# THE EFFECTS OF EMPLOYEE HETEROGENIETY ON FIRM PERFORMANCE: MEASURING THE IMPACT OF INTERNATIONAL DIVERSITY IN THE NATIONAL BASKETBALL ASSOCIATION

A THESIS

Presented to

The Faculty of the Department of Economics and Business

The Colorado College

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Arts

By

Chris Mayo-Smith

May 2014

The Effects of Employee Heterogeneity On Firm Performance: Measuring the Impact of International Diversity in the National Basketball Association

Chris Mayo-Smith

May 2014

Economics

**Abstract**

The effects of team heterogeneity on a team's win percentage are measured using panel data from the 2002-2008 National Basketball Association (NBA). Technology increases have allowed global firms the options of hiring international workers. This thesis shows the benefits and problems associated with employing a geographical diverse workforce in the NBA. The Herfindahl-Hirshman Index was used to measure team diversity for the 30 NBA teams, which is regressed against regular season win percentage. The original results were not significant, but further regressions showed that increases in HHI and diversity, led to higher win percentages.

KEYWORDS: heterogeneity, National Basketball Association, human resource management

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED
UNAUTHORIZED AID ON THIS THESIS

Signature

TABLE OF CONTENTS


ABSTRACT iii

ACKNOWLEDGEMENTS iv

1 INTRODUCTION AND MOTIVATION 1

2 LITERATURE REVIEW 2

2.1 Labor Markets of Organizations …….......................................................... 2

2.2 Human Resource Management of Global Firms………………………......... 3

2.3 Labor Markets of professional Sports ..................................................... 5

3 THEORY AND MODEL 8

3.1 Dependent Variable…………………….........……………………............. 9

3.2 Team Ability…………………….........……………………........................ 10

3.2A Game Statistics…………………….........……………………........... 10

3.2B Payroll…………………….........……………………........................ 12

3.3 Coaching Ability…………………….........……………………................. 13

3.4 Diversity…………………….........……………………............................... 14

4 DATA 16

5 METHODS 19

6 RESULTS 19

6.1 Model One and Model Two…………………….........…………………….. 20

6.2 Model Three and Model Four…………………….........…………………... 22

7 DISCUSSION AND CONCLUSIONS 26

LIST OF TABLES

4.1 Summary Statistics Model One ………. ….…………………………….…...... 16

4.2 Player Productivity Mean by Geographic Region ………………………….. 18

6.1 Hypothesized and Actual Signs from Model One …………………………... 20

6.2 Random-Effects Regression for Regular Season Win Percentage ………….. 23

6.3 Correlation Matrix of Select Independent Variables………………………… 25

LIST OF FIGURES

3.1 Firm Performance Function …………………..………………………………. 8

3.2 Herfindahl-Hirshman Index ….………………………………………………….. 14

3.3 Model One ……...………...…………………………………………………... 15

6.1 Model Two ……..…………………………………………………………….. 21

# ACKNOWLEDGEMENTS

First, I would like to thank Professor Jim Parco for teaching me to embrace the process and struggle of writing independently, and for your sound advice and encouragement along the way. To Phoenix Van-Wagoner for your patience, time and cheer no matter the circumstance. I would like to acknowledge Professor Kevin Rask for your help and assistance in compiling my dataset, and your ideas on where I could go with my study. Thank you Professor Aju Fenn for your help in explaining certain sports economic theories. Finally, I would like to thank my red pen, which lasted through all of my edits.

*There's more to life than basketball, but there's more to basketball than basketball.*
~ Phil Jackson, 13 time NBA Champion

## 1. Introduction and Motivation

"Brazil rebounds the ball and passes it to France. Argentina is running up the court and moves into position to catch the ball. Argentina deftly sidesteps his defender and drops the ball off to United States for a slam-dunk!" The previous sentences represented a San Antonio Spurs play from the 2012-2013 National Basketball Association (NBA) season. Players' country of origin was substituted for their actual names. This example falls within the realm of the effects diversity on organizational success. This paper is falling within this field of research by trying to answer the question: *What are the effects of employee heterogeneity on a firm's performance*? This will be measured through regular season win percentage in the National Basketball Association from the 2002-2003 to the 2008-2009 seasons.

There are costs and benefits associated with incorporating international employees in any business (Cunningham, 2007; Fink & Pastore, 1999; Kahane, Longley, & Simmons, 2013). These are seen through the increased costs in adapting the personnel to the cultural and language differences (Cunningham, 2007; Fink & Pastore, 1999). International employees can also bring unique talents and ways of approaching problems that are different from domestic employees (Eschker, Perez & Siegler, 2004; Kahane et al., 2013; Ottaviano & Peri, 2006).

Over the past twenty years, there has been an explosion of international talent recruited to play in the NBA (Eschker et al., 2004). In the 1999-2000 NBA season 35 players identified as international, while in the 2012-2013 season that number grew to 83 international players from 36 countries accounting for 18% of total NBA rosters (NBA, 2012). This trend of recruiting international talent has not only been seen in professional sports, but also in other highly competitive markets such as technology firms and pharmaceutical companies where the search for talent is not just a domestic affair but an international one (Storey, 2009). Measuring this trend in the NBA is a way to highlight one macro trend being seen in the labor market of the United States.

Firms want to know whether or not the increased costs of employing these diverse workers outweigh what they bring in a unique skill set.[1] The NBA provides a dataset that will allow this information to be attainable as well as measurable. This study looks at the level of international diversity through the Herfindahl-Hershman Index, and how this impacts win percentage.[2]

## 2. Literature Review

### 2.1 Labor Markets of Organizations

Organizations seek to maximize performance given capital constraints (Giambatista, 2004; Murray 2010). Of specific interest is the human capital constraint.

