	4.33	1.00
Observations	217	99	58	41
<b>Contract Length (in years)</b>				
Mean	2.005	2.396	<b>2.605</b>	<b>2.185</b>
Std Dev	0.99	0.840	0.935	0.674
Min	1	1	1	1
Median	2	2	3	2
Max	10	5	5	4
Observations	383	169	86	84
<b>Experience of Manager</b>				
Manager's Age	51.42 (7.47)	49.77 (6.99)	<b>53.129</b> (6.65)	<b>46.40</b> (5.59)
MLB Winning Percentage	0.5025 (0.05)	-	0.498 (0.05)	-
MLB Seasons	5.89 (6.54)	<b>3.458</b> (4.75)	<b>6.890</b> (4.71)	0.070 (0.20)
Minor League Seasons	4.20 (4.43)	4.026 (4.54)	4.153 (4.60)	3.90 (4.50)
<b>Team Data</b>				
Previous Record	.497 (0.07)	.463 (0.09)	.458 (0.08)	.468 (0.10)
Previous RS – RA	733-742	720-761	723-770	716-752
Previous Manager's WOE	-0.187 (3.89)	-0.279 (3.78)	-0.720 (3.84)	0.170 (3.74)
Batting Age, Pitching Age	28.8,28.6	28.9,28.5	28.9,28.5	28.7,28.5
Franchise Value	339.02 (263.02)	329.45 (243.94)	343.80 (261.64)	319.93 (226.45)
Payroll (in millions)	64.48 (38.54)	62.19 (35.07)	65.18 (38.02)	59.03 (32.38)
Payroll Change (%)	12.32 (27.40)	8.88 (28.78)	8.20 (25.90)	9.56 (31.55)
Attendance (-1) (in millions)	2.355 (0.72)	2.277 (0.71)	2.361 (0.78)	2.187 (0.63)
Attendance (-1) Change (%)	1.59 (19.83)	-0.95 (18.93)	-0.05 (17.76)	-1.84 (19.98)

Notes: Standard deviation in parentheses.

RS – RA: runs scored by team and runs scored against the team during the previous season to the new contract.

Batting Age – Pitching Age: Average age of field players and pitching staff during the previous season to the new contract.

Franchise Value: Value of MLB franchise in the year the manager is hired, as estimated by Forbes.

Payroll: Team's Payroll in the year the manager is hired, taken from Cot's Baseball Salaries and The Baseball Cube websites.

Payroll Change: Team's change in payroll (in percent) in the year the new contract is in effect, taken from Cot's Baseball Salaries and The Baseball Cube websites.

Attendance (-1): Team's Attendance the previous year the manager is hired, taken from Baseball Reference and Baseball Cube websites.

**Bold:** Significantly different from previous category (column).

**Table 4. Descriptive Statistics – Measuring New Contract Impact**

	ALL	ALL New Hires	Non-Rookies New Hires	Rookies New Hires
Change in Franchise Value (%)	9.11 (15.50)	8.61 (16.43)	9.71 (17.05)	7.53 (15.83)
Attendance Change (%)	1.59 (19.83)	-0.18 (19.17)	-0.55 (19.14)	0.19 (19.32)
New Manager's Contract WOE	-0.126 (4.23)	-0.338 (4.33)	0.378 (4.15)	<b>-1.090</b> (4.41)
Change in WL Percentage	0.53 (6.91)	0.98 (6.80)	1.81 (6.93)	0.11 (6.60)
Change in RS (%)	1.32 (13.07)	1.81 (12.53)	1.63 (13.16)	2.01 (11.90)
Change in RA (%)	0.46 (13.58)	-0.07 (12.30)	-0.31 (12.82)	-0.19 (11.80)
Change in Batting Age (%)	0.07 (3.37)	-0.01 (3.30)	0.10 (3.40)	-0.11 (3.21)
Change in Pitching Age (%)	-0.18 (4.04)	-0.55 (3.82)	-0.49 (3.86)	-0.61 (3.80)
<b>Team Data</b>				
Record	.497 (0.07)	.466 (0.08)	.460 (0.08)	.472 (0.10)
Runs Scored – Runs Against	733-742	720-761	723-770	716-752
Batting Age – Pitching Age	28.8-28.6	28.9-28.5	28.9-28.5	28.7-28.5
Payroll (in millions)	64.48 (38.54)	61.76 (35.11)	64.89 (37.61)	58.613 (32.33)
Payroll Change (%)	12.32 (27.40)	8.78 (28.48)	9.80 (27.05)	5.66 (32.65)
Attendance (-1) (in millions)	2.355 (0.72)	2.278 (0.71)	2.335 (0.78)	2.222 (0.63)
Attendance Change (%)	1.59 (19.83)	-0.28 (18.93)	-0.85 (17.76)	0.31 (19.98)

Notes: Standard deviation in parentheses.

