Determinants of Franchise Value in the National Basketball Association

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Durham, North Carolina
2017

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Acknowledgements

I would first like to acknowledge Dr. Connell Fullenkamp. His encouragement to write my corporate finance final paper on a subject that was not on the list of assigned topics – the finances of NBA expansion – led me down the path of NBA franchise valuation. I would also like to acknowledge my seminar advisors, Dr. Alison Hagy and Dr. Kent Kimbrough, and fellow honors student, Jeff Zeren, for their extraordinary guidance throughout the year.

Dedicated to my parents: Melisande and Robert

Abstract

Franchise values in the National Basketball Association (NBA) have increased more than 200% in five years, with the average franchise in 2017 worth $1.36 billion. Using a hedonic model, a comparables analysis, and a discounted cash flow analysis to model panel data on NBA franchises between 2009 and 2016, this paper finds that market, performance, star players, and team brand are significant determinants of franchise value at the team level. Additionally, the NBA's television contract is the primary driver of league-wide franchise value appreciation over time. As a result of the recent franchise value growth, the NBA is rumored to be looking to expand the number of teams in the league. The valuation methodologies in this paper suggest Seattle would be the best location for an expansion franchise and predict that a franchise there would be worth $1.4 billion in 2017.

JEL Classification: Z2, Z23, G32
Keywords: Sports Economics, Sports Finance, Value of Firms

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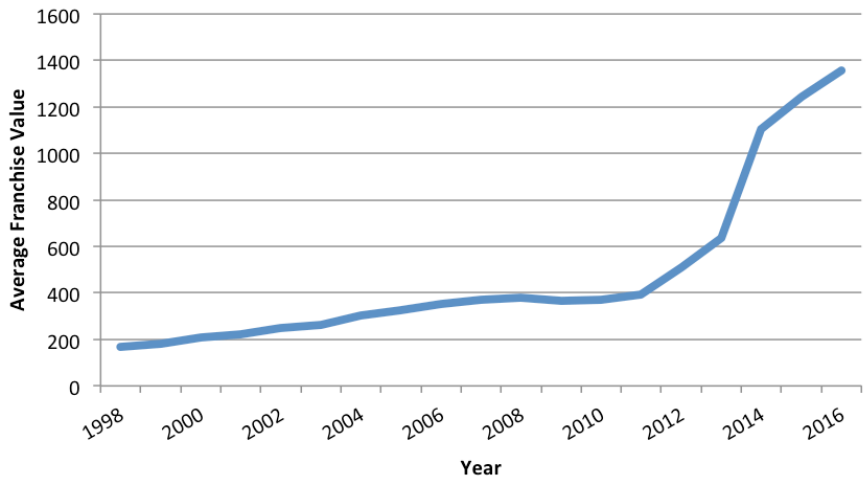
1 Introduction

The value of a franchise in the National Basketball Association (NBA) has more than tripled over the previous five years, with the average franchise worth $1.36 billion in 2017, according to estimates published by *Forbes* (2017). While this recent boom is unusually large, NBA franchises have seen consistent long-term growth. During the past 18 years, franchise values have grown 11% annually (Figure 1). The primary growth driver is a massive 9-year, $24 billion national television deal the league signed with ESPN and TNT in 2014. Additional sources of the increasing league-wide prosperity include an expansion of the pipeline to international revenue sources (with China and India being the most important target markets for the NBA), an increase in the value of local television contracts, and a spike in the value of team-specific and general NBA sponsorship partnerships (Badenhausen, 2016). The sum of these factors amounts to a bullish estimate of the league's future growth prospects. The combination of the NBA's sound financial standing and expected growth helps motivate the question: how much is any given NBA franchise worth and what factors determine that valuation?