[1] European players have often been regarded as having stronger fundamentals across all player heights, as opposed to tall domestic players who often rely on dunks. Furthermore, certain moves, such as the "euro-step" have originated from international player influences.
[2] International diversity is measured by having NBA players in one of six potential geographic regions: USA/Canada, Europe, Africa, South/Central America, Asia/Australia and other.

The nature of these human capital constraints have changed in recent years as companies shift organizational form and structure (Kahane et al., 2013). Bureaucratic organizations, with strict lines of communication and a hierarchical leadership structure, are not always suited for the contemporary challenges posed (Storey, 2009; Cunningham, 2007). Dramatically overstating organizational change and the nature of labor markets is something of which to be wary (Storey, 2009). However, with the increase in the diversity and breadth of talent pools globally, as well as changes in technology, the competitive landscape for companies is as fierce as it has ever been (Fink & Pastore, 1999; Erhardt, 2003; Lazear 1999).

This new landscape makes understanding how to effectively employ a heterogeneous workforce critical. Potential international employees are competing for, and winning, highly skilled jobs that were previously inaccessible to them (Storey, 2009; Hankin, 2005; Lazear, 1999). These new employees are working for companies, or global firms, that are open to hiring them. A global firm is a firm whose employees stem from a diverse set of cultures and countries (Lazear, 1999). With increases in technology and communication areas of the world previously unconnected are now accessible to these global firms if they have sufficient human resources and recruiting.

**2.2 Human Resource Management of Global Firms**

Global firms in the technology (Storey, 2009), pharmaceutical (Storey, 2009), healthcare (Storey, 2009) and sports (Fenn, 2005) industry are seeing an influx in high level international employees. The human resource management teams (HR) in these industries understand recruiting and training a new employee comes with certain sunk costs. These sunk costs, of time and money, often increase when HR has to cater to the legal, lingual and cultural differences from diverse backgrounds (Lazear, 1999; Cunningham 2007). One question to raise is: are added benefits from a culturally heterogeneous workforce worth the increased start up and acquisition cost associated with hiring them (Lazear, 1999; Simmons & Berri, 2011; Surdam, 2012)?

Effectively managing this question, of employing heterogeneous workers or not, will give organizations a competitive advantage in their field (Cunningham, 2007; Lazear, 1999). To do this, HR needs to accurately convey the positive and negatives which can stem from a diverse international group. Cultural heterogeneity among workers has been shown to bring about diversity in thought and a uniqueness of skill set (Lazear, 1999), two potentially valuable assets. This can lead to increased creativity and innovation in problem solving, as well as fostering a more open work environment (Cunningham, 2007; Lazear, 1999).

In contrast, too much difference has the potential to lead to communication deficiencies or coworker resentment (Kahane et al., 2013). Today, increasing diversity is often an anecdotal answer to all problems companies face. However, understanding the dichotomy of diversity makes selecting the proper diversity management technique essential for global firms (Lazear, 1999; Cunningham, 2007, Storey, 2009; Kahane et al., 2013).

These global firms are challenged by the lack of quantitative measurements or statistics on diversity (Kahn, 2000; Lazear, 1999; Ottaviano, 2006). This stems from the difficulty the public has in acquiring performance and demographic statistics on a population or company (Kahane et al., 2013; Kahn, 2000; Lazear, 1999; Ottaviano, 2006). Certain research has found a robust correlation between an increase in foreign-born residents and the financial impact on cities (Ottaviano, 2006). This macro-level analysis is not of concern in this study. Another study found that increasing board of director diversity had a positive impact on financial performance (Erhardt, 2003). Although this micro level analysis was focused on diversity, it did not provide an analysis of specific organization team structure (Erhardt, 2003), which is the subject of interest in this paper. Therefore, measuring firm output as a function of worker diversity is extremely challenging, if not impossible, in most industries (Kahane et al., 2013; Kahn, 2000; Lazear, 1999).

### 2.3 Labor Markets in Professional Sports

The professional sports industry in North America is an exception to acquiring worker and firm data. It is an industry where, as Kahn (2000) notes, "…we know the name, face and life history of every production worker and supervisor in the industry. Total compensation packages and performance statistics for each individual are widely available." Furthermore, professional sports in North America have seen a dramatic increase in foreign employees over the past two decades (Eschker, 2004). Sports, therefore, are able to empirically answer certain labor market questions that other industries cannot (Kahn, 2000).

Scully's seminal work (1974) estimated a production function in sports for the first time. The output, Major League Baseball (MLB) teams win percentage, was modeled as a function of worker, managerial and team skills. Kahane (2013) built upon this general model by adding a variable of team diversity to examine potential gains of employing culturally diverse work teams by using panel data from the National Hockey League. That study examined the specific distribution of players from geographic regions using a Herfindahl-Hirschman index (HHI). This was a new approach to using the HHI in sports, where HHI is often used to measure competitive balance and inequalities amongst teams (Dorian, 2008).

The current study builds on the works of Scully, Kahane, and others through examining a different industry and dataset from the National Basketball Association (NBA). Previous basketball literature has examined the effects of other factors on firm output in the NBA such as change in coaching status and pay inequality (Hofler & Payne, 2006; Martinez, 2013; Simmons & Berri, 2011). Kahn (1988) highlighted the negative effects of discrimination, based on race, in the NBA during the 1980s. In the 1990s, impacts on salary discrimination were measured through the lens of international diversity (Eschker, 2004). Eschker found that international players were being paid a premium over equivalent domestic players for the 1996-1997 and 1997-1998 seasons. A dramatic increase in international players during this time led to what Eschker called the ‘winner’s curse.’ Teams overpaid for players before they had developed resources to accurately scout and evaluate them (Jozsa, 2011; Eschker, 2004). This example shows the importance of why having a solid HR management plan relating to internationally diverse players is important in any industry.