Runs Scored – Runs Against: runs scored by team and runs scored against the team during the previous season to the new contract.

Batting Age – Pitching Age: Average age of field players and pitching staff during the previous season to the new contract.

Payroll: Team's Payroll in the year the manager is hired, taken from Cot's Baseball Salaries and The Baseball Cube websites.

Payroll Change: Team's change in payroll (in percent) in the year the new contract is in effect, taken from Cot's Baseball Salaries and The Baseball Cube websites.

Attendance (-1): Team's Attendance the previous year the manager is hired, taken from Baseball Reference website.

**Bold:** Significantly different from previous category (column).

**Table 5. Managerial Factor Structure**

<b>Variance Explained by Each Factor</b>		
<b>Factor1</b>	<b>Factor2</b>	<b>Factor3</b>
4.5385930	2.1468246	0.4500758

<b>Rotated Factor Pattern (Standardized Regression Coefficients)</b>			
	<b>Factor1</b>	<b>Factor2</b>	<b>Factor3</b>
<b>MLBWL_0</b>	0.06044	0.89122	-0.00731
<b>MLBWL_1</b>	0.05279	0.62578	-0.08891
<b>M_Av_finish</b>	0.07392	-0.85515	-0.12158
<b>MOY</b>	0.80619	-0.01277	-0.01318
<b>MOY_top5</b>	0.88940	0.08174	-0.00895
<b>MLB_seas</b>	0.98364	-0.14501	0.05907
<b>M_WOE</b>	0.47064	0.22720	-0.18028
<b>M_Age</b>	0.51864	0.03492	0.44454
<b>Min_sea</b>	-0.07685	0.00224	0.43245
<b>CarPlayApp</b>	0.93142	0.07633	-0.05239
<b>CarPenn</b>	0.89135	-0.00946	-0.06224

Notes:

All factors loadings are calculated using the principal-axis factoring method for factor extraction.

We perform an oblique rotation after an orthogonal varimax rotation.

All variables are defined in Appendix.

**Table 6. Determinants of Annual Salary for Managers**

<b>Variable</b>	<b>Log Pay</b>	<b>Log Pay/Payroll</b>
<b>Intercept</b>	-102.453 (10.556)*	-74.92655 (15.55722)*
<b>MOY_top5</b>	0.03147 (0.01505)*	0.02365 (0.01888)
<b>MLB_seas</b>	0.02946 (0.0083)*	0.02828 (0.00959)*
<b>M_Age^2</b>	0.00007 (0.00004)	-
<b>Min_sea</b>	-0.02816 (0.00613)*	-0.01571 (0.00713)*
<b>l_Payroll_0</b>	0.26200 (0.06234)*	-
<b>Dpay</b>	-	-0.11570 (0.1088)
<b>T_WL_1</b>		-1.78122 (0.45425)*
<b>Award</b>	0.22360 (0.06629)*	0.26422 (0.08310)*
<b>Aw_Top5</b>	0.22078 (0.06727)*	0.23912 (0.08679)*
<b>Time_trend</b>	0.04846 (0.0057)*	0.00158 (0.00490)
<b>N</b>	217	209
<b>R-Square</b>	0.8187	0.5152
<b>White</b>	44.54 (.2865)	38.87 (.5212)
<b>LM-M_WOE</b>	0.9328	0.1368
<b>LM-M_WL</b>	0.6671	0.0510

Note:

White: LM test for 1<sup>st</sup> and 2<sup>nd</sup> moment misspecification (p-value in parenthesis).

LM-M\_WOE test: Test for the inclusion of a manager's career WOE at time of hiring. Test follows a chi-squared distribution with 1 degree of freedom.