Figure 1: Average Real NBA Franchise Value Over Time



The primary application to uncovering the determinants of NBA franchise value is the analysis of league expansion. In 2016, the commissioner of the NBA, Adam Silver, said that the league may consider expanding the number of teams in the league once the owners and players agree on a new Collective Bargaining Agreement (Daniels, 2016; Padian, 2016). The CBA was completed and signed by both parties in January 2017 (See Appendix A). Thus, if league officials are to be taken at their word, the league will shift its attention toward expansion. For the NBA to analyze the financial impact of such a move, they would have to first maximize the amount they could charge in an expansion

fee if they sold a new franchise in an auction (including finding the optimal location for the team). Then, they would have to compare the estimated expansion fee to the opportunity costs of expansion. Silver summarized the league's thinking on the subject:

> The way the owners see expansion at the moment is really the equivalent of selling equity in the [league]. We are 30 partners right now. Thirty teams. Each of those teams own 1/30th of all the global opportunities of the NBA. So the issue becomes, if you expand, do you want to sell one of those interests off to a new group of partners?

Similar to a business considering spinning off one of its segments, the NBA must determine the price it could receive for the expansion team and weigh that valuation against the present value of all future league revenues that each owner would relinquish to the new ownership group. Dallas Mavericks owner Mark Cuban explained that the decision comes down to determining whether or not the price the league could charge the new owner of the expansion team is larger than the television and shared revenue that each owner is giving up:"I just think the price of the expansion fee has to be so high that the NBA owners think, 'Ok, we're crazy not to do it' " (Lashbrook, 2013). Determining how much the NBA could charge for a new expansion team and valuing the opportunity costs of having an additional franchise in the league are the primary concerns in analyzing expansion. Thus, while the goal of this paper is to determine and do inference on the most important drivers of franchise value in the NBA, a valuable application is to use the results to construct franchise value estimates of potential expansion franchises to ascertain the fair market price and optimal location of hypothetical expansion teams.

Past investigation into sports franchise valuation primarily examines the four largest North American professional sports leagues: the NBA, the National Football League (NFL), the National Hockey League (NHL), and Major League Baseball (MLB). The research can be divided into two important categories, hedonic modeling on franchise value estimates from *Forbes* and analysis of actual franchise transaction prices. Alexander and Kern (2004), Miller (2007), Ulrich (2011), and Vine (2004) used hedonic modeling to analyze franchise values. The authors generally found that market size, competition, team performance, stadium age, and franchise age were significant determinants of value. However, the findings are not NBA specific and do not reflect the substantial changes the league has undergone recently, do not always incorporate available team financial data, and are biased downward when compared to real transaction prices of professional sports franchises. This paper builds upon this literature by using NBA specific and up-to-date data, incorporating revenues and operating income in its models, and adjusting for the sale price premium of NBA franchises.

Humphreys and Mondello (2008) and Humphreys and Lee (2009) analyzed franchise sales in the NBA, NFL, NHL, and MLB prices in the context of growth rates over time. Humphreys and Mondello (2008) used a method they deemed the hedonic price index method (See Appendix B) to estimate that the quality-adjusted growth in franchise prices was 16% between 1969 and 2006. Humphreys and Lee (2009) examined professional sports franchises that were sold at least twice to analyze the change in value in the time between sales, which they called repeat sales method. In contrast to Humphreys and Mondello, they found that quality-adjusted franchise values did not significantly appreciate in the time between sales. This paper builds upon these works by not only analyzing that NBA franchises are increasing in value, but attempting to determine the drivers of that growth.

This study analyzes the determinants of NBA franchise value using three models: a hedonic model, a comparable company analysis (or simply a comparables analysis), and a discounted cash flow analysis (DCF). First, the hedonic model uses ordinary least squares (OLS) regression to estimate NBA franchise values using panel data on franchise-specific and league characteristics. The results from the hedonic model show that market size, team on-court success (and the interaction between these two variables), superstar players, franchise brand equity, and capital structure are significant determinants of franchise value. Additionally, league-wide growth can be explained by the television contract, the number of international players in the league, and time – essentially growth left unexplained by the other league variables. Second, the comparables analysis uses an OLS model and the same panel data to estimate franchise sales multiples – franchise value divided by revenue. This sales multiple model adds a layer of complexity to the straightforward hedonic model by incorporating a team's revenue into its franchise value estimates. The team-specific determinants of sales multiples are market size, team performance, the interaction between market size and team performance, franchise brand equity, and capital structure. The league-wide predictors are the television contract, finals viewership, and cable subscriptions. Lastly, the DCF model discounts estimates of future cash flows by a discount rate subtracted by a growth rate to find the present value of NBA franchises. This valuation model incorporates projected franchise profitability in the form of estimated unlevered free cash flow (UFCF) – cash flows before taking interest payments into account – and each franchise's capital structure to determine value.