The impact on output of team racial and age diversity has also been studied in professional sports. Using NBA and MLB data from 1950-1997, Timmerman found that an increase in race and age diversity in the NBA had a negative impact on team output (measured in win percentage), while not affecting baseball (Timmerman, 2000). Different sports require different amounts of teamwork and interdependence. Baseball does not require a high level of interdependence amongst players, but is more a sum of individual performance.  Whether or not a MLB player gets a hit rarely, if ever, depends upon his teammates direct actions (Timmerman, 2000). Basketball, in contrast, requires a high level of interdependence, which can be seen by watching any level of play. Conflict and uncooperative behavior based on racial stereotypes seem more likely to affect performance in basketball, and other highly interdependent sports, where teammates have to work together on both the offensive end (to score points) and defense end (stopping opponents from scoring) to produce results (Timmerman, 2000).

There are competing theories on the effects of employing a completely heterogeneous or homogenous workforce on performance (Timmerman, 2000; Janis, 1972). These differing theories will be evaluated empirically by trying to answer the question: what are the effects of employee international heterogeneity on firm output in the NBA? This will be examined by measuring the effect team heterogeneity had on regular season NBA win percentage from the 2002-2003 to 2008-2009 seasons. Extrapolating professional sports labor market data to other industries has it limits (Kahn, 2000). The availability of statistics, an internationally diverse pool of workers, and previous literature surrounding similar questions makes this question feasible and relevant to any industry or firm looking to have a heterogeneous workforce (Hofler & Payne, 2006; Zak, Huang & Siegfried, 1979; Berri 2013).

## 3. Theory and Model

Outputs are a function of their inputs; the difficulty is in finding inputs that represent the outputs in the most effective way. For an input to be effective, it should be empirically measurable and also relate to the output in a significant way. Skully (1974) highlighted that certain inputs in sports contribute more effectively to a team's output. These inputs for sports, in general, are worker talent and managerial ability (Skully, 1974). The additional input that is measured in this study is that of team diversity. The first two inputs are used as a control to allow for the focus input, team diversity, to be measured. Therefore, the general function used to model a NBA team's success in the regular season from 2002-2008 is:

$$\textit{Firm performance}_{i,t} = f\left(\textit{worker talent}_{i,t}\ \textit{managerial skill}_{i,t}\ \textit{team diversity}_{i,t}\right) \qquad (3.1)$$

Where the subscript *i* refers to the specific year and the subscript *t* refers to a specific team.

The following theory section elaborates on function 3.1 by explaining the specific variables that were used to measure win percentage. These variables were used in a generalized least squares regression to measure regular season win percentage in the NBA from 2002-2008. The general function is used to establish the basic premise of the final model. This section will start by describing the reasons that the specific variables were decided upon, along with their hypothesized effects on the dependent variable. Next, the theory section will show the complete equation that was originally used to measure win percentage. The section will conclude with a brief explanation of other models.

**3.1 Dependent variable**

This study used a team's on court success as a measure of output and performance. Output in this study was measured by calculating a team's win percentage during the regular season, which is standard in many sports economic papers (Kahane et al., 2013; Timmerman, 2000; Giambatista, 2004; Fizel, 1997). Win percentage is the percentage of games a team won divided by total games. For the years measured (2002-2008), all teams played in 82 games per season. A team wins in basketball by scoring more points than its opponent in the 48 minutes of playing time. In the event that the teams are tied at the end of 48 minutes, they play a 5-minute overtime period. These overtime periods continue until one team has more points than the other team at the conclusion of overtime.

### 3.2 Team Ability

**A. Game statistics.** The team, for the purposes of this study, was composed of players who played at least 984 minutes in a regular season, which averages out to 12 minutes a game.[3] Therefore, each team had approximately nine players, which are typically the players affecting the outcome of games the most.[4] From this point forward, players will refer to these players averaging more then 12 minutes a game. Individual player skill vectors were combined as weighted averages based on minutes played to produce team-by-team statistics. Using weighted averages based on minutes for player skill vectors was justified because it is assumed that players with more minutes have a larger impact on team performance. These team statistics were field goal percentage (FGP), free throw percentage (FTP), three point field goal percentage (TPFGP), Rebounds per game (RebsGame), and turnovers per game (TOG).

FGP, FTP and TPFGP are all offensive measures of efficiency. These measured directly impact the total points scored for a team. A team wins when it scores more points than an opponent, so measuring the efficiency in terms of scoring is a logical measure of talent. A free throw (foul shot), is awarded in basketball for many different reasons, but

[3] In the case of trades, the player is measured for the team that they have played more games for only if they have accumulated at least 984 minutes for that team. For example, Ron Artest played 40 games for Sacramento Kings in 2005 and only 16 for the Indianapolis Pacers. In the 40 games he accumulated more than 984 minutes 82*12 minutes per game. This way we are only taking into account trades of very high caliber players, who affect the output of the team from their trade.

[4] The maximum number of players allowed on an NBA active roster during the regular season is thirteen.

is most often when the opponent fouls a player in the act of shooting.[5] One successfully converted free throw results in one point for the team shooting. A field goal is awarded in basketball to any team that gets the ball in the hoop, with the exception of a free throw, and is worth either two or three points. Field goal percentage shows how efficiently a team scores with the possessions that they have. A higher field goal percentage will result in more points each time the team has the ball. Three point field goals (worth three points) are awarded to a team when the ball is shot from behind the three-point arc. Three points is the most points that can be scored on a single shot attempt in basketball. All else being equal, an increase in the offensive efficiency measures of FTP, FGP and TPFGP are hypothesized to increase team win percentage.