LM-M<sub>WL</sub> test: Test for the inclusion of a manager's career winning percentage at time of hiring and the winning percentage of the last season coached by manager. Test follows a chi-squared distribution with 2 degrees of freedom.

**Table 7. Determinants of Annual Salary for Experienced Managers**

<b>All Experienced Managers</b>		<b>New Hired Experienced Managers</b>	
<b>Variable</b>	<b>Parameter Estimate</b>	<b>Variable</b>	<b>Parameter Estimate</b>
<b>Intercept</b>	-136.72326 (9.53369)*	<b>Intercept</b>	-124.33504 (11.02832)*
<b>Interim</b>	-0.31608 (0.14417)*	<b>Connection</b>	-0.09247 (0.06892)
<b>MOY_top5</b>	0.04844 (0.01631)*		
<b>MLB_seas</b>	0.02062 (0.00927)*	<b>MLB_seas</b>	0.06421 (0.00986)*
<b>M_Age^2</b>	0.0000949 (0.000051)	<b>M_Age^2</b>	0.00000939 (0.0000589)
<b>Min_sea</b>	-0.03447 (0.00770)*	<b>Min_sea</b>	-0.03006 (0.00778)*
<b>Dpay</b>	0.25056 (0.12093)*		
<b>Bage_1</b>	0.08951 (0.02204)*		
<b>Award</b>	0.19518 (0.06980)*	<b>Award</b>	0.41281 (0.09147)*
<b>Aw_Top5</b>	0.21107 (0.08809)*		
<b>Time_trend</b>	0.06660 (0.00478)*	<b>Time_trend</b>	0.06203 (0.00553)*
<b>N</b>	169		95
<b>R-Square</b>	0.8059		0.8476
<b>White</b>	62.72 (.3459)		19.99 (.7473)
<b>LM-M_WOE</b>	1.1022		1.3395
<b>LM-M_WL</b>	2.2576		2.4475
<b>LM-M_Factors</b>	1.7056		3.2889
<b>LM-Team Rec</b>	6.3030		3.2218

Note:

White: LM test for 1<sup>st</sup> and 2<sup>nd</sup> moment misspecification (p-value in parenthesis).

LM-M\_WOE test: Test for the inclusion of a manager's career WOE at time of hiring. Test follows a chi-squared distribution with 1 degree of freedom.

LM-M\_WL test: Test for the inclusion of a manager's career winning percentage at time of hiring and the winning percentage of the last season coached by manager. Test follows a chi-squared distribution with 2 degrees of freedom.

LM-M\_Factors: Test for the inclusion of the 3 managerial factors determined by factor analysis. Test follows a chi-squared distribution with 3 degrees of freedom.

LM-Team Rec: Test for the inclusion of three team performance measures at time t-1: winning percentage, runs scored and runs scored against. Test follows a chi-squared distribution with 3 degrees of freedom.

**Table 8. Determinants of Winning Percentage**

<b>Variable</b>	<b>T_WL_0</b>	<b>T_WL+1</b>	<b>T_WL_av</b>
<b>Intercept</b>	0.25542 (0.02621)*	0.44815 (0.08900)	0.34644 (0.06989)
<b>MF1_WOE</b>	0.000571 (0.0002245)*	0.000458 (0.000250)	0.000528 (0.000197)*
<b>Dpay</b>	0.04369 (0.01385)*	0.00795 (0.01590)*	0.02569 (0.01247)*
<b>T_WL_1</b>	0.43364 (0.05245)*	0.43045 (0.06117)*	0.44133 (0.04784)*
<b>Catcher</b>	0.01307 (0.00745)	-	0.00702 (0.00656)
<b>Bage_1</b>	-	-0.00619 (0.00322)	-0.00313 (0.00252)
<b>N</b>	280	271	271
<b>R-Square</b>	0.2839	0.1914	0.3169
<b>White</b>	14.97 (.3093)	12.35 (.5784)	12.35 (.5784)
<b>LM-M_WOE</b>	0.195	0.404	0.489
<b>LM-M_WL</b>	2.32	0.16	1.037
<b>LM-log Pay</b>	0.07	0.76	0.16
<b>LM-log Pay_P</b>	3.50	1.797	1.727
<b>LM-M_Factors</b>	0.083	1.92	1.670

Note:

MF1\_WOE: MF1 with the coefficient of M\_WOE set equal to 0.