The combination of the results yields a complete picture of NBA franchise values and their determinants, strengthening the results from one model alone. The model parameters were used to make predictions of franchise value for hypothetical expansion teams. Seattle was the most valuable location with an estimated franchise value of about $1.4 billion. This result could inform the NBA's analysis of expansion by comparing it to the opportunity costs of an extra team in the league. Therefore, by using both econometric and financial modeling methods and drawing upon up-to-date data on NBA

team value estimates a panel of franchise characteristics data, this paper makes inferences on NBA franchise valuation and its determinants, which can be applied to NBA-related decisions such as expansion, and presents valuation techniques that can be applied to the determination of sports franchise values in other leagues.

In section two I provide a background on the NBA and the drivers of the league's growth. In section three I give an in-depth review of the existing literature on professional sports franchise valuation. In section four I describe the econometric and financial theory that drives the analyses in this paper. In section five I describe the data used to estimate the models of NBA franchise value. In section six I present my empirical framework, interpret model parameters, evaluate results, and make predictions. Lastly, in section seven I draw conclusions about my findings.

2 Background

The NBA is the second largest North American professional sports league according to operating income, although it sits a distant second behind the NFL (Fort, 2016).[1] The league was founded in 1949 with the merging of the Basketball Association of America and the National Basketball League.[2] While the original NBA contained 17 teams, the league had consolidated to eight franchises by 1954 largely because of financial difficulties.[3] However, the NBA has grown substantially in the years since its humble beginnings. From 1954 to 2016, the league has grown from eight franchises to 30 and franchise values have increased substantially. The first transaction of an NBA team was the sale of the Boston Celtics to Walter Brown in 1951 for the meager price of $2,500 — about $23,000 in 2016 dollars (Fort, 2016). On the other hand, the largest transaction price to date was the sale of the Los Angeles Clippers to former Microsoft CEO Steve Ballmer in 2014 for $2 billion. From the 2012-13 season through the 2015-16 season, league revenues have increased more than 11% annually, and league projections expect this growth to continue into the future (Coon, 2016; Fort, 2016; Zillgitt, 2016). This rapid growth, which has shown few signs of slowing down, holds many implications for the future of the league. The catalysts of the NBA's recent surge in prosperity are global growth, prosperous media rights deals, and successful branding.

[1]Operating income is equivalent to EBITDA — earnings before interest, taxes, depreciation, and amortization. Essentially, it is a way to measure a company's operating performance without considering outside factors such as financing and accounting decisions and tax environment.

[2]There were significant synergies with the combination of these leagues. The Basketball Association of America was concentrated in mostly small Midwestern markets but had a majority of the talented players. The National Basketball League consisted mostly of franchises in large markets, but its teams were lacking in talent

[3]Many of the teams located in small markets either folded (Sheboygan Redskins) or relocated (Fort Wayne Pistons to Detroit) shortly after the league's founding (Quirk & Fort, 1992).

2.1 International

The NBA's global growth has been a driver for increasing franchise values. At the start of the 2016-17 season, there were 113 international players on NBA rosters, which is about a quarter of the league ("NBA rosters feature" 2016). There are professional basketball leagues throughout Europe with fan bases that are passionate about the game, which is a market the NBA can penetrate further. However, the real growth for the NBA has come and will continue to come from Asia. China and India, where young basketball-crazed demographics have become obsessed with the NBA, are particularly important markets for the NBA (Chi, 2014). China's interest in the NBA began in earnest when Yao Ming was drafted 1st overall in the 2001 NBA draft. Ming became one of the best players in the league and eventually was inducted into the Basketball Hall of Fame. He led the NBA in all-star voting in 2005 and 2006 predominantly due to his massive Chinese following, and his team, the Houston Rockets, became China's favorite NBA team. Research done by the NBA reports that 300 million people in China play basketball recreationally, equivalent to the entire population of the United States, which sheds light on the pure size of potential fans in China (Heitner, 2015). The Chinese Basketball Association is one of the most followed leagues in the world and has revenues large enough to pay former NBA players salaries in the millions. The NBA has a contract with the Chinese digital media company, Tencent, which delivers NBA content to China, including distribution of live NBA regular season and playoff games (Badenhausen, 2016). The NBA has been able to grow through fervent efforts to expand the league's reach into the Chinese market and must continue to do so to drive future growth.