The next statistic measured, RebsGame, is a proxy for defensive efficiency. Rebounds show how frequently a team regains possession after a missed shot attempt. If an opponent misses a shot, which is oftentimes the result of strong defense, then a defensive rebound allows the team to have an offensive possession, and a chance to score. More defensive rebounds, in general, result in a lower field goal percentage for the opponent, and thus fewer points. Offensive rebounds are also recorded in the rebounds per game measure. Offensive rebounds allow a team to retain possession of the ball after a missed shot attempt. Increasing a team's possessions is an effective way to score

[5] Foul shots can also be awarded when a team commits over four fouls in a quarter. Once the fifth foul is called, whether the player was shooting or not, he is awarded two free throws, unless it was an offense foul. A technical foul (given when a player or coach is unsportsmanlike)is another event where one free throw is awarded to the opposing team. Finally, a flagrant foul (awarded when a player fouls with excessive contact), results in the opposing team shooting two free throws.

points, while also limiting the number of opponents' possessions. Therefore, ceteris paribus, it is hypothesized that an increase in rebounds per game will have a positive impact on winning percentage. The final statistic aggregated from player skill vectors was turnovers. A turnover is when the team gives the ball away to the opponent without getting off any shot attempts. Higher turnover rates per game represent inefficiency in possessions. Other things equal, an increase in turnovers per game will decrease a team's performance.

**B. Payroll.** Another statistic that relates to win percentage is payroll. Payroll is a sum of all players' salaries on the team. A player's salary is assumed to be a measure (albeit imperfect) of individual talent. Talent is often measured by in-game statistics such as the ones listed in 3.2A. However talent, and a player's salary, can also take into account softer, less quantifiable skills such as leadership ability or the effect a player has on the locker room (Kahane et al., 2013). It should be noted that payroll as a measure of team ability has its flaws, as individual salaries are negotiated in a restricted labor market (Kahane et al., 2013; Fenn, 2006). Furthermore, NBA team salaries are worth tens of millions of dollars, so even a relatively large numerical change in payroll will have a minor impact on win percentage.

For this reason, salary ratio measured by team payroll divided by league averaged payroll, was used as an independent variable in the original model. This variable attempts to measure the overall talent of a team in comparison to others. The squared value of the relative payroll was also computed, following Kahane (2013), to take into account diminishing returns of performance. The team salary data was a sum of the entire rosters salaries, regardless of total minutes played. It is assumed, however, that the highest paid players are the ones playing the most minutes, so the salary data is a close proxy. It is hypothesized that, ceteris paribus, higher SalaryRatio and SalaryRatioSq will have a positive impact on win percentage. Equation 3.1 simplified the output of team performance to three categories of inputs. This section expanded the first input, worker talent, to the variables that will be used in the final model.

**3.3 Coaching Ability**

The second input in equation 3.1 is managerial skill. Managerial skill was measured by calculating a coaches' career win percentage, which follows aspects of previous studies measuring coaching ability[6] in sports (Martinez, 2013; Kahane et al., 2013). Career win percentage was calculated by dividing the total number of games won as coach by total games coached. A coach is responsible for creating a game plan that will best organize and motivate his players and the team to win (Martinez, 2013). In this sense, a coach's role is similar to a manager within an organization, who oversees and directs employees towards success. A basketball coach decides the amount of playing time a player gets, and what combination of players are on the court together. Since basketball has such a high degree of interdependence, it is important to put players on the court together who will succeed (Timmerman, 2000). This high degree of interdependence can lead to disputes and disagreements within a team, and it is often the

[6] In cases where there has been a midseason change of coach, the coach with the higher number of total games coached in that specific season will be measured.

job of a coach, as it would be for a manager in a firm, to settle them fairly and justly. A skilled coach will do these things more frequently, and thus have a better chance of winning games. Therefore, other things held constant, it is hypothesized that higher career coaching win percentage will improve a team's performance.

**3.4 Diversity**

The final input in equation 3.1 is team diversity. Diversity or international heterogeneity in this study was looking at the international make-up of teams by employing the Herfindahl-Hirshman Index (HHI). The HHI in this study was used to measure the concentration of international players on a team.[7] Players were placed in one of six geographic regions. The regions were USA/Canada, Europe, Africa, South/Central America, Asia/Australia and Other[8]. This is building on the work of Kahane who used the HHI when measuring heterogeneity in the NHL. The index is shown below:

$$HHI=\sum(MS_{it})^2 \tag{3.2}$$

where $MS_{it}$, or market share, is the percentage of players on team *t* from one of the six geographic regions in year *i*. Therefore a team with no diversity, or all players from one region, would have an HHI=1. The HHI was employed to record a more accurate depiction of diversity then past sports literature, where diversity was measured through dummy variables (Eschker & Perez, 2004). By incorporating more regions than simply

[7] An international player was defined as a player who was born outside of the United States or Canada and did not play in the U.S. until at least age fifteen. Loul Deng, for example, was defined as international player, even though he played one year collegiately at Duke.

[8] The other category was reserved for players not fitting any of the other categories. Israel and Haiti are examples of two countries labeled as other.

international or domestic a more accurate depiction of diversity should be achieved. The HHI was calculated for every team for all of the years measured.

Within the NBA, the majority of players are not international. For this reason the numbers will be skewed towards the domestic group. To account for this, international players minutes as a percentage of total team minutes was simultaneously calculated. This measure is called the Ratiointlmins and is following what Kahane did to account for a similar problem when examining international diversity in the NHL (Kahane et al., 2013).

Therefore, the original model (Model One) for measuring regular season win percentage is below:

$$WinPercentage_{i,t} = \beta FGP_{i,t} + \beta FTP_{i,t} + \beta TPFGP_{i,t} + \beta Rebsgame_{i,t} + \beta TOG_{i,t} + \beta Salaryratio_{i,t} + \beta Salaryratiosq_{i,t} + \beta careerwinpct_{i,t} + \beta HHI_{i,t} + \beta Ratiointlmins_{i,t} + \varepsilon_{I,t} \quad (3.3)$$

Where $\text{WinPercentage}_{it}$ represents the win percentage in year *i* for team *t.* The results section(6) shows the regression results of Model One as well as the regression results of three other models. These later models are adjusted versions of Model One based off of theoretical reasons for change. Explanations of these models was not included in this section(3) as they were adjusted and changed after having ran the original regression in order to get more statistically significant results as measured by p-values. To include them in the theory section would be considered data mining and for this reason they are in the results section.