White: LM test for 1<sup>st</sup> and 2<sup>nd</sup> moment misspecification (p-value in parenthesis).

LM-M\_WOE test: Test for the inclusion of a manager's career WOE at time of hiring. Test follows a chi-squared distribution with 1 degree of freedom.

LM-M\_WL test: Test for the inclusion of a manager's career winning percentage at time of hiring and the winning percentage of the last season coached by manager. Test follows a chi-squared distribution with 2 degrees of freedom.

LM-M\_Factors: Test for the inclusion of the 3 managerial factors determined by factor analysis. Test follows a chi-squared distribution with 3 degrees of freedom.

LM-log Pay and LM-log\_Pay\_P: Test for the inclusion of the log Pay and log Pay scaled by Payroll. Both tests follow a chi-squared distribution with 1 degree of freedom.

**Table 9. Determinants of Making the Playoffs – Probit Estimation**

<b>Variable</b>	<b>Playoffs_0</b>
<b>Intercept</b>	-3.1684 (0.6799)*
<b>MLB_seas</b>	0.0410 (0.0114)*
<b>Playoff_1</b>	0.5594 (0.2148)*
<b>T_WL_1</b>	3.9536 (1.3656)*
<b>N</b>	381
<b>Likelihood Ratio</b>	56.18*
<b>Percent Concordant</b>	74.6
<b>Wald-M_WOE</b>	0.011
<b>Wald-M_WL</b>	0.033
<b>Wald-log Pay</b>	0.003
<b>Wald-log Pay_P</b>	0.004
<b>Wald-M_Rookie</b>	1.435
<b>Wald-MOY_top5</b>	0.528
<b>Wald-MOY_top5</b>	0.580
<b>Wald-Bage_1</b>	0.046
<b>Wald-Connection</b>	0.548

Note:

Playoff\_1: The team made the playoff the previous season.

Wald-X: Wald test for the inclusion of variable X Test follows a chi-squared distribution with 1 degree of freedom.

**Table 10. Determinants of Attendance**

<b>Variable</b>	<b>Log Attendance</b>	<b>Change in Attendance</b>
<b>Intercept</b>	1.18956 (2.91659)	5.44154 (3.58776)
<b>NL</b>	0.03652 (0.01932)	0.04193 (0.02385)
<b>MLB_seas</b>	0.00359 (0.00148)*	0.00479 (0.00183)*
<b>I_Attend_1</b>	0.75528 (0.03173)*	-0.31367 (0.03920)*
<b>Change in Payroll</b>	0.19679 (0.03654)*	0.21185 (0.04515)*
<b>Dat_1</b>	-0.07070 (0.04922)	-0.07516 (0.06082)
<b>RS_1</b>	0.000360 (0.000120)*	0.000305 (0.000148)*
<b>Playoff_1</b>	0.07754 (0.02586)*	0.07027 (0.03173)*
<b>Time trend</b>	0.00102 (0.00146)	-0.000576 (0.00180)
<b>N</b>	363	363
<b>R-Square</b>	0.7230	0.2376
<b>White</b>	50.30	44.43
<b>LM-New_Hire</b>	0.324	0.325
<b>LM-M_WOE</b>	0.852	0.428
<b>LM-M_WL</b>	0.226	0.256
<b>LM-log Pay</b>	0.003	0.003
<b>LM-M_Rookie</b>	0.792	0.217
<b>LM-MOY &amp; MOY_top5</b>	1.2206	0.432
<b>LM-Bage_1 &amp; Page_1</b>	1.185	0.718
<b>LM-Log Payroll</b>	1.620	2.094

<b>Variable</b>	<b>Log Attendance</b>	<b>Change in Attendance</b>
<b>LM-M_Factors</b>	0.528	0.307
<b>LM-RA_1 &amp; T_WL_1</b>	0.430	0.323
<b>LM-Network</b>	2.184	0.969

Note:

LM-X: LM test for the inclusion of variable X Test follows a chi-squared distribution with 1 degree of freedom.