After China, India has become the next most important international demographic on the NBA's radar. In fact, Commissioner Silver called the Indian market the "next frontier" of the NBA's international branding expansion effort (Gowen, 2016). The reasons for the focus on India are twofold: the country has the second largest population in the world and has a young demographic – 350 million people between the ages of 10 and 24 – which perfectly fits the NBA's target market. To reach this market, the NBA has been progressive with its strategies to generate an NBA fan base. The league has partnered with charities to introduce basketball programs in schools allowing them to reach more a million students. The league also signed a television deal with an Indian sports channel to broadcast 14 NBA games a week (Gowen, 2016). The NBA must continue to capture and generate interest in NBA content and merchandise in the Indian market to spark further growth for the league. Thus, the NBA has progressed on the international front, which is likely one of the drivers of the league's growth, and further development of the international market will be an important way for the league to continue enhancing value.

2.2 Media

The demand for broadcasting rights to live sporting events is at a crossroads. Consumers of television, especially those in young demographics, are increasingly resorting to online subscriptions services such as Netflix to get access to content. As a result, cable subscriptions are stagnating and declining. Subscriptions decreased 3% from 2014 to 2016 (Meola, 2016). This phenomenon, often called "cord-cutting", has shown no signs of slowing down. Cable subscriptions are expected to decline 1.5% per year over the next ten years (Tuttle, 2016). For cable television broadcasters and distributors, carrying live sports is a way to combat the cord cutting trend. Consumers looking to watch live sports will still have to buy cable.

Furthermore, in an era where viewers can record television shows and watch them later while fast-forwarding through the commercials, commercial air time during sports games is coveted by advertisers looking to maximize the number of eyes on their commercial because sports are almost exclusively consumed live (Wortheim, 2014). Thus, live sports content is extremely valuable for television broadcasters and distributors. As a result, the NBA was able to negotiate a television deal that pays more than $2 billion annually and teams such as the Lakers, Clippers, and Mavericks have been able to significantly increase television contracts. On the other hand, the rise of cord cutting threatens the primary way the NBA distributes its content, cable television. If cable distributors lose subscribers, the loss in revenue will eventually trickle down to the NBA. While the NBA's television contract is guaranteed through 2025, the future of the NBA's content distribution afterward is uncertain. Overall, the effects of alternative methods of viewing content are mixed.

2.3 Brand

The brands of the NBA and its players are important to the league's success. As a league, the NBA employs progressive sponsorship strategies to capture value from its brand. While a common practice for professional soccer teams, the NBA is the first North American sports league to allow sponsorships on jerseys beyond the athletic apparel brand responsible for designing the uniforms.[4] NBA teams currently have the right to negotiate these jersey sponsorships, which will begin in the 2017-18 season. Some of these arrangements have already been agreed upon – the Sacramento Kings and Philadelphia 76ers have sponsorship agreements with Blue Diamond Almonds and StubHub respectively, both of which are worth $5 million per year. Moreover, relatively more successful teams are seeking far richer contracts such as the Golden State Warriors desire for $15 to $20

[4]For example, the jerseys of world-renowned soccer team Real Madrid have "Fly Emirates" written across the front rather than the name of the team.

million in exchange for the right to advertise on their jerseys (Heitner, 2016).

