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THESIS

THE EXISTENCE OF RACIAL BIASES IN SEPARATION OF NATIONAL BASKETBALL ASSOCIATION HEAD COACHES: REALITY AND MYTHS

by

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This thesis will investigate the existence of racial biases in the National Basketball Association (NBA) by examining the probability of African-American head coaches being separated from their assignments, conditional on several factors, for the last twenty-three regular seasons. The research is widely descriptive, and tends to determine whether racial bias has existed in the separations of African-American head coaches in the NBA. Comprehensive analysis of the most significant factors that affect the coaches' tenure in the league is performed. Based on the estimated results, recommendations are offered on current policies to continue reducing any racial bias in the NBA, to not only emphasize the current situation, but to create additional and specific bases for future studies.

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THE EXISTENCE OF RACIAL BIASES IN SEPARATION OF NATIONAL BASKETBALL ASSOCIATION HEAD COACHES: REALITY AND MYTHS

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ABSTRACT

This thesis will investigate the existence of racial biases in the National Basketball Association (NBA) by examining the probability of African-American head coaches being separated from their assignments, conditional on several factors, for the last twenty-three regular seasons. The research is widely descriptive, and tends to determine whether racial bias has existed in the separations of African-American head coaches in the NBA. Comprehensive analysis of the most significant factors that affect the coaches' tenure in the league is performed. Based on the estimated results, recommendations are offered on current policies to continue reducing any racial bias in the NBA, to not only emphasize the current situation, but to create additional and specific bases for future studies.

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TABLE OF CONTENTS

LIST OF TABLES

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I. INTRODUCTION

The National Basketball Association (NBA) is a leader among athletic organizations, not only because of its huge profits but also for its progressive and forward-looking policies, which have changed over the years, regarding cases of racial and gender discrimination. Percentages of African-American players, coaches, and officials have significantly increased in the past three to four decades, reflecting progress on racial issues inside the NBA community and outside the organization in society. According to Lapchick et al. (2011), "The NBA remains the industry leader on issues related to racial and gender hiring practices. As the 2011 Racial and Gender Report Card shows, the National Basketball Association had the best grade among the men's leagues for race and gender, as it has for two decades" (p. 1).

A. BACKGROUND

Arguments about the existence of racial biases and discrimination in particular communities or organizations around the world are still speculative and, therefore, require research. Currently, debates and discussions about racial biases are becoming more controversial and present broad areas for studies, which lead to further examinations of the issue.

From its foundation in 1946, the NBA has come a long way—from a "white" organization to a truly multi-racial, international organization with stakeholders from many countries and racial groups. Today, African-Americans comprise a huge majority of players due to their personal statistics and performance, which are the main factors in the NBA draft and subsequent assignments.

The African-American coaching experience tells a different story. In 1966, Bill Russell—the Celtics' former superstar and one of the best defensive players in the history of the league—became the first African-American head coach in the NBA and was quite successful in this assignment (1968-1969 NBA champion as coach). In the late 1980s, many teams began hiring black coaches in greater numbers. Later on, in the 1990s, that trend was partially abandoned. By the start of the 2015–2016 season, there were only

seven African-American head coaches in the league, down 50% from three years earlier—and the fewest number in 16 years. As of 2017, the situation has not changed significantly; during the season, the NBA employed just eight African-American trainers.

This statistical overview is inconclusive and does not explain all factors—but it provides the impetus to study them. By correctly estimating existing relationships between specific factors and their corresponding effects on output, this thesis might be valuable for future studies.

B. PURPOSE

This research aims to provide a comprehensive analysis of racial biases in the separations of NBA head coaches. I will study the probability of African-American head coaches in the NBA being separated (fired/resigned/retired), in particular coaching assignments (on average), and estimate the coaching longevity of African-Americans based on their levels of performance (success or lack thereof) and other possible factors, which affect their tenure in particular franchises. Furthermore, the research focuses on partial effects of isolated personal and productive variables as well as estimates how various individual-specific effects correlate with some independent variables such as race, performance, and assignment. Specifically, I distinguish between coaching assignments (good and bad) through the level of a particular team's previous performance and investigate the probability of coaches being separated, based on the quality of assignments. Finally, based on the study's findings, I offer recommendations for current policies to reduce racial bias in the NBA.

C. SCOPE

The scope of this thesis covers the whole population of NBA coaches, from the 1985–1986 through the 2016–2017 season. An investigation into racial bias in sports, especially in one of the four U.S. major leagues, will explain many significant factors in the hierarchy and their direct or indirect contribution to targeted questions. The entire population of head coaches from the NBA's first season delivers a holistic picture of the issue. Isolating the racial factor in separation, among many others, is essential in the research and provides specific estimates for desirable outputs.

D. METHODOLOGY

The research was generally quantitative, and the methodology included the several steps.

I reviewed available relevant literature and articles, related theses, and other sources of information, such as official (NBA.com) and other major sport websites (Basketball Reference.com), on racial discrimination in firing NBA head coaches since the inception of the league. Then, I assessed how previous research contributed to existing beliefs and selected important ideas from those studies.

I manually collected data from the most informative and open web-based sources, such as NBA.com and Basketball-Reference.com, about whole populations of NBA head coaches since the first season in 1985 through the last season. Next, I converted all observations in Excel files to Stata—so as to develop and estimate the relationship of the variables using the versatility and variety of Stata's features.

I conducted survival analysis to examine the duration (in this case, the number of quarters in the regular season) until the separation (firing/resigning/retiring) of the coach. To fit all variables into the most appropriate method in survival analysis, I ran several Cox proportional hazard models and tried to fit the most appropriate among them. Because of the binary character of the dependent variable (separated/not separated), the presence of categorical and continuous predictors, and the time variable, I implemented the Cox proportional hazard model. The reason for choosing such a model is to better predict the probability of being separated in the observed period, given the coach is an African-American, compared to the reference group of white coaches. The key explanatory variable (also binary) in the research is RACEBlack (African-American head coach, 1/0). During the research, I also estimated the partial effect on the outcome (separation) by involving some control factors ranging in importance, including five-year period effects. Finally, I assessed our dependent variable as whether the coach is separated.

E. BENEFITS OF THE STUDY

Racial discrimination and bias are common problems in many organizations that operate in multiracial, multiethnic environments, and avoiding such discrimination is highly favorable for all. Many if not all stakeholders are vitally interested and often deploy scientific approaches to investigate discrimination and other related issues. Concomitantly, changing particular policies according to conducted studies helps to improve organizational culture. Furthermore, involving different scientific methods for studies seems invaluable for researchers, who will be able to use the information for future research.

The main benefits of this study are the different approach and the specific scope, which provide another informative picture for future research that I hope will contribute progressively to answer questions about discrimination. The results could not only illuminate the current situation, but also form the basis of future studies.

F. CHAPTER ORGANIZATION

Chapter II, the literature review, provides a relative analysis of previous studies and specific publications about racial bias in the NBA and of the methods for assessing these issues. Historical analysis helps to investigate the issue by exploring new ways for determining its existence. In Chapter III, I characterize the methodology of the study, using specific approaches to estimate the relationship among existing factors (variables), which were deployed in the models. The chapter also describes the dataset and its components, such as names of the variables and their estimates. Chapter IV provides survival model results and analysis. Finally, Chapter V offers conclusions based on summative analysis, areas for future study, and some recommendations to develop existing policies.