**Table 11. Distribution of Variables per MLB Experience**

	Rookie	< 5 years	5-9 years	9+ years
<b>SALARIES</b>				
Average (Standard deviation)	0.507 (0.218)	<b>0.644</b> (0.448)	<b>1.291</b> (0.925)	<b>2.205</b> (1.373)
Sample Size ( <i>N</i> )	41	102	58	56
<b>MANAGER VARIABLES</b>				
Managed in Minors (% of total)	47 (62%)	139 (66%)	70 (74%)	60 (75%)
Voted in MOY top 5, at least once (%)	-	70 (33%)	90 ( <b>94%</b> )	81 ( <b>100%</b> )
Voted MOY, at least once (%)	-	18 (9%)	36 ( <b>38%</b> )	64 ( <b>79%</b> )
Made Playoffs (at least once) (%)	-	38 (18%)	63 ( <b>65%</b> )	77 ( <b>95%</b> )
MLB Winning Percentage (SD)	-	.491 (0.06)	<b>.505</b> (0.03)	<b>.517</b> (0.03)
Minors Winning Percentage (SD)	.515 (0.04)	.513 (0.04)	.515 (0.03)	<b>.542</b> (0.03)
Minors Experience (SD)	4.042 (4.67)	4.212 (4.59)	4.438 (4.56)	3.691 (3.72)
Manager's WOE (SD)	-	0.036 (6.61)	0.402 (12.06)	<b>10.24</b> (12.45)
Manager's WOE per season (SD)	-	0.072 (3.35)	-0.015 (1.86)	<b>0.607</b> (0.79)
<b>TEAM VARIABLES</b>				
Attendance, in millions (SD)	2.001 (0.83)	2.142 (0.858)	2.170 (0.943)	<b>2.519</b> (0.869)
Payroll, in millions (SD)	57.30 (31.48)	58.21 (36.54)	65.69 (40.81)	76.79 (38.21)
Batting Age at <i>t-1</i> (SD)	27.01 (6.95)	28.00 (4.55)	28.59 (3.24)	28.77 (3.51)
Pitching Age at <i>t-1</i> (SD)	26.71 (6.91)	27.78 (4.54)	28.30 (3.20)	28.54 (3.51)
Winning Percentage at <i>t-1</i> (SD)	0.480 (0.07)	0.493 (0.07)	0.494 (0.07)	<b>0.517</b> (0.07)
Runs Differential at <i>t-1</i> (SD)	-36.17 (93.86)	-18.23 (94.98)	2.86 (101.54)	6.79 (101.01)
Made Playoffs <i>t-1</i> (SD)	7 (8%)	34 (16%)	26 ( <b>29%</b> )	24 (30%)
Value at <i>t-1</i> , in millions (SD)	277.88 (187.21)	284.81 (228.48)	311.17 (265.81)	349.06 (193.40)

Notes:

(%): Percent of total in category in parenthesis

(SD): Standard deviation in parenthesis

Runs Differential: Runs Scored – Runs Against

**Bold:** Significantly different from previous category (column).

## **Appendix: Definition of variables**

Duration: Duration of manager's contract (in years). Time t-1 variable.

Pay\_year: Annual salary of MLB manager. Time t-1 variable.

Interim: Dummy variable (1 if manager was previously named interim manager). Time t-1 variable.

Fired: Dummy variable (1 if manager was fired before the end of contract). Time t-1 variable.

Seasons: Number of seasons fulfilled during contract. Time t-1 variable.

Extension: Dummy variable (1 if contract signed is an extension). Time t-1 variable.

Option: Dummy variable (1 if contract has an option provision for extra years). Time t-1 variable.

Connection: Dummy variable (1 if manager has a previous connection to a team's GM). Time t-1 variable.

Promoted: Dummy variable (1 if manager was promoted within the organization). Time t-1 variable.

Min\_coach: Dummy variable (1 if manager was a minor league coach). Time t-1 variable.

Rookie: Dummy variable (1 if manager has never coached before in MLB). Time t-1 variable.

New\_Hire: Dummy variable (1 if manager is a new hire). Time t-1 variable.

NL: Dummy variable (1 if team managed is in the National League). Time t-1 variable.

MLBWL\_0: Manager's lifetime winning percentage in MLB at time of signing contract. Time t-1 variable.

MLBWL\_1: Manager's previous season winning percentage in MLB at time of signing contract. Time t-1 variable.

Winseason: Number of manager's winning seasons in MLB. Time t-1 variable.