## 4. Data

Table 4.1 below shows the summary statistics for Model One as well as the data sources from where they were gathered. The data measured was unbalanced panel data from the 2002-2008 NBA seasons. The data was unbalanced because the NBA had 29 teams for the first two year measured (2002-2003), until the Charlotte Bobcats were added as an expansion team in the 2004 season. A total of 208 team observations were measured and recorded in the dataset.

Table 4.1- Summary Statistics Model One (n=208 observations)

| Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| Winpct | 0.50 | 0.15 | 0.16 | 0.82 |
| Fgp | 0.46 | 0.02 | 0.42 | 0.51 |
| Ftp | 0.76 | 0.03 | 0.65 | 0.85 |
| Tpfgp | 0.27 | 0.04 | 0.17 | 0.41 |
| Rebsgame | 37.91 | 4.18 | 24.81 | 49.85 |
| Tog | 13.10 | 1.67 | 8.44 | 18.22 |
| Salaryratio | 1.00 | 0.22 | 0.40 | 2.01 |
| Salaryratiosq | 1.05 | 0.51 | 0.16 | 4.03 |
| Careerwinpct | 0.51 | 0.10 | 0.26 | 0.70 |
| HHI | 0.77 | 0.17 | 0.34 | 1.00 |
| Ratiointmins | 0.14 | 0.12 | 0.00 | 0.55 |

Note: All data from Basketballreference.com, with the exception of salary information from Eskimo.com/~pbender.

Professor Kevin Rask assisted, using SAS coding, in transferring an excel spreadsheet containing 1,747 player skill vectors, player diversity statistics and coach career win percentages to a team based spreadsheet. Next, the salary ratio and salary ratio squared were added on to this team-based spreadsheet. The team statistics compiled in the final excel dataset can be seen in table 4.1. HHI information was calculated for each team individually after all other data had been compiled

Having a disjoint skill set between international and domestic workers is important when considering employing them in a firm (Kahane et al., 2013; Lazear, 1999). For this reason a difference in means test of player statistics by geographic region (using p-values) was performed on the original excel dataset. These mean player performance measures can be seen in Table 4.2. Table 4.2 reveals that there are statistically significant differences in skill sets between different geographic regions. The null hypothesis in the testing of the means is that there is no difference between means for different groups.

Field goal percentage for all of the regions, with the exception of the Other region, was seen as significantly different from the aggregated means of all other regions. The African region was seen as significantly different from the aggregate mean for all five of the performance measures. Of particular note, the European region (which had the second highest number of observations after the domestic region) had a statistically significant difference in mean from the domestic region in FGP and TOG. This could be the result of European training and coaching, which is known for its emphasis on shooting and skill work from a young age. Lazear highlights the necessity for disjointed skill sets in worker ability for hiring international talent, and Table 4.2 supports that notion (1999).

Table 4.2- Player Productivity Mean By Geographic Region

| | Performance Measure | | | | |
|---|---|---|---|---|---|
| Int'l Region | FGP | FTP | TPFGP | RPG | TOG |
| Domestic (n=1495) | | | | | |
| Mean | **0.45** | 0.76 | **0.27** | **4.76** | **1.66** |
| (P-value) to reject null | **(0.000)** | (0.41) | **(0.025)** | **(0.015)** | **(0.009)** |
| European (n=164) | | | | | |
| Mean | **0.46** | 0.76 | 0.26 | 4.91 | **1.50** |
| (P-value) to reject null | **(0.093)*** | (0.73) | (0.78) | (0.58) | **(0.003)** |
| South American (n=52) | | | | | |
| Mean | **0.48** | 0.74 | 0.23 | 4.86 | 1.60 |
| (P-value) to reject null | **(0.006)** | (0.22) | (0.13) | (0.89) | (0.56) |
| African (n=17) | | | | | |
| Mean | **0.48** | **0.70** | **0.15** | **6.57** | **1.31** |
| (P-value) to reject null | **(0.036)** | **(0.016)** | **(0.016)** | **(0.017)** | **(0.01)** |
| Asia/AUS (n=12) | | | | | |
| Mean | **0.52** | 0.75 | 0.17 | **8.911** | **2.44** |
| (P-value) to reject null | **(0.000)** | (0.97) | (0.29) | **(0.000)** | **(0.001)** |
| Other (n=7) | | | | | |
| Mean | 0.48 | 0.76 | 0.25 | **3.50** | **1.08** |
| (P-value) to reject null | (0.37) | (0.72) | (0.76) | **(0.045)** | **(0.039)** |

Note: Mean values are pooled across players for all seasons measured with their weighted averages. Null hypothesis is that group identified mean is the same as all other observations in data set. P-values are assuming unequal variance. Bolded entries show significance at 5% to reject null hypothesis. Bolded and stars show 10% significance.

The low number of observations for certain geographic regions in Table 4.2 is of concern. These low numbers lead to certain individual players contributing more to the mean performance measures then a domestic counterpart.[9] This highlights the need to gather more years of data to increase the number of observations for both team and player statistics.

[9] For example, Yao Ming, a 7'5" Chinese center, is responsible for the inflated Asia/AUS RPG numbers as compared to the pooled means of other regions. This is because he accounts for the majority of observations in the years recorded, and always averaged many rebounds a game.

## 5. Methods

Table 4.2 highlighted the statistical difference between players of geographic regions. What still needed to be determined was if this difference in skill set lead to an increase in wins for teams. To do this a random-effects generalized least squares regression was used on the data.[10] A random-effects model was chosen, as opposed to a fixed-effects model, after results from a Hausman Test favored the random effects model. The generalized least squares (GLS) regression was run because the tests were trying to isolate the effects on all the teams in the NBA, and GLS was able to do this more accurately then an ordinary least squares regression.