II. LITERATURE REVIEW

This chapter focuses on existing studies and other publications, which have significantly enriched overall knowledge about racial bias in sports, especially in major professional leagues. Despite the lack of literature specifically about racial biases in the firing (separation) of NBA head coaches, in which my research is vitally interested, this review considers and analyzes related materials that deal with the topic generally.

A. OVERVIEW

Research into racial bias in firing (separation) head coaches is negligible, particularly in last two decades. Coaching assignments differ significantly from other mid- or high-level managerial jobs in the sports market and represent a specific level of managerial responsibilities, as a manager (head coach) is required to react and make decisions rapidly during a particular game or season. Whereas his experience, knowledge, and charisma could lead to an overall increase in a team's productivity, the lack thereof could cause the downfall of a team. Unfortunately, both fans and owners believe the saying "Players win games and coaches lose them." The history of the NBA is full of instances in which coaches were blamed for poor performance and finally fired or forced to resign.

Ostensibly, firing a coach is easier than firing major players—and not because they are paid less. It is well known that players, especially starters, or stars, earn significantly more on average than coaches do because they are considered main contributors to success, according to their statistics of productivity. The productivity of coaches is more complicated because it is measured by a team's overall performance (e.g., percentage of wins, play-off achievements, etc.).

B. STUDIES ABOUT RACIAL DISCRIMINATION AMONG PLAYERS IN THE NBA

Many studies have focused on pay discrimination among players based on race. For example, Kahn and Sherer (1988) investigated the issues of discriminative pay among NBA players based on data from the 1980s, concluding that white players earn

about 20% more than black players, holding all else constant and controlling for productivity and market-related variables. However, the authors expressed some doubt about racial discrimination in salaries, because many of the highest paid players were black, and suggested that discriminatory pay was caused by customers who tend to see and support players of their own race. The study had a limited dataset, from the 1985–1986 season, which may not have captured enough observations to represent the entire picture and the actual tendency of racial discrimination, even in the 1980s. This study does not directly contribute to recent research, but it suggests some sort of existing racial discrimination in the not-so-distant past, even if it was caused or correlated accidentally. Thus, investigating issues further using more specified approaches tends to create a scientific basis for future studies of discrimination.

Exploring the issue of discrimination, Kahn (2009) continued his series of research on the treatment of African-Americans in the NBA. He attempted to answer the question by changing the scope of his study. To explain the need of subsequent studies, he noted, “Despite this clear evidence of black success in the NBA, the question of discrimination against African Americans remains a salient one” (Kahn, 2009, p. 2). Moreover, borrowing the idea from Shropshire (2000), Kahn emphasized that the lockout in 1998 brought some doubts about racial peace in the NBA, when a majority of NBA players saw the move as a racial confrontation between white team owners and the 80% black union.

In the same study, Kahn devoted an entire chapter to investigating the discrimination in hiring and firing, which have a closer relation to our study. Expressing doubt, he lamented, “Even if there were equal pay for equal work in basketball, it is still possible that black players (or coaches) face barriers to entry or lower probabilities of being retained than equally performing white players (or coaches)” (Kahn, 2009, p. 13).

The actual and unique worth of this study is that Kahn summarized all major previous research and grouped studies in terms of existing racial discrimination in the year of its publication. To be precise, 12 studies (on wage discrimination in the NBA) found racial discrimination in salaries in the 1980s whereas the studies from the ‘90s rejected these arguments (Kahn, 2009, pp. 26–28). The summary of research on hiring

and retention discrimination by race showed that among seven previous studies, only one (Hoang and Rascher, 1999) inferred racial discrimination against NBA players being cut in the '80s, and only Kahn's 2006 study analyzed the issue by investigating the coaches' case. Another more controversial summary cataloged all existing studies of customer discrimination in the NBA. Eight studies, mainly from the 1980s, detected racial bias in attendance while later studies, mostly from the 1990s, detected no such bias (Kahn, 2009, pp. 26–28).

C. STUDIES ABOUT RACIAL DISCRIMINATION AMONG HEAD COACHES IN THE NBA

A comprehensive study by Kahn (2004) estimated racial differences in the retention, salaries, and performance of NBA head coaches over seasons 1996–2003. He used a hazard function model to examine the issues. The author discovered statistically insignificant estimates in chances of being fired for racial differences, conditional on various factors of the quality of coaching performance. Moreover, controlling for performance and qualifications, Kahn found no racial differences in resignations, annual compensation, or contract duration among the coaches. In conclusion, the author found no discriminative treatment of NBA head coaches. Observing the data, which spanned 2000–2003, the author emphasized the large number of African-American coaches in the NBA, when they represented 45% of all coaching assignments. Notably, this analysis tried to investigate the issue targeted on a period when the number of African-American coaches was equal to others (whites). The applicability of Kahn's research to this study is evident in the methodology used to examine the issue.

In 2008, Fort, Lee, & Berri went further and investigated racial discrimination in the NBA by estimating the technical efficiency of coaching performance (i.e., a team's winning percentages at the firing of a head coach). The technical efficiency (TE) is the measure of the relationship between present winning results and a "frontier" of winning achievements. As a result, the higher this estimate, a coach is more efficient. The group estimated the effect of technical efficiency (TE) on average in seasons 2000–2003 on firings and determined average tenures (ATs) among white and black coaches. Combining both factors (TE and AT), results showed that no discriminative treatment

occurred during this period; at firing, the TE of black coaches was 0.676, and the TE of white coaches was 0.666 (Fort, Lee, & Berri, 2008). Other more intriguing results were shown in retention estimates. Fort et al. (2008) found that on average, tenures differ by race; whereas white coaches had higher ATs (7.45) than black coaches (3.50), the average TE was also higher (0.853 versus 0.782). The study clearly shows that some questions about discriminative treatment are still unanswered. There is no doubt that on average retained black coaches have higher technical efficiency, but this evidence merely indicates that retention has a direct effect on productivity. On the other hand, the average tenures of white coaches, which are approximately 2.5 times longer than those of black coaches, do not prove such a difference has a strong relationship to the difference in technical efficiency (an advantage of just 0.071 TE for white coaches).

Based on the previous analyses, Fort et al. (2008) offered some important ideas for practitioners:

> First, TE is a useful measure because it: (1) actually sorts coaches by their contribution to team success and (2) is also flexible enough to allow comparisons across various groups for any practitioner reason. Second, owners behave as if they use such a measure in their actual retention decisions. This will come as news to some observers adhering to other models of retention (e.g., good old boy networks). Third, NBA coaches are highly paid, so knowing when to replace a coach is important financially. In fact, fired coaches had a TE that is 13% lower than retained coaches with clear significant implications for paying coaches. Owners know the value of winning sold to fans, and they can calculate the marginal contribution of coaches through TE assessments. (p. 12)

This detailed explanation of the importance of TE, which is considered the most general factor for measuring coaches' productivity, consists of a combination of several singular factors. Such estimates have allowed practitioners to classify coaches by their level of contribution and created a basis for owners to make decisions about the retention of coaches. For this thesis, we created similar variables in a slightly different way, but the idea of combining several important factors to streamline the effect of productivity was a significant finding.

In concluding their research, Fort et al. (2008) warned researchers, "Any result that fails to find evidence of discrimination in retention is only a small part of the overall

analysis of discriminatory impacts" (p. 13). This statement surely underlines the importance of further research into racial discrimination, not only in the NBA but also in many other organizations.