In addition to team and league brand management, NBA players are exceedingly marketable. Out of the top 40 highest paid athlete endorsers in 2016, 13 are in the NBA while only six play in the NFL and zero in the MLB (Weber, 2016). NBA players are appealing from a sponsorship perspective because they are highly visible on the court, they play a sport with a relatively large international following, and they are tremendously important to their team's success. The highest athlete endorsement earners list is filled with athletes playing in individual sports (golf and tennis) and sports with a large international following (soccer) (Weber, 2016). From a visibility perspective, there are a total of 10 players in an NBA game at any given time, as opposed to 22 in the NFL and 18 in the MLB, which gives NBA players, especially those who play a lot of minutes, more time on the court than their counterparts in the MLB and NFL. The NBA is also ahead of the MLB and NFL in international following, which boosts the marketability of its players. NBA superstars have an immense impact on the outcome of games. According to ESPN's Real Plus Minus player value metric, Lebron James, probably the best player in the NBA, added 21.6 wins to the Cavaliers record in 2015-16. The team won 57 total games, which means the James accounted for about 38% of the Cavaliers regular season win total, a massive proportion for an individual player. The NBA's recognizable athletes further the league's brand and drive interest in its content and products.

The NBA is undergoing a period of rapid growth, which has been driven by increasing international following, media rights, and brand equity. This paper's analysis uses variables aimed at capturing the effects of these value-driving characteristics of the league and its players, which can provide insight into true drivers behind advances in NBA franchise values and incomes.

3 Literature Review

Past academic examination of professional sports franchise valuation was sparse before the 1990s. The lack of research on the topic may simply be due to the fact that before this time owning a professional sports team was largely unprofitable and ownership was reserved for those who were wealthy enough to sustain losses for the sake of the utility derived from owning a team (Quirk & Fort, 1992; Vogel, 1999; Vine, 2004). However, in the last 15 years, economists have conducted a substantial amount of research on the subject and today there exists a solid basis on which to build future study. Existing literature on sports franchise values has analyzed all four major professional sports leagues in North America (MLB, NBA, NFL and NHL) at once and has examined the MLB in particular. There is no existing research focused solely on NBA franchise valuation.

Previous literature on professional sports franchise values can be divided into two primary strands of research: (1) modeling franchise value estimates from *Forbes* and (2) analyzing franchise transaction prices and historical growth rates.

3.1 Modeling on Franchise Value Estimates

Alexander and Kern (2004), Miller (2007), Ulrich (2011), and Vine (2004) used hedonic modeling to find the determinants of professional sports franchise value estimates from *Forbes* and *Financial World*. Alexander and Kern (2004) modeled franchise values in the NBA, NFL, NHL, and MLB between 1991 and 1997 to do a regression on franchise value with predictors such as income in the team's home market, metropolitan population, and whether or not the team had a regional identity.[5] They also included a time variable to account for variation in franchise values across years that is not explained by a franchise's characteristics alone. They found that a team's market size (approximated by metropolitan population), performance, (captured by a team's place in the standings in the year prior), and the presence of a new stadium were significant predictors of franchise value.

Similarly, Miller (2007) examined panel data on MLB franchise values between 1990 and 2002 with the aim to build upon research on the impact of new stadiums on franchise values. Miller found that after controlling for variation in team quality and market, the coefficient for stadium age was significant and negative, meaning that as stadiums get older franchise values decrease. However, the cost of the new stadium (if funded privately) did not offset the boost to franchise values that new stadiums provide, which (according to Miller), sheds light on why professional sports team lobby for public subsidies when building new stadiums.

Aside from not including any team financial metrics made publicly available by *Forbes*, there are three issues with applying Alexander and Kern (2004) and Miller's (2007) findings directly to the NBA. Firstly, the coefficients they estimated may deviate greatly when only considering the NBA versus using data from other leagues. Secondly, determinations made 10 years ago may no longer apply to the current environment. Thirdly, models based on estimates of franchise value from *Forbes* have a downward bias when compared to real transaction prices of professional sports franchises. This paper will improve upon the existing research by using data that is specific to the NBA, reflects recent league trends, and addresses the bias of the franchise value estimates.