Furthermore, tests allowed the non-normality of error terms and heteroskedasticity to be confidently rejected. A correlation matrix was used to test for the presence of multicollinearity. Serial correlation was tested for and present in the models, but this was to be expected, as the performance of a team will likely have an affect on their performance in the following year.

## 6. Results

Adding or removing variables to an original model after having ran a regression, and not reporting it, is tantamount to data mining. The regression results of all models can be seen in Table 6.2, which shows a random effects generalized least squares regression for regular season win percentage in the NBA from 2002-2008. However, to show the process of discovery that was involved in creating these models (and to help

[10] Stata 13 software was used to conduct all regressions and tests on the dataset

potential research looking to build off of this work), this section is separated into two sections. The first section(6.1) discusses the results of Model One and Model Two and what was learned from these models. Section 6.2 builds on what was learned in Section 6.1 while exploring the results in a more substantial way.

**6.1 Model One and Model Two**

Table 6.1 shows the hypothesized and actual signs from Model One (equation 3.3), along with the level of significance for each variable when regressed.

Table 6.1 - Hypothesized and Actual Signs from Model One with Levels of Significance

| Variable | Hypothesized Sign | Actual Sign | Statistically Significant |
|---|---|---|---|
| Field Goal Percentage (FGP) | + | + | *** |
| Free Throw Percentage (FTP) | + | + | NO |
| Three Point FGP | + | + | * |
| Rebounds/Game | + | + | *** |
| Turnovers/ Game | - | - | *** |
| Salary Ratio | + | + | NO |
| Salary Ratio Squared | + | + | NO |
| Career Win Percentage | + | + | *** |
| HHI | - | + | NO |
| Ratio International Minutes | + | + | NO |

Note: ***p<0.01, **p<0.05, *p<0.1

The hypothesized values of Model 1 were all correct, with the exception of HHI, but what was of larger concern and note was the level of significance that the independent variables had. Five of the ten variables, FTP, SalaryRatio, SalaryRatioSq, HHI and RatioIntlMins all came back as statistically insignificant at the 90% level. This means that the null hypothesis, that these variables hold no explanatory power, cannot be reject with a statistically significant level of confidence.

Model One did not provide the level of explanatory power that the research and literature review had anticipated. Therefore, Model Two (equation 6.1) was created after further thought and research, with the hope that it would be able to better explain the effect heterogeneity has on firm output. That model is below:

$$WinPercentage_{i,t} = \beta FGP_{i,t} + \beta Rebsgames_{i,t} + \beta TOG_{i,t} + \beta Salaryratio_{i,t} + \beta careerwinpct_{i,t} + \beta HHI_{i,t} + \beta Ratiointlmins_{i,t} + \varepsilon_{I,t} \quad (6.1)$$

Where $WinPercentage_{it}$ represents the win percentage in year *i* for team *t.* In creating equation 6.1, three of the independent variables were removed from Model One (equation 3.3). First, the variable of FTP was justifiably removed because free throws only represent one point, and do not occur as often as field goals. Second, the TPFGP variable was removed because FGP takes into account both two and three point field goals, so the effect of TPFGP is still being measured. Finally, SalaryRatioSq was removed as salary ratio covers the same basic premise that salary ratio squared does.

The best fitting equation (measured in R Squared) between the first two Models measuring win percentage is Model One, but it only has a slight edge. However, the lack of significance in Model One, led to the creation of Model Two. In Model Two, the original focus variables of HHI and the RatioIntlmins, have significance at the 10% level.

The coefficient of HHI in Model Two was positive, which infers that moving towards homogeneity has a positive impact on win percentage. RatioIntlmins was also significant and had a positive coefficient. Interpreting the two focus variables led to the realization of a flaw in the original theory. The independent variable of RatioIntlmins was defined as "international players minutes as a percentage of total team minutes." HHI is measuring player composition within a team, while RatioIntlmins is measuring minutes played. This apples-to-oranges comparison makes interpreting the HHI in relation to the dependent variable of win percentage difficult.

**6.2 Model Three and Model Four**

To fix the flaw in the original theory an independent variable of Relative International Share (RIS) was created to replace RatioIntlMins and used in Model Three and Model Four. RIS is the number of international players on a team divided by the league average of international players. Thus, RIS and HHI allow the relative number of international players on a team to be calculated, and also show which teams have relatively high shares of players from the same international group.

Model Three in the Table 6.2 has the same independent variables as Model One with the exception that Ratiointlmins is now RIS. This same concept is true with Model Two and Model Four. The focus variables of HHI and RIS in Model Three and Model Four are positive and significant at the 1% level or better. The positive coefficients of both of these variables lead to some interesting conclusions.