A unique and interesting study was published by Schroffel and Magee (2012). The authors focused on the relations between players and coaches in the NBA, posing the question of how the players' minutes per game are affected by the racial homogeneity of the actors. The scope of the research was considerable—including statistics from 1991 through 2004, covering more than a decade and explaining racially biased tendencies even during the period when discrimination had significantly declined. Highlighting the originality of this study, the coaches were not presented as "victims" (e.g., of firing and retention cases) but as generators of such discriminative biases. Controlling for the players' quality of performance and cities' demographics (the population's racial components), the authors found strong racial discrimination proportionate to the minutes per game the players experienced although the degree of racial bias in start lists was unclear (Schroffel & Magee, 2012). They determined that the same race-matching between coach and player "increases playing time by one minute per game between 1991 and 2004 and by over three minutes per game during the 2002 and 2003 seasons" (p. 1). The results of the research conclusively showed "that own-race bias emerges strongly in decisions made under pressure but that people can overcome implicit biases when making decisions after careful consideration" (Schroffel & Magee, 2012, p. 19).

To emphasize the value of the research, I focused on the differences in decision-making—in this case, the decisions on coaches, whereby racial bias emerges mainly under the pressure of time—to explain the nature of racial bias. Such bias has no link to the rationality of decision makers but explains the nature of people, or at least ruling and managing actors who still trust their own race the most, even in the 21st century. Overall results from the study show that some activities in the NBA are still affected by racial biases (Schroffel & Magee, 2012, p. 19).

Affirming the importance of further research, a study by Wangrow, Schepker, and Barker (2017) examined the dismissals of NBA coaches in more general terms using the Cox proportional hazard model. The authors put forward several hypotheses about the

coaches' separations, such as the curvilinear relevance of the relationship between coaches' performance and the likelihood of firing, change in expectations and the likelihood of dismissal, probability of being fired and the reputation capital of the coaches, and four other related hypotheses. Their scope covered the last three decades and tried to explain the dynamics of the issue over the entire period. To prove their assumptions, the authors presented a dependent dummy variable, which had a value of 1 if the coach was fired. Several explanatory variables were used: a team's performance with the coach, team expectations, coach–general manager duality, and a coach's reputation among others. Additionally, to capture period effects, Wangrow et al. introduced as many as 30 control variables, the racial minority variable, or "race," among them.

According to the tested hypotheses, the most significant results of the study were as follows: 16% of the coaches were fired during the first season, or shortly thereafter; from the remaining 84%, 22% were fired after their second season in assignment; increased team expectations were strongly related to dismissals ($p < 0.01$); coach–general manager duality along with the coach's reputation had a positive effect on the retention and, moreover, were statistically significant at the 95% level (Wangrow et al., 2017, p. 9). Interestingly, being a minority coach (used as a control variable) increased the odds of being dismissed in the first year of assignment by four percent while, in following years (2–5 years), the odds notably decreased, even showing an inverse relationship (reducing the odds up to 16% in the second year of assignment, p. 9). However, in the sixth season and beyond, the likelihood of dismissal among minorities increased again. In the results section, reviewing the overall picture, Wangrow et al., (2017) concluded, "No coach was dismissed in the entire sample if he won 75% or more of his games" (p. 11), which seems reasonable, even if these results (percentage of wins) are quite high and have not been reproduced since that time.

Finally, the authors emphasized their contribution in using a different methodology, the Cox proportional hazard model, to investigate the issue of coaching dismissals (generally) and related factors. This relatively new approach, which had not

been used before, will hopefully direct some future research in employing a variety of econometrical models.

D. CONCLUSION

The majority of previous research and publications investigated the general issue of discriminatory racial bias using various contributive factors, or variables, to examine different outputs, such as pay, retention, and hiring among others. The studies were mostly oriented to examine racial issues in overall demonstrations, slightly focusing on the coaching dismissals. On the other hand, very few of them directly focused on the causes of coaches' dismissals (Wangrow et al., 2017). The majority of the results in the last three decades clearly show significant decay of racial discrimination, even suggesting that the area for similar research has been depleted (Fort et al., 2008).

I believe that the results from previous studies have created significant ground to move forward while some factors should be estimated using different methodological approaches. I deeply appreciate all authors of the studies, who admitted that results were inconclusive and required further investigation of the issue, due to data limitations or different types of biases. Additionally, further investigations of the issue using different scientific approaches and involving various factors, along with an enhanced scope, will allow a review of the situation from different angles to eliminate existing doubts about such treatment. To develop this assumption, this thesis uses a methodology and models that differ from previous studies.

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III. DATA AND METHODOLOGY

This chapter represents the collected data from several public sources, involving the variables and methodology I used to estimate the probability of being separated (fired/resigned/retired) among African-American head coaches based on their productivity or lack thereof. The first part of the chapter introduces the main sources, from whence the dataset was constructed, and explains the importance of collecting necessary information to examine the issue. The second part describes involved variables and the purpose of including them in the proposed regressions. Additionally, descriptive statistics (tables) help to illustrate the overall situation of coaching in the observed seasons (1985–2017). The last part describes the methodology and analytical methods I used to estimate the effect of race on the probability of being separated (fired/resigned/retired) using a coach's productivity and experience as control factors.

A. DATA SOURCES

I used several resources to collect data for the research. General information about head coaches was gathered from two statistically exhaustive web sources: the official site of the National Basketball Association and Sports Reference, LLC, a company that operates several sports-related websites, including Baseball-Reference.com, Pro-Football-Reference.com, Basketball Reference, and Hockey Reference. Basketball Reference provides personal and productive information about NBA head coaches. Both sources are public and have free access. Additional informational sources, such as *A Biographical Directory of Professional Basketball Coaches* by Marcus (2003), were used to verify the collected information from the main sources.

1. The official site of the National Basketball Association (http://www.nba.com/#/) was used to import data for the study, but mostly for verifying the information from the main source, Basketball Reference, which had some omissions.

2. Sport Reference, LLC (https://www.basketball-reference.com/) is a company that operates several sports-related websites. Basketball

Reference (website) provides personal and productive information about NBA head coaches, along with team and individual statistics. The source is public and has free access. The site's database was used to collect statistical information about head coach productivity and awards, team performance (wins–losses percentages), and dates of hiring and firing.

3. Wikipedia (https://en.wikipedia.org/wiki/) was mainly used as a hub for several references (journal and newspaper articles) to determine the race of a coach and other demographic information, which was not available from the two main sources. The site includes additional information about coaches' firings and the dates of temporary assignments. This source was very useful during the construction of the data, when records from two main sources needed to be verified or augmented.

4. *A Biographical Directory of Professional Basketball Coaches* by Marcus (2003) was used primarily as a control source to check the veracity of firings and other separations from the main sources. In this book, the author sorted coaching records alphabetically and annually. Short but detailed descriptions were helpful during data construction.

B. DATA SELECTION

To strengthen the scope of the research, I selected all head coaches from 1985 to 2017 who were assigned to their position on a permanent basis. The dataset, constructed from these regular seasons, includes all recorded observations during that period. The period was chosen purposely to capture the maximum representation of assigned Africa-American head coaches, in contrast with previous decades. Before the 1980s, the portion of non-white head coaches in the NBA was too small (only nine African-American head coaches in four decades); thus, estimating the probability of being separated (fired/resigned/retired) by race during that period seemed unessential. As mentioned in Chapter I, the purpose of this thesis is to investigate the main factors that affect dismissals and other separations among African-American head coaches in the NBA. To

examine such factors, I tried to capture the most interracially representative period with a large portion of African-American coaches.