Av\_finish: Average divisional finish of MLB teams previously managed by manager. Time t-1 variable.

MOY: Number of MOY awards. Time t-1 variable.

MOY\_top5: Number of times a manager finished in the top 5 of the MOY vote. Time t-1 variable.

Award: Dummy variable if manager voted MOY at least once. Time t-1 variable.

Award\_top5: Dummy variable if manager finished in the top 5 of MOY vote at least once. Time t-1 variable.

MLB\_seas: Number of MLB seasons as an MLB manager. Time t-1 variable.

M\_WOE: A manager's Wins over Expected. Horwitz's (1994) proposed performance measure. Time t-1 variable.

M\_Age: Manager's age at time of hiring. Time t-1 variable.

Min\_Rec: Manager's winning percentage in the minor league (if managed in the minors). Time  $t-1$  variable.

Min\_sea: Number of minor league seasons managed. Time  $t-1$  variable.

Payroll\_0: Team's payroll at start current or just-completed season ( $t$ ) a contract is signed (time  $t$ ), known at  $t-1$ . Time  $t-1$  variable.

Payroll\_1: Team's payroll at start of the previous season ( $t-1$ ) a contract is signed. Time  $t-1$  variable.

Dpay: Change in payroll at  $t$ , known at  $t-1$ . Time  $t-1$  variable.

Attend\_0: Team's attendance in  $t$ . Time  $t$  variable.

Attend\_1: Team's attendance in  $t-1$ . Time  $t-1$  variable.

Attend\_2: Team's attendance in  $t-2$ . Time  $t-1$  variable.

Dat\_0: Change in attendance from  $t-1$  to  $t$ .

Dat\_1: Change in attendance at time  $t-1$

T\_WL\_0: Team's win-loss percentage record at time  $t$ .

T\_WOE\_0: Team's WOE record at time  $t$ .

Finish: : Team's divisional finish at time  $t$ .

Rel\_Fin\_0: Relative finish to worst team in division (lower is better) at time  $t$ .

Playoffs: Dummy variable (1 if team made the playoff at the end of seasons), time  $t$  variable.

RS\_0: Team's runs scored at end of season, time  $t$  variable.

RA\_0: Team's runs against at end of season, time  $t$  variable.

Bage\_0: Team's batting age at the end of the season time  $t$  variable.

Page\_0: Team's pitching age at the end of the season time  $t$  variable.

T\_WL\_1: Team's win-loss percentage record at time  $t-1$ . Time  $t-1$  variable.

T\_WOE\_1: Team's WOE record at time  $t-1$ . Time  $t-1$  variable.

Rel\_Fin\_1: Relative finish to worst team in division (lower is better) at time  $t-1$ . Time  $t-1$  variable.

Playoffs\_1: Dummy variable (1 if team made the playoff at the end of previous seasons). Time  $t-1$  variable.

RS\_1: Team's runs scored at end of previous season. Time  $t-1$  variable.

RA\_1: Team's runs against at end of previous season. Time  $t-1$  variable.

Bage\_1: Team's batting age at the end of the previous season. Time  $t-1$  variable.

Page\_1: Team's pitching age at the end of the previous season. Time  $t-1$  variable.

T\_WL+1: Team's win-loss percentage record at time t+1.

T\_WOE+1: Team's WOE record at time t+1.

Rel\_Fin+1: Relative finish to worst team in division (lower is better) at time t+1.

Playoffs+1: Dummy variable (1 if team made the playoff at the end of next seasons).

RS+1: Team's runs scored at end of season, time t+1 variable.

RA+1: Team's runs against at end of season, time t+1 variable.

Bage+1: Team's batting age at the end of the season time t+1 variable.

Page+1: Team's pitching age at the end of the season time t+1 variable.

Revenue\_0: Team's revenue at time t, as calculated by Forbes. Time t variable.

OpInc\_0: Team's operating income at time t, as calculated by Forbes. Time t variable.

Value\_0: Team's value at time t, as calculated by Forbes. Time t variable.

D\_Value\_0: Change in Team's revenue at time t, as calculated by Forbes. Time t variable.

Val\_1: Team's value at time t-1, as calculated by Forbes. Time t-1 variable.

CarPlayApp: Manager's career playoffs appearances. Time t-1 variable.

CarPen: Manager's career pennant's won. Time t-1 variable.