Ulrich (2011) and Vine (2004) performed a similar regression technique as Alexan-

[5] According to Alexander and Kern, the Utah Jazz would have a regional identity because their name includes the state of Utah rather than the home city, Salt Lake City. On the other hand, the Denver Nuggets are named after the city of Denver rather than the state of Colorado, and thus do not have a regional identity.

der and Kern (2004) and Miller (2007), but also included various financial metrics such as revenue, net income, and debt ratio. Ulrich (2007) examined MLB franchise values from 2000-2010 and concluded that the most important drivers of franchise value were team revenues and market size. Ulrich included on-field performance and a measure of management skill (in the form of wins per dollar in salary spent) in his model but found that they did not have a significant relationship with value. Vine (2004) found that revenue was a significantly associated with value, but other metrics such as operating income were not significant. This paper will build upon this research with a regression that estimates the multiple of franchise value over revenue, in addition to the regression on value itself. In this way, it will incorporate both a team's financial data and economic characteristics to estimate value, which differentiates it from previous research.

Vine (2004) compared franchise sales prices in the NBA, NFL, NHL, and MLB between 1999 and 2003 to estimates of franchise value from *Forbes*. He found that sports franchise transaction prices were on average 27% higher than the requisite estimates of value. Regarding the NBA in particular, franchises sold at a 38% premium to the *Forbes* estimate. Vine posited that the premium paid for sports franchise prices was the result of prospective owners believing that the utility of owning a sports team was much greater than the utility of owning a relatively more traditional asset – such as shares of stock in a public company. Vine described this phenomenon as the "ego factor" (2004). The idea is that the clientele who buy professional teams have preferences such that they will pay more than fair value for a sports franchise because of the added benefits. For example, owners may derive added utility from sitting court side or in box seats at games, interacting with players on a day-to-day basis, and being a part of the team's decision-making process. On the other hand, Alexander and Kern (2004) explained that the premium paid for sports franchises may be attributable to the "winner's curse" in bidding competitions for franchises.[6] In either case, this paper will use Vine's technique to determine the premium paid for NBA franchises using up-to-date sales price data. This premium could then be applied to analyses using estimates of franchise value to ascertain, for example, the price for which the NBA could sell an expansion team.

3.2 Analysis of Franchise Sale Prices

Humphreys and Mondello (2008) and Humphreys and Lee (2009) examined historical growth rates of franchise sales prices. Humphreys and Mondello (2008) used hedonic modeling to estimate franchise transaction prices, calling it the hedonic price

[6]The winner's curse is a phenomenon that can occur in auctions. To demonstrate, let's assume an item that has roughly the same value to each of the bidders is put up for auction. Each player independently estimates the value of the item and bids. The winner of an auction is the bidder who submits the highest bid. If we assume that the average bid is accurate, then the highest bidder overestimates the item's value and has thus fallen prey to the winner's curse.

index method. They analyzed a data set containing franchise sale prices in the NBA, NFL, NHL, and MLB between 1969 and 2006. They concluded that franchise age, facility ownership, local competitors, and metropolitan population were significant predictors of professional sports franchise sale prices while team performance was not. They included a time variable to account for variation in franchise sale prices across time unexplained by franchise characteristics. The magnitude of the time variable, or the quality-adjusted price index, was 16%. They concluded that owners of professional sports teams earned significant capital gains over the period of their analysis.

Humphreys and Lee (2009) examined franchises that were sold twice to analyze the change in value in the time between sales, which they called a repeat sales method. The authors found that after adjusting for the underlying quality of the sports franchises by accounting for factors such as a team's market, reputation, and league, there is no clear upward trend in sports franchise values over time according to the difference in prices. The authors posit that this result deviates from the result of the hedonic price index method because they did not account for changes in team characteristics in the period between when the team was bought and sold. This paper will improve upon analysis of franchise growth rates by examining the determinants of NBA franchise growth over time rather than simply finding its existence or magnitude.

This paper incorporates and improves upon the previous research by creating three distinct models for NBA franchise values that can be used in conjunction to compensate for deficiencies in any individual model. The hedonic model uses a panel of franchise characteristics data including variables used in prior analyses as well as variables that explain the specific drivers of franchise values in the NBA. The sales multiple model incorporates both franchise characteristics as well as revenue, which is unprecedented in the previous analyses of sports franchise valuation. Both the hedonic and the sales multiple models will use league-wide variables (in addition to franchise specific variables) to explain sources of franchise value growth over time. The DCF model values franchises by projecting future cash flows, a very different methodology than the regression models, and can be used to unearth income-driven value and verify the results from the hedonic and sales multiple models.