Table 6.2- Random-Effects Regression for Regular Season Win Percentage

| **Variables** | [1] Coefficient | [2] Coefficient | [3] Coefficient | [4] Coefficient |
|---|---|---|---|---|
| FGP | 2.48*** | 2.71*** | 2.68*** | 2.94*** |
| | (0.484) | (0.436) | (0.470) | (0.430) |
| FTP | 0.012 | - | 0.096 | - |
| | (0.288) | | (0.288) | |
| TPFGP | 0.300* | - | 0.308** | - |
| | (0.164) | | (0.149) | |
| Rebs Game | 0.015*** | 0.016*** | 0.014*** | 0.015*** |
| | (0.008) | (0.016) | (0.002) | (0.002) |
| TOG | -.025*** | -0.027*** | -0.024*** | -0.027*** |
| | (0.006) | (0.006) | (0.006) | (0.006) |
| Salary Ratio | 0.247 | 0.043 | 0.270 | 0.037 |
| | (0.234) | (0.050) | (0.229) | (.041) |
| SalaryRatioSq | -0.096 | - | -0.108 | - |
| | (0.098) | | (0.094) | |
| CareerWinPct | 0.606*** | 0.621*** | 0.612*** | 0.630*** |
| | (0.089) | (0.089) | (0.091) | (0.092) |
| HHI | 0.204 | 0.220* | 0.174*** | 0.179*** |
| | (0.129) | (0.126) | (0.058) | (0.056) |
| RatioIntlMins | 0.261 | 0.284* | - | - |
| | (0.170) | (0.164) | - | |
| RelativeIntlShare | - | - | 0.031*** | 0.031*** |
| | | | (0.011) | (0.01) |
| Constant | -1.71*** | -1.54*** | -1.74*** | -1.569*** |
| | (0.295) | (0.237) | (0.260) | (0.196) |
| Overall $R^2$ | 0.569 | 0.552 | 0.569 | 0.55 |
| Observations | 208 | 208 | 208 | 208 |

Note: ***p<0.01,**p<0.05,*p<0.10. Robust standard errors in parenthesis. Model number in brackets.

An increase in HHI means that the level of diversity within a team is going down. The positive coefficient implies that lowering levels of diversity has a positive impact on team win percentage. This was not in line with the original hypothesis, but does show why only having HHI, without RIS, as a measure of diversity is problematic. The positive coefficient of RIS implies that teams with relatively greater number of international players will have an increase in win percentage. This indicates that if HHI is equivalent, then teams with higher RIS will do better. It also indicates that if a team has the same relative share of international players, then a higher HHI (indicative of a concentration of diversity) will lead to a better win percentage.

These results theoretically make sense, considering the costs that come with employing international players, if players are coming from similar geographic areas they are more likely to share cultural or lingual identities. This would potentially decrease the HR integration costs associated with employing international workers. Another possible reason is that if there are a relatively higher percentage of international players from the same region, they are less likely to feel isolated within the team. Another potential hypothesis, which necessitates further research, is that foreign workers lead to an increase in productivity for domestic and/or foreign workers (Ottaviano, 2006). This could be from differences in the psychological approach to work and teamwork that international players have opposed to domestic workers (Kahane, 2013).

The control variables of FGP, TPFGP, REBSGAME, TOG and CareerWinPct have significant coefficients for Model Three. An increase in all of these statistics, with the exception of TOG, has a positive impact on regular season win percentage. The coefficients of Salary Ratio and SalaryRatioSq do not have any measurable level of significance in Model Three. The variables in Model Four all hold the same signs and level of significance as Model Three. There are not any significant differences in the magnitudes of coefficients between the two models either. The greatest difference is seen in Model Four's FGP coefficient, which is 0.26 higher than Model Three. This could be from it having more explanatory power stemming from omitted variable bias.

Another problem affecting the coefficients of the Models is the presence of multicollinearity. Table 6.3 highlights the high degree of correlation that exists between HHI-RIS, RebsGame-TOG, and Salary Ratio-SalaryRatioSq.

Table 6.3- Correlation Matrix of Select Independent Variables

| Variables | TOG | RebsGame | RIS | HHI | Salary Ratio | Salary Ratio Sq. |
|---|---|---|---|---|---|---|
| TOG | 1.000 | | | | | |
| RebsGame | **0.567** | 1.000 | | | | |
| RIS | 0.0158 | 0.1487 | 1.000 | | | |
| HHI | 0.0086 | -0.0562 | **-0.8645** | 1.000 | | |
| Salary Ratio | 0.0347 | 0.0607 | -0.0913 | 0.1345 | 1.000 | |
| Salary Ratio Sq. | 0.0499 | 0.0497 | -0.0930 | 0.1459 | **0.9828** | 1.000 |

Note: Bolded numbers display high multicollinearity. Variables with low collinearity were left out.

HHI and RIS are noted as being related, but both still give explanatory power to the models. Having RIS out of the model makes HHI insignificant. For this reason, even with the high degree of multicollinearity, the RIS allows for a more accurate measure of HHI to be recorded. The correlation that exists between TOG and RebsGame is not as high as HHI-RIS. The theoretical reasons for keeping these two variables is still sound, so in future studies an increased sample size could reduce the multicollinearity. The final variables that displayed multicollinearity were Salary Ratio, and SalaryRatioSq. This correlation was to be expected, as it is a squared value. The theoretical reason for having both of these variables was to account for diminishing returns of performance from increased salary.

## 7. Discussion and Conclusions

The need for understanding the impacts of diversity on performance is crucial in a more globalized world. The data and results gathered examined the impacts of diversity on intra-firm level performance. Results found that increased international workers have a positive impact on performance in the NBA. Furthermore, performance was enhanced if the composition of workers are coming from the same geographic region. This could be applied to a HR department if they have a choice of hiring two international employees, one of whom is of the same nationality or from the same geographic region as a current worker in the firm.

The reasons for this improved output could come from the decreased integration cost that a firm would spend, as they have experience integrating people of similar cultures and nationalities. Consequently, the less time and effort spent getting the new employees accustomed to the workplace environment and team dynamics allows for more time spent on other problems or projects for the remaining members of the firm. Along with decreasing costs in recruitment and training, having international employees from the same geographic area could lead to greater feelings of camaraderie and teamwork between them. Further research into the specific affects international employees have on individual worker outputs should be explored.