First, I selected only head coaches who were assigned on a permanent basis and omitted all temporary coaching assignments, such as "interim" coaches—assistant coaches who led a franchise for several games in a season before hiring an actual head coach—and other similar assignments. Interim coaches are usually less experienced (e.g., assistants, coaches from lower leagues, etc.), and temporary (interim) assignments are usually short-term duties even though they may generate high productivity (e.g., percentage of wins, streaks, etc.). Thus, the dataset for this thesis includes only coaches in permanent positions, which are usually long-term duties. By omitting such information and emphasizing only head coaches, I focused on the main question of the research.

Through the period of data collection, I manually determined the race of each head coach, searching various websites, but mostly major sport e-sources, which offer photographs and additional (mostly demographic) information about sports personalities. Afterward, I created an Excel file, where I recorded all necessary observations about head coaches' productivity and experience to convert them for analysis using Stata, a statistical software package, for further investigation of the targeted questions.

For a better understanding of the involved factors to examine the issue of racial biases in firings and other separations, the following describes the variables and the purpose of their use. Table 1 includes a statistical summary of all variables (1985–2017) with short descriptions, their means, and standard deviations. The summary also presents the variable names, numbers of observation, and corresponding value ranges. The names of variables simplify their use in Stata while descriptions provide more details.

Table 1. Summary of Variables (N = 4020)

Variable	Description	Mean	Std. Dev.
RACEBlack	African-American head coach (1/0)	0.282	0.449
AQL	Team's averaged (3 y.) % of wins at hiring a new coach	0.465	0.148
EXPTxY	Coach's previous teams' experience (in years)	4.474	6.022
lag1wp	Lagged winning % (1 quarter prior)	0.425	0.251
lag2wp	Lagged winning % (2 quarter prior)	0.401	0.266
lagseasonw~s	Lagged season wins in previous season	29.072	22.136

Table 2 presents the cross tabulation analysis of the dependent variable and the key independent variable to introduce the overall picture of the two main categorical variables. Both variables are dummies, and, therefore, the corresponding numbers are easily readable. The dataset has 4,020 observations, including 2,888 for white coaches (RACE (Black) = 0)) and 1,132 for black coaches (RACE (Black) = 1)), 72% and 18%, respectively. In the dataset, there are 290 observed firings/separations, of which 96 (33%) are African-American coaches and 194 (67%) are their white counterparts. Further analysis indicates that from all corresponding assignments, separations (fired/resigned/retired) of black coaches constitute eight percent while similar separations of white coaches are almost the same—at seven percent. Without controlling for several important factors—such as productivity, quality, and experience—the absence of racial bias in separations cannot be concluded at this stage of the study. All further investigations with controlling factors and results are presented in Chapter IV.

Table 2. Tabulation of Independent and Key Explanatory Variables

FIRED/LEAVE	RACE (Black)		Total
	0	1	
0	2,694	1,036	3,730
1	194	96	290
Total	2,888	1,132	4,020

C. MEASURES OF COACHING QUALITY, EXPERIENCE, AND VARIABLES

Experiencing some problems in determining the real cause of coaches leaving a franchise, I decided to merge both reasons, firing and resigning. The problem I faced during the collection of data was conflicting information from different sources, i.e., a coach was either fired or resigned. Moreover, some coaches were forced or persuaded to resign. Indeed, there is a thin line between being fired and resigning, and a more compliant person is unlikely to be fired. Generally, there are many unmeasurable reasons (e.g., personal relations with owners, superstars, and amenability among others), voluntary and involuntary, for leaving. This was the main reason for combining and estimating them together. Therefore, to simplify the outcome and make it more rational, the dependent variable had to be dichotomous.

To study the variations of the probability of being separated (fired/resigned/retired), I considered that a coaching tenure has only two possible outcomes, leaving versus staying with a team. The dependent variable (value 1, 0) indicates whether a coach was fired (or resigned) in a regular season-quarter (1–4)—where leaving at end of the season is classified as the fourth quarter—or stayed with the team.

According to the primary question, the key independent variable of the study is the race of the head coaches. In this case, I chose dummy variable “black” (value 1) for

African-American head coaches and "white" (value 0) for all other coaches, who are mainly white (only one head coach, E. Spoelstra, identified as Asian-American).

I chose several independent variables to control a head coach's quality and experience. The quality of the coaches should be determined by their ability to win games—82 in the regular season. The measure of coaching productivity was estimated as a percentage of wins in a particular seasonal quarter (wins/games ratio) and expressed as a coefficient. For capturing periodic productivity and emphasizing independence from each other, I divided all regular seasons by four nearly equal parts—quarters. The first three quarters represent 20 games each whereas the last quarter represents 22 games. Exceptions were in seasons 1998–99 (50 games) and 2011–2012 (66 games). Therefore, productivity records of both seasons are given incompletely. In the 1998–99 season, productivity is shown fully for the first two quarters and for the remaining 10 games while the 2011–2012 season includes three full quarters (60 games, 20 games each) and a shortened fourth quarter (six games).

Another set of explanatory variables, which I used to control for the expected confounding bias, are presented as control variables, such as a coach's current productivity records, coaching experience, and quality of the coaches. A coach's records are shown as the productivity records in current quarters. Further, I collected information about every team's previous three years of winning percentages on average to determine the quality of an assignment and to assume the expected progress of having a new coach from the owners' point of view. Another aspect of the control variables is coaching experience, a coach's experience indicating the ability to lead a franchise based on previous achievements, such as the number of years in previous tenures as well as quarterly and annual cumulative experience.

For better prediction of the outcome variable (separated) and to avoid endogeneity, I created another set of control variables: lag1wp and lag2wp (previous seasons' percentage of wins by respective quarter) and lagseasonwins (averaged number of wins in previous season). Specifically, these variables highlight the records in prior quarters for quarters 2–4, record two quarters back for quarters 3–4, record three quarters back for quarter 4, and record prior years for quarters 1–4. The lagged values of such

variables are introduced on purpose to predict the current values of the dependent variable, which is based not only on current but also on previous quarterly productivity (percentage of wins, wins).

Specifically, I indicated each period for a single coach assigned to one particular franchise, uninterrupted. The period's unit of measurement is a seasonal quarter (20–22 games). Additionally, if a coach leaves a team for any reason, I considered his new assignment a new position, and the period restarts, even in the case of hiring by the same team.

D. METHODOLOGY

The following presents the methodology and selected methods that I used for this study.

1. I provided survival analysis to examine the duration of time (in our case, number of games) until the coach's separation. The survival analysis is based on coaches' tenures in their current assignments; therefore, I examined the probability of each coach surviving every tenure in all observed seasons (1985–2017).

2. The input dataset for the survival consists of the duration of a single coaching tenure, measured in quarters during which a head coach was observed before he was fired or left. In our case, we observed one record (single tenure) per coach.

3. Because of the binary character of the dependent variable (fired/leave = 1, stayed = 0) and its categorical nature as well as the existence of the period variable, I implemented Cox hazard regression (stcox) models to better predict the probability of being separated (fired/resigned/retired) and handle the effect of several covariates on the probability of survival.