4 Theoretical Framework

The theoretical framework for this paper falls into three distinct categories: hedonic modeling, comparable company analysis, and discounted cash flow analysis.

4.1 Hedonic Model

A hedonic model uses OLS regression to estimate the value of an asset that cannot be valued directly. In other contexts, it has been used to evaluate real estate prices using a property's characteristics such as location, square feet, and number of bedrooms as predictors in a linear regression for sale price.[7] In the case of professional sports franchise valuation, modeling value using observable characteristics is a necessary substitute for using financial statements. The general hedonic model can be written,

$$ln(Value_{it}) = \alpha_t C_t + \beta \mathbf{S}_{it} + \epsilon_{it} \tag{1}$$

In the equation, $ln(Value_{it})$ is log franchise value estimate, which is log-transformed for normality (See Section 5.2.1). $\mathbf{S}_{it}$ is a vector of franchise characteristics each with coefficient β to be estimated. C_t is a time varying intercept with coefficient α_t that captures variation in franchise value across time that is not accounted for by franchise characteristics. Finally, ϵ_{it} is a normally distributed error term.

4.2 Comparable Company Analysis

The comparable company (comparables) analysis assesses the value of a company using metrics of other businesses in the same industry and of similar size. For example, it would be performed by calculating the sales multiple (the value divided by the revenue) for each of the companies to are deemed to be similar one being reviewed (Equation 2).

$$Sales\ Multiple = \frac{Value}{Revenue} \tag{2}$$

A basic analysis would compute the average or median multiple of the similar companies and multiply that multiple by the revenue of the company at hand to determine its value (Equation 3).

$$Value = Sales\ Multiple_{Median} * Revenue \tag{3}$$

This model operates under the assumption that similar companies will have similar valuation multiples, regardless of individual advantages or disadvantages that may cause the revenue growth opportunities to vary across companies. However, comparables analysis can be extended to allow for the sales multiple to vary according to company-specific characteristics of interest. The sales multiples for the similar companies can be estimated

[7]The technique is also used to determine the prices of wine and antique furniture (Humphreys & Mondello, 2008).

using OLS with the multiple as the dependent variable and the chosen characteristics as the regressors. The model for this technique is specific below,

$$Sales\ Multiple = \alpha + \beta x_i + \epsilon_i \tag{4}$$

where the sales multiple is estimated by OLS with intercept α, vector of company characteristics x_i, and coefficient vector β to be estimated (Brealey et al. 2006). This methodology allows for the model to account for greater across company variation, accounting for inherent advantages and disadvantages in revenue growth opportunities that may not show up in current the top line, and thus offers a better estimate of company value.

4.3 Discounted Cash Flow Analysis

A discounted cash flow analysis (DCF) is used to estimate the attractiveness of an investment opportunity by projecting future cash flows and discounting them back to a present value. One type of DCF is the dividend discount model (DDM). The DDM projects future dividend payouts and discounts them back to present value using a discount rate subtracted by a growth rate. The DDM is analogous to the model for a perpetuity: it discounts a stream of future cash flows with no end to determine present value (Equation 5).

$$P = \frac{D}{r - g} \tag{5}$$

Where P is the present value of the company, D is the expected dividend next year, g is a terminal growth rate, and r is the discount rate. The growth rate can be estimated in a myriad of ways, but one such method would be to use historical earnings per share (EPS) growth or forecasted EPS growth. The method for finding the discount rate can vary, but the most common technique is to use the weighted average cost of capital (WACC) of the company being valued. Equation 6 shows the specification for computing WACC.

$$WACC = \frac{D}{D+E} * r_d + \frac{E}{D+E} * r_e \tag{6}$$

D is the value of a company's debt and E is the value of a company's equity. r_d is the interest rate the company pays on its debt. r_e is the expected return on a company's equity determined using the capital asset pricing model (CAPM).

$$CAPM = r_f + \beta(r_m - r_f) \tag{7}$$

CAPM is return on equity (r_e). r_f is the risk-free rate of return often approximated by the interest rate of the U.S. 10-year treasury bill. r_m is the expected return of the market often approximated by the historical return of the S&P 500. β is a measure of the volatility, or systematic risk, of a security or a portfolio in comparison to the market as a whole (Brealey et al. 2006). Financial publications such as *Bloomberg* often publish estimates of β for public companies. However, it must be calculated directly for private companies.