Increasing the relative share of international players on an NBA team was found to lead to an increase in victories. This could potentially result in the mindset that having a team composed of all international players, mainly from the same geographic region, would be the best possible combination for a team to increase win percentage. Although the model results imply this, there are certain limits to be acknowledged. For example, the availability of high-level basketball talent in the United States is extremely high. This is due to a large population, and existing structures, such as the National Collegiate Athletic Association, that allow players to develop and compete in the spotlight of NBA recruiters. Currently, in many of the other geographic regions that were used to measure diversity, highly competitive professional leagues or athletic associations do not exists to prepare players for the NBA.[11] Therefore, although diverse team dynamics leads to increased wins, the current talent pool is probably not large enough to support a switch to a completely international NBA team. However, as basketball becomes a more international sport, basketball structures could develop to where the talent pool grows even more competitive.

One area of this study that has room for improvement is defining the geographic groups. The availability of data made these categories broad, and resulted in generalizations about player ability from said groups. Furthermore, the prevalence of international players from geographic regions, primarily Asia/Australia and Africa was limited, increasing the sample size by including more years is a way to alleviate this

[11] This is especially prevalent in the South American, African and Asia/Australia regions.

problem. Furthermore, omitted variable bias in independent variables is a concern that is present in this, as well as all studies. Research and theory led to the use of this model, but using different variables to measure team skill, or diversity could also be employed in the future.

In conclusion, the results from this study show that there can be positive impacts on firm performance by increasing intra-firm diversity. The reason for this increase could be due to the uniqueness in talent that international employees bring. The results also imply that if a NBA team is to increase the heterogeneity of its workforce, it will benefit the most from having employees from the same geographic area. This could stem from the decreased integration costs that organizations need to adapt these players or employees to the systems already in place. Successfully incorporating increased international diversity in the workplace is something that firms need to be cognizant of. This paper advanced the literature by showing the positive effects of employing international workers, especially when there was a degree of homogeneity amongst those employees.

## Sources Referenced


Berri, D. J., & Bradbury, J. C. (2010). Working in the land of the metricians. *Journal of Sports Economics, 11*(1), 29-47.

Berri, D. J., Brook, S. L., & Fenn, A. J. (2011). From college to the pros: Predicting the NBA amateur player draft. *Journal of Productivity Analysis, 35*(1), 25-35.

Berri, D. J., & Jewell, R. T. (2004). Wage inequality and firm performance: Professional basketball's natural experiment. *Atlantic Economic Journal, 32*(2), 130-139.

Cunningham, G. B. (2007). *Diversity in sport organizations* Holcomb Hathaway, Incorporated.

Erhardt, N. L., Werbel, J. D., & Shrader, C. B. (2003). Board of director diversity and firm financial performance. *Corporate Governance: An International Review, 11*(2), 102-111.

Eschker, E., Perez, S. J., & Siegler, M. V. (2004). The NBA and the influx of international basketball players. *Applied Economics, 36*(10), 1009-1020.

Fink, J. S., & Pastore, D. L. (1999). Diversity in sport? Utilizing the business literature to devise a comprehensive framework of diversity initiatives. *Quest, 51*(4), 310-327.

Fizel, J. L., & D'Itri, M. P. (1997). Managerial efficiency, managerial succession and organizational performance. *Managerial and Decision Economics, 18*(4), 295-308.

Frick, B., & Simmons, R. (2008). The impact of managerial quality on organizational performance: Evidence from German soccer. *Managerial and Decision Economics, 29*(7), 593-600.

Giambatista, R. C. (2004). Jumping through hoops: A longitudinal study of leader life cycles in the NBA. *The Leadership Quarterly, 15*(5), 607-624.

Hankin, H. (2005). The New Workforce: Five Sweeping Trends That Will Shape Your Company's Future. *American Management Association.*

Hofler, R. A., & Payne, J. E. (1997). Measuring efficiency in the National Basketball Association. *Economics Letters, 55*(2), 293-299.

Hofler, R. A., & Payne, J. E. (2006). Efficiency in the national basketball association: A stochastic frontier approach with panel data. *Managerial & Decision Economics, 27*(4), 279-285.

Jackson, S. E., Joshi, A., & Erhardt, N. L. (2003). Recent research on team and organizational diversity: SWOT analysis and implications. *Journal of Management, 29*(6), 801-830.

Janis, I. L. (1972). Victims of groupthink: A psychological study of foreign-policy decisions and fiascoes. *Psychology Today,* 1971.

Jozsa, F. P. (2011). *The national basketball association : Business, organization and strategy*. Hackensack, NJ: World Scientific.

Kahane, L., Longley, N., & Simmons, R. (2013). The effects of coworker heterogeneity on firm-level output: Assessing the impacts of cultural and language diversity in the national hockey league. *Review of Economics and Statistics, 95*(1), 302-314.

Kahn, L. M. (2000). The sports business as a labor market laboratory. *The Journal of Economic Perspectives, 14*(3), 75-94.

Lazear, E. P. (1999). Globalisation and the market for teammates. *Economic Journal, 109*(454), C15-C40.

Martinez, J. A., & Caudill, S. B. (2013). Does midseason change of coach improve team performance? Evidence from the NBA. *Journal of Sport Management, 27*(2), 108-113.

Ottaviano, G. I. P., & Peri, G. (2006). The economic value of cultural diversity: Evidence from US cities. *Journal of Economic Geography, 6*(1), 9-44.

*Record-tying 84 international players on opening-night rosters. (2012)* NBA. *Retrieved November 3rd, 2013 from http://www.nba.com/2012/news/10/30/international-players-on-opening-night-rosters/*

Simmons, R., & Berri, D. J. (2011). Mixing the princes and the paupers: Pay and performance in the national basketball association. *Labour Economics, 18*(3), 381-388.

Storey, J., Wright, P. M., & Ulrich, D. (2009). *The routledge companion to strategic human resource management* Taylor & Francis US.

Timmerman, T. A. (2000). Racial diversity, age diversity, interdependence, and team performance. *Small Group Research, 31*(5), 592-606.

Zak, T. A., Huang, C. J., & Siegfried, J. J. (1979). Production efficiency - case of professional basketball. *Journal of Business, 52*(3), 379-392.