4. The key independent variable (also binary) in the analysis is RACEBlack, identifying an African-American head coach. Some combinations of the key variable with mixed groups of control variables were regressed to set

the correct models. Given that the value of 1 is a black coach, I compared given estimates with reference groups of white coaches, involving controlling for factors to reduce omitted variable bias.

5. Another group of independent variables (productivity, quality, and experience) related to the probability of being separated (fired/resigned/retired) were used as control variables (head coaches' productivity, quality of assignments, previous experience, and period).

E. CONCLUSION

According to the given description of the dataset, the involved variables, and chosen methodology, I ran suitable regressions and chose appropriate models to explain the relationship of the deployed factors for the purpose of estimating the effects of being an African-American head coach in the NBA on separation (fired/resigned/retired). All estimates and models are presented in Chapter IV.

IV. SURVIVAL ANALYSIS AND RESULTS

This chapter presents all obtained results of survival analysis using the Cox proportional hazard for estimating the probability of being separated (fired/resigned/retired) among African-American relative to white head coaches, based on their productivity or lack thereof in the 1985–2017 period. The choice of selecting survival analysis to study racial discrimination is based on our interest in examining the time until separation occurs. The Cox proportional hazard method was preferred over other survival analysis methods because I was interested how various factors (covariates) affect the hazard (probability) of being separated. This type of model is most commonly used to distinguish and determine the effects from each individual covariate on the probability of surviving in a given state. The analyses include the statistics of regular seasons only with the coaches' quality variable (control variable) of acquiring the NBA title (championship), taken from post-season success.

A. SURVIVAL ANALYSIS

This section presents the analyses estimating the probability of "surviving" in the current state (continues the tenure) for African-American head coaches compared with their white counterparts, conditional on success or lack thereof. The Cox proportional hazard regression with its coefficient estimates (hazard ratio) is used to predict the behavior of the dichotomous dependent variable, in our case, the probability of surviving the single tenure, affected by race and controlling for various productivity and quality factors. All coefficients from presented models are in hazard ratios and consequently interpreted using economic terms.

I used the Cox model assuming that our independent variables have proportional hazard rates over time. In practical application, we were able to determine that the survival curves have constant relative hazard.

B. CONTROLLING FOR PRODUCTIVITY, EXPERIENCE, AND THE QUALITY OF ASSIGNMENTS

With an initial/basic model (see Table 3, Model 1) of two binary variables, the Cox proportional hazard regression indicates that overall, African-American head coaches have a 32% greater risk of being fired than white coaches during the entire observed period (1985–2017), without controlling for anything. The difference is statistically significant at the five percent level.

The Tables 3–4 (Models 1–10) present results from regressions involving key explanatory variables in combination with several observed factors, such as productivity, experience and the quality of the assignments.

To further examine the relationship between the outcome and the key explanatory variable, I incorporated more related factors, which would have likely had some influence on being fired or retained. I tried to control for coaches' experience and productivity as well as team success. First, I fixed the team's quality (AQL)—calculated as the average winning percentage for the last three years before hiring a particular coach. Controlling for this factor, we eliminate the influence of differences in coaching assignments, assuming that African-American coaches would have been given lower-quality assignments. The results show that controlling for AQL alone, an African-American head coach is 34% more likely to be fired (see Table 3, Model 2). The AQL factor itself, controlling for race, shows that a one-unit increase in AQL reflects a 59% lower hazard in separation probability. The results are logical—based on the proposition that with a better team a coach has more time to develop and prolong his tenure—or perhaps the team's previous achievements maintain the quality in the current season. However, that assumption is based on the level of current productivity, or its quarterly or annual average. The results are significant at the 5% level.

Table 3. Models 1–5

Vars	Model 1	Model 2	Model 3	Model 4	Model 5
Race (Black)	1.320* (2.128)	1.343* (2.257)	1.316* (2.095)	1.226 (1.527)	1.197 (1.347)
AQL		0.412* (-2.057)		0.628 (-1.057)	0.752 (-0.647)
EXP (TxY)			0.997 (-0.247)	0.998 (-0.227)	0.997 (-0.304)
lagseasonwins				0.979*** (-3.529)	0.988 (-1.890)
lag1wp					0.234*** (-4.243)
N	3023	3023	3023	3023	3023

Exponentiated coefficients; t - statistic in parentheses
* p<0.05, **p<0.01, ***p<0.001

I used the coach's experience, EXPTxY, as an indicator of having the experience of coaching a different team before the current coaching tenure. The variable has an insignificant estimate, maintaining an approximate 99% hazard ratio in all models, holding constant different sets of covariates. Its small effect on the probability of being separated is clearly evident from Model 3 (Table 3) in comparison to Model 1 (Table 3); statistics show that the probability of being separated for African-Americans do not change significantly, reflecting a 0.4% decrease, from 32.0% to 31.6%. Therefore, we can infer that having summative (yearly) experience in previous assignments does not affect the relationship between the key explanatory variable and the probability of being separated. Thus, the relationship between race and probability to be fired cannot be explained by prior experience. Most likely, the previous experience of coaching different teams is associated with coaches' quality, conditional on their productivity, which would also be based on the teams' (owners') expectations.

The next step in developing our models is to include productivity factors. To better predict our dependent variable, in Chapter III we introduced lagged variables of coaches' productivity. Thus, involving such factors, I also started controlling for productivity in previous quarters, still holding other factors constant. Coaches'

productivity factors are represented as the average number of wins in the prior season. Measuring such productivity, we had to omit the estimates for the coaches in the first season of their tenures and those who had only one season in their careers, because of the lagged character of the variable. Models 4–8 and 10 present the combinations of controlling for "lagseasonwins" with different groups of factors, such as teams' level (assignments level), coaches' productivity, and experience. Model 10 shows that African-American head coaches has a hazard ratio of 1.21, which indicates they have a higher probability of being separated (fired/resigned/retired) by 21%, holding lagseasonwins constant. Parameters of variable lagseasonwins are statistically significant at the 1% level. The hazard of lagseasonwins itself is very small, but as a control factor, it is quite significant in lowering the hazard for RACEBLack from 1.32 to 1.21; and, the latter estimate is not significant at the 5% level.

The coaches' other productivity factors are presented in terms of prior quarterly (20–22 games) winning percentages. The variables indicate winning percentages in each previous quarter, lagging separately for one and two quarters back. With these productivity variables (lag1wp and lag2wp) to control for, the lagged variable (lagseasonwins) loses its significance due to high correlations with productivity and picks up the lagged effects from previous quarters. In Model 5, we observe some change in the coefficient estimates of RACEBLack, whose hazard ratio drops from 1.32 to 1.20, indicating that by additionally controlling for the lagged productivity (lag1wp), the probability of African-American head coaches being separated (fired/resigned/retired) is 20% higher than for whites, at the 10% level. Additionally, controlling for another lagged variable (lag2wp), the coefficient estimate of RACEBlack goes down and does not reach the 80% CI, holding the hazard ratio of 1.18 close to previous estimates, all else constant (Models 6–7; see Table 4). In Models 5–7, the productivity variables are always significant at the 5% level, while lag1wp is even more significant at 1% level. The productivity variables show their important nature in cases of coaches being separated, emphasizing that productivity (current or prior) always remains the most important factor for coaching tenures. The estimates (ceteris paribus) for the lagged variables (lag1wp and lag2wp) are always statistically significant, indicating that a one-unit increase in lag1wp

and lag2wp lower the hazard ratio of being separated, down by 0.33 and 0.41, respectively (Models 6 and 7).