Estimating β can be through an OLS regression that compares the returns of the investment to the returns of the market (Equation 8).

$$r_i = \alpha + \beta r_m \tag{8}$$

r_i is the price of an individual stock over a given period of time. r_m is the price of a market benchmark over the same period of time. The estimated β is the sensitivity of the stock's return to the market return.

5 Data

5.1 Franchise Value Estimates and Prices

Two types of franchise value data were considered for this paper. Franchise value estimates published by *Forbes* since 1998 and actual team transaction prices throughout the history of the NBA. This data is largely compiled from Rodney Fort's collection of *Forbes*' franchise value data and transaction prices of professional sports franchises, which is publicly available on his website (https://umich.app.box.com/s/41707f0b2619c0107b8b).

The NBA franchise transaction price data set is too small, imprecise, and untrustworthy for a robust model to estimate franchise sale prices.[8] Fort's data set has the prices for 92 franchise transactions. Four additional franchises have been sold since the last transaction included in Fort's data set. 96 observations are not ideal for OLS modeling with more than a few parameters and there are a myriad of problems with the data that further reduce the observations and erode the value in a model on franchise sale prices. First, Fort's recorded sale prices do not always match with news reports on team sales prices. Second, 16 team sales occurred before 1969, the first year annual metropolitan population, one of the main predictors of the model, was publicly available. Third, for more than half of those data points, while the price the new ownership group paid is known, the exact percentage of the franchise that was sold is unknown. For example, when Leslie Alexander bought the Rockets for $85 million in 1993, Fort notes

[8] A model on NBA franchise values could be done by applying Humphreys and Mondello's (2008) hedonic price index model specifically to the NBA (See Appendix B).

that Alexander purchased a "majority share" of the team, which leaves a wide range of potential team valuations, which depends on the exact percentage of the franchise that was exchanged (2017). Fourth, there are many transactions in which the price includes an ownership stake in the stadium, other sports teams in the city, or shares in real estate developments near the stadium. Therefore, it is often difficult to discern a franchise's true sale valuation. While recent sale price data is used to compute an average sale price premium, it is not large or reliable enough to use as a dependent variable in a regression model.

As a result, this paper uses *Forbes*' NBA franchise data in all three of its models and the sale price data for comparison. The data *Forbes* releases includes estimates of franchise value, operating income, revenue, and debt as a percentage of value. Vine (2004) and Vogel (1999) wrote that *Forbes* derives its franchise value estimates by applying a multiple to revenue, which is determined by a multitude of factors including venue and lease terms, debt, and market size. This paper, in addition modeling franchise values directly, also models the variation in sales multiple across franchises. While *Forbes* may use a similar method, it does not release its exact determinations to the public. Thus, the sales multiple model in this paper may uncover parts of the methodology behind *Forbes*' franchise value estimates and shed light on how important various franchise characteristics are in *Forbes*' model.

The primary weaknesses with the team financial data is that the actual financial statements of NBA franchises are not available to the public. Without financial statements for every team in 2017, it is impossible to build a proper discounted cash flow analyses and this paper must rely on a large amount of assumptions and estimates to fill in the gaps. Fort's data set contains four actual NBA franchise financial statements: Charlotte Bobcats in 2011-12, New Orleans Hornets in 2008-09, and New Jersey Nets in 2004-05 and 2005-06. These financial statements provide some insight into team yearly spending on capital expenditures (CAPEX) and interest rates. While these statements are useful for context, they are not current and there is a small sample of them. As a result, this paper relies on financial metrics from *Forbes* and other publicly available economic characteristics of NBA franchises to estimate franchise value.

Forbes' franchise value estimates are used as the observations of the dependent variable in the hedonic model