Table 4. Models 6–10

Vars	Model 6	Model 7	Model 8	Model 9	Model 10
Race (Black)	1.183 (1.261)	1.189 (1.303)	1.230 (1.555)	1.335* (2.199)	1.210 (1.444)
AQL	0.767 (-0.605)	0.785 (-0.556)	0.637 (-1.034)	0.401* (-2.113)	
EXP (TxY)	0.996 (-0.382)			0.995 (-0.520)	
lagseasonwins	0.992 (-1.145)	0.992 (-1.182)	0.978*** (-3.563)		0.977*** (-3.959)
lag1wp	0.333** (-2.906)	0.333** (-2.904)			
lag2wp	0.406* (-2.262)	0.408* (-2.250)			
N	3023	3023	3023	3023	3023

Exponentiated coefficients; t - statistic in parentheses
* p<0.05, **p<0.01, ***p<0.001

C. DIFFERENCES IN HAZARD RATIOS FOR 10-YEAR AND 15-YEAR PERIODS

To determine the differences in the probability of being separated for African-American head coaches in various periods, I introduced the dummy variables for each 10-year (Table 6) as well as 15- and 17-year periods (Table 6). The entire period of observations (1985–2017) was split into six equal five-year periods while the last part was determined a three-year period for 2015–2017, because our observations end with the last regular season's statistics. Another division was set for 15-year and 17-year periods. To be precise, I estimated the effects within different periods to investigate dynamics of the probability of being separated throughout the years. The purpose of such a division is based on the willingness to examine how the separations for African-American head coaches differ in specific periods (decades and longer).

In all models with year-period effects, I held constant average team quality (AQL), coaching experience in the previous assignments (EXPTxY), and the productivity factors (lagseasonwins, lag1wp, lag2wp). Through all year-period effect models, the key explanatory variable (RACEBlack) shows insignificant estimates below the conventional 10% level, so it is difficult to determine the year-period effects. The significance of the probability of being separated is detected in the 2010–2014 regular seasons. Only the last observed period shows significant estimates, when the hazard ratio for RACEBlack is 1.84, indicating that, ceteris paribus, African-American head coaches are at a 84% higher risk of being separated than whites, which is significant at the five-percent level. No other 10-year period models showed significant estimates for interpretation, even at the 85–90% CI.

Following the theory, we expanded the periods to 15 and 17 years, respectively. Being limited with 33 years for the entire period, the 15-year periods were set to start every five years to capture more information (see Table 6). The results do not explain whether race matters in being separated, showing insignificant estimates for the key explanatory variable. Notably, the productivity variables (lag1wp and lag2wp) remain the main factors in separation.

Thus, comparing both groups given the year-period effect, we notice that in 10-year periods, we are able to determine little differences in the separations (Table 5, Models 11–14) whereas 15-year periods show absolute insignificance in racial matters, and all affects are captured by the productivity variables. The productivity factor is the most realistic element in the sport, which can be captured at any time, but the longer the period, the higher the probability of capturing it.

Table 5. 10-Year Period Models (11–14)

Vars	Model 11	Model 12	Model 13	Model 14
	1985-1994	1995-2004	2005-2014	2010-2017
Race (Black)	1.017 (0.052)	1.227 (0.866)	1.160 (0.639)	1.842* (2.293)
AQL	1.100 (0.106)	0.365 (-1.412)	1.603 (0.542)	0.272 (-1.196)
EXP (TxY)	1.010 (0.425)	0.974 (-1.515)	1.010 (0.520)	1.027 (1.293)
lag1wp	1.120* (-2.243)	0.922 (-0.130)	0.118** (-3.062)	0.235 (-1.712)
lag2wp	0.667 (-0.410)	0.116** (-3.218)	1.118 (0.155)	0.429 (-0.963)
lagseasonwins	0.997 (-0.190)	0.997 (-0.277)	0.990 (-0.777)	0.985 (-1.065)
N	703	1006	1015	807

Exponentiated coefficients; t - statistic in parentheses
* p<0.05, **p<0.01, ***p<0.001

Table 6. 15-Year Period Models (15–19)

Vars	Model 15	Model 16	Model 17	Model 18	Model 19
	1985-1999	1990-2004	1995-2009	2000-2014	2000-2017
Race (Black)	1.112 (0.450)	1.302 (1.353)	1.022 (0.117)	1.136 (0.697)	1.270 (1.423)
AQL	0.669 (-0.586)	0.581 (-0.952)	0.814 (-0.335)	0.815 (-0.323)	0.847 (-0.273)
EXP (TxY)	0.999 (-0.041)	0.982 (-1.245)	0.980 (-1.353)	0.988 (-0.793)	0.994 (-0.407)
lag1wp	0.575 (-0.947)	0.610 (-0.942)	0.472 (-1.466)	0.152** (-3.271)	0.179** (-3.178)
lag2wp	0.149** (-2.777)	0.196** (-2.892)	0.299* (-2.211)	0.692 (-0.666)	0.720 (-0.626)
lagseasonwins	1.003 (0.264)	0.996 (-0.371)	0.994 (-0.603)	0.986 (-1.462)	0.986 (-1.568)
N	1213	1478	1512	1511	1809

Exponentiated coefficients; t - statistic in parentheses
* p<0.05, **p<0.01, ***p<0.001

Based on the models, I determined that in the last eight-year period, the African-American head coaches experience a higher risk of being separated, holding all else constant. To explain the results, I propose that the higher risk of separation for African-Americans in the last decade is based on increased competition in the head-coach labor market for low-level assignments. Owners become more impatient, looking for immediate success with unsuccessful teams and having to make tough decisions. For the last decade, many African-Americans were assigned head coaching positions mainly in low-level franchises, with low probabilities to make the play-offs; thereafter, the average results or productivity decreased in proportion to increased competitiveness among the coaches. Based on this assumption, such factors would increase the hazard rates of being separated for African-Americans.

To conclude the analysis with year-effect variables (Tables 5–6), we should mention that all productivity variables (lag1wp, lag2wp, and lagseasonwins) have similar effects on the estimates of the key explanatory variable. Examining the year-period effect on the outcome, we see that all productivity variables capture all effects in the presented models.

D. EFFECT OF THE INTERACTED VARIABLES

The next step in estimating the probability of being separated is to examine the interactions between the key explanatory variable and the control factors. By creating interacted variables, I tried to estimate the joint effect by using combinations of the key explanatory and some control variables simultaneously.

To capture the joint effect of race and productivity, I generated three new variables: RACEBlackL1, RACEBlackL2, and RACEBlackL. The new variable RACEBlackL1 is the interacted variable of RACEBlack and lag1wp, which is generated to explain how the previous productivity (the winning records in prior quarters for quarters 2–4, record two quarters back for quarters 3–4, record three quarters back for quarter 4, and record prior years for quarters 1–4) differs across African-American head coaches and estimate its joint effect on the probability of being separated. The two other interacted variables were created for similar purposes and were run in the same manner.

Additionally, to follow the theory, I created an interaction between RACEBlack and the experience variable (EXPTxY) as well as RACEBlack and the assignment level (AQL), pursuing the same goals of capturing the simultaneous effect of the interactions.

Table 7 presents results of the regressions in terms of hazard ratio, controlling for experience (EXPTxY), the assignment level (AQL), and productivity variables. Throughout all models in Table 7, the key variable RACEBlack is not significant at all, and all effects are picked up by productivity factors (lag1wp and lag2wp), confirming that productivity is the most significant element of performance determining the probability of being fired.

Table 7. Models with Interactions (IEM 1–5)

Vars	IEM1	IEM2	IEM3	IEM4	IEM5
Race (Black)	1.122 (0.403)	0.887 (-0.423)	1.204 (0.752)	1.332 (0.675)	1.265 (1.460)
AQL	0.766 (-0.609)	0.764 (-0.612)	0.767 (-0.604)	0.834 (-0.347)	0.774 (-0.579)
EXP (TxY)	0.996 (-0.391)	0.996 (-0.432)	0.996 (-0.374)	0.996 (-0.362)	1.001 (0.068)
lag1wp	0.318** (-2.615)	0.334** (-2.901)	0.334** (-2.900)	0.334* (-2.897)	0.333** (-2.900)
lag2wp	0.406* (-2.258)	0.308* (-2.547)	0.406* (-2.262)	0.405* (-2.267)	0.404* (-2.273)
lagseasonwins	0.992 (-1.132)	0.993 (-0.996)	0.992 (-1.080)	0.992 (-1.157)	0.993 (-1.084)
RACEBlackL1	1.141 (0.212)				
RACEBlackL2		2.036 (1.160)			
RACEBlackL			0.999 (-0.085)		
RACEBlackAQL				0.769 (-0.293)	
RACEBlackE~Y					0.983 (-0.728)
N	3022	3022	3022	3022	3022

Exponentiated coefficients; t - statistic in parentheses
* p<0.05, **p<0.01, ***p<0.001

E. DIFFERENCES AMONG CONTROL VARIABLES

Finally, I ran several models to estimate the differences in hazard rates of being separated among different segments inside control variables. The first two models (Table 8) present the coefficients of the estimated probability of being separated for head coaches with a maximum 0.500 AQL (ALM 1) and another AQL higher than 0.500 (ALM 2). The last two models (EXM 1 and 2) explain the probability of being separated for head coaches with two different ranges of the previous coaching experience, with maximums of 10 years and more than 10 years, respectively.

Table 8. Models with Segmentations (ALM 1–2, EXM 1–2)

Vars	ALM1	ALM2	EXM1	EXM2
Race (Black)	1.248 (1.286)	1.062 (0.274)	1.292 (1.814)	0.469 (-1.457)
EXP (TxY)	0.994 (-0.532)	1.007 (0.306)		
lag1wp	0.338* (-2.159)	0.311* (-1.997)	0.326** (-2.732)	0.236 (-1.318)
lag2wp	0.309* (-2.299)	0.607 (-0.793)	0.314** (-2.677)	2.099 (0.656)
lagseasonwins	1.000 (0.013)	0.980 (-1.798)	1.001 (0.085)	0.939** (-2.812)
AQL			0.510 (-1.489)	96.077* (2.528)
N	1797	1225	2549	473

Exponentiated coefficients; t - statistic in parentheses
* p<0.05, **p<0.01, ***p<0.001

Almost all estimates from the table indicate the insignificance of the key independent variable (RACEBlack), again emphasizing that the probability of being separated is not related to race, while it depends on productivity, especially on prior productivity. However, we could determine that for the coaches with ten or less years of experience, African-Americans have a 29.2% greater risk of being separated than whites, at the 10% level. This estimate, even at a lower level, proves that race actually matters.

For example, Gregg Popovich (San Antonio Spurs) has a value of 0 because he never changed teams. It means that for coaches with successful careers, African-Americans have a higher risk of being separated, despite demonstrated results.

In addition, we noticed some interesting numbers for productivity factors. For example, ALM 1 model (lower segment of the assignments, AQL = <.500; Table 8) shows that the one-unit increase in productivity variables (lag1wp and lag2wp**)** is associated with a 66–69% decrease in hazard rates, all else constant. This could be explained with the rational behavior of owners. They understand that progressive productivity, even in small numbers, is a good reason for securing a coach for a certain period.

In the case of differences in coaching experiences among different franchises, we still observe the importance of productivity factors. For coaches who have five or less years of coaching different franchises; a one-unit increase in variable lag2wp lowers the hazard by 66% while a one-unit increase in variable lag1wp lowers the hazard by 75%. These different percentages explain the nature of the variables, whereby lag1wp is more powerful because it depends on the last 20 played games.

F. CONCLUSION

This chapter presented the results of survival analysis using the Cox proportional hazard model to estimate the risk of African-American head coaches being separated based on their prior productivity, experience, and level of assignments throughout 1985–2017 in the NBA.

During the research, I examined the effect of the key explanatory variable on the response variable. I estimated the key variable as having a unique effect on being separated and in combinations with several control variables such as prior productivity, experience, and year-period effect. Purposely, to estimate the joint effect, I also generated the interactions between the main regressor and the productivity variables as well as with experience and the assignment variables. However, most interactions and year-effect variables show insignificant results for interpretation.

The main finding of the research is not that African-American head coaches have a higher hazard than their white counterparts—if we estimate just the unique effect of the key explanatory variable RACEBlack on the probability of being separated. Definitely, this relationship should be investigated further, with different sets of control groups, which were not included in our observations. The most interesting estimate we were able to determine is the decrease in hazard rates for RACEBlack with the involvement of new control variables. In controlling for each additional variable, including 10- and 15-year period dummies, the results always show a decrease in hazard for African-Americans, which could be considered the absence of racial bias using existing factors in the study. On the other hand, in the case of interacted variables and with different segments for productivity and assignment level, we could not determine that the risk of being separated as an African-American head coach is higher than it is for a white coach due to insignificant estimates of the key explanatory variable.

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This chapter presents a comprehensive summary of the study on implicit racial bias in separations of NBA head coaches. The chapter summarizes the main aspects of this thesis, makes a conclusive analytical review, and offers recommendations based on the assessment results. Recommendations are provided for a separate group of professionals—scholars, researchers, and NBA executives—who are interested in the development of both communities.

B. SUMMARY

The study examined the risk of separation (firing/resigning/retiring) among African-American head coaches in the NBA and estimated the effect of possibly related factors, which would affect their tenure. Particularly, this thesis investigated the probability of being separated for African-American head coaches in a single tenure, based on their levels of performance (success or lack thereof), quality of assignments, and experience.

To create an informative basis for the research, the dataset was manually constructed from the official site of the National Basketball Association and Sports Reference, LLC, which provide personal and productive information about NBA head coaches. An additional source, *A Biographical Directory of Professional Basketball Coaches*, was used to review and clarify the information from the main sources. To straighten the scope of research, we focused on a more interracially presentable period with a large portion of African-American coaches and included all necessary observations from 1985 to 2017.

To explain the involved factors of examining the risk of racial biases in firings and other separations, we described all the variables and the purpose of their use in Chapter III. Tables 1–3 included the statistical summary of the deployed factors: the variable names, number of observations, and corresponding values.

In making connections between existing studies and this thesis, we noticed that the majority of previous research and publications were focused on investigations of racial bias in overall demonstrations. A very small part from previous research directly focused on the causes of coaches' separations (Wangrow et al., 2017). However, to summarize the existing scientific basis of racial discrimination, we surveyed studies from the last three decades and recognized the substantial decline in discrimination, suggesting that the area of research had been diluted (Fort et al., 2008).

To be confident that our intention to investigate the proposed topic was based on realistic issues, we relied on the words of researchers, who admitted the biases and limitations of the results. In order to investigate racial discrimination using different scientific approaches, we considered the most appropriate set of methods (Survival Analysis) for targeted questions.

The research was conducted under survival analysis using the Cox proportional hazard regression. In addition, parametric Weibull regression was used to verify the accuracy of the output from the Cox models. However, the Weibull distribution did not show any meaningful differences from the Cox proportional hazard models and, therefore, its regression results have not been described in detail. For simplicity, all estimates from the regression were interpreted in the form of hazard ratios and the percentage differences of the hazard.

Along with the main point of interest—the probability of being separated for African-American head coaches—the research purposely focused on the partial effects of covariates to determine the final model. First, we estimated the isolated effect of the key explanatory variable, consequently adding the control factors. Next, we considered the joint effect of created interactions between the key variable and variables of control groups. Various individual-specific effects were composed of tested models to estimate the best fit. Finally, in order to examine the issue in time-specific periods, we divided the observations for five- and 15-year periods, finally examining the differences throughout the observed regular seasons.

C. STUDY LIMITATIONS

Despite capturing the broad range of observations from regular seasons' statistics, the data still had some limitations. I constructed the dataset from 1985–2017 regular season statistics, which include quarterly divisions among the seasons. I intentionally omitted all observations earlier than 1985 because there were only a few African-Americans before that point. Another problem, which caused a move from the initial state of the dependent variable, was a lack of confidence in the distinction between firing and resigning.

Many sources, including Basketball Reference and NBA websites, have conflicting information about the real causes of leaving among coaches. This discrepancy level was so high (almost one-third of the whole population), that we decided to merge all firings and resignations and introduce a joint factor as a probability of being separated. Despite this merging, I strongly believe that firing and resigning are mainly caused by the same reason—experiencing problems achieving results. Moreover, coaches who had significant experience coaching a particular team as well as some success in the past were rarely fired, even with low productivity. In my opinion, this phenomenon is a matter of respect from owners and teams and has absolutely no connection to measurable values.

D. FINDINGS

First, we were able to determine that without involving any control factors, the probability of African-American head coaches being separated (fired/resigned/retired) is higher to some degree (a 32% hazard rate), which is based on some realistic factors not included in our models (e.g., salary caps, rosters, or different experience measures).

Second, I controlled for team quality (AQL) holding constant the difference in the level of assignments, which varies widely in the NBA. Several top franchises have flexibility in coach replacements still holding the same roster and top-ranked players. For new head coaches, the experienced and distinguished roster, or its stability, frames expected success, which also varies with the owners' expectations and teams' traditions. Therefore, holding the level of assignments (averaged three-year winning percentage) constantly affects African-Americans being separated at a 1.34 hazard ratio (34%

higher—a two percentage point increase from 1.32 hazard ratio), indicating that firings among all coaches is not solely affected by ethnicity or race.

Third, the prior seasonal (annual) experience of coaching in different tenures keeps the hazard ratio at the same level (1.34) for African-Americans, indicating that such experience has no significant effect on the probability of being separated.

Continuing the study, I deployed the productivity variables as control factors. The control group of prior (lagged) productivity variables shows their actual importance during the research. Their significance is as clearly visible in singular effects as in interactions with the key explanatory variable—despite showing some insignificant coefficients, their effect on the key variable was quite significant. We used different lagged variables to better predict the probability of being separated using productivity in previous quarters. The result of using such factors as control variables in the regressions are presented in some models (see Chapter IV), where the results for RACEBlack lose their explanatory significance. However, there is also some difference among those variables. The variable lag1wp (previous 20-game winning percentage) is always stronger than others (lagged variables). These differences show that in the NBA, as well as in other sports leagues, the prior or closest-to-the-current period of productivity plays an important role in securing any type of assignment. There is just the matter of how well the head coach performed in the past and how the nearest past credits the present and future, in the case of having some ongoing troubles.

Such findings indicate that African-American head coaches are more vulnerable than their white counterparts, and their separations rely more on current or prior productivity lagging 20 or 40 games back. This sort of racial bias still exists in the league, based on some factors unobserved in this research, such as trust between owners and the coaches, coaches' personal characteristics, and more. To estimate the differences in the probability of being separated across the observed period, I created 10- and 15-year period dummy variables and examined the hazard ratios for Africa-American head coaches in observable decades and in half-periods. According to the estimates, I determined that only in last period, 2010–2017, African-American head coaches

experienced a 27% higher risk of being separated than white coaches, holding all else constant.

In studying the regression results, I examined the probability of being separated by including the interactions between race and the productivity. Newly generated variables were used to explain how the various estimates of productivity differ across head coaches and demonstrate their joint effect on the probability of being separated.

In all models with interacted variables, the probability of being separated for African-American head coaches remains insignificant, ceteris paribus, whereas the productivity variables are most significant in models IEM 1–5 (see Chapter IV). This explains that the probability of being separated is solely based on the prior productivity and not on the significant estimating joint-effect of the key variable and control factors.

Finally, in the models with estimated results from different segments of control variables (AQL and EXPTxY), we stated that African-Americans (EXPTxY < 5) have a 29.2% greater risk of being separated than whites, at a 10% level. This result proves the existence of racial issues in separations. Again, in these series of models, we continually monitored the importance of productivity factors. For example, for coaches who have five or fewer years of coaching different franchises, a one-unit increase in variable lag2wp lowers the hazard by 66% while a one-unit increase in variable lag1wp lowers the hazard by 75%.

E. RECOMMENDATIONS FOR RESEARCHERS

Because this thesis has not determined any substantial existence of racial bias in the probability of being separated, our recommendations do not include any notable offers in the form of NBA policies to reduce this perceived problem. Our recommendations generally advise owners and general managers to pay attention to the interesting findings from this thesis, as well as encourage researchers to use our results in their attempts to further investigate various discrimination.

For further research, we highly recommend using the Cox regression group of models for survival analysis because of its flexibility in handling many covariates and

ability to manage jointly time-dependent or time-independent variables. In favor of the Cox group of models, we emphasize that included variables and their values are dependent on each other, which is why survival analysis was preferred to logistic regression with its binary output.

We recommend that areas for further study include different factors, such as the head coach's previous experience coaching at the assist level and the experience of playing in the NBA. We cannot predict whether the experience or previous personal achievements as a player will have a significant effect on the probability of being separated (fired/resigned/retired) because not all great players become successful coaches. Nevertheless, the personal charisma and respect of being a star may affect the owners' decision in firing a coach. On the other hand, the experience of being an assistant may also contribute to a coach's ability to handle the following promotion to a head coach position. Another group of independent variables should include various factors such as age, roster stability, players' and team's productivity, a capability of owners to overpay salary caps to keep high-level players, and playoff statistics among others. For example, it is common in all sports to keep rosters unchanged—or at least the starters who contribute to the team's success. Moreover, having enough money to pay for luxury taxes allows teams to hire expensive superstars. All of these recommendations are based on the author's initial ideas, which had been considered before constructing the data but were abandoned due to time and source limitations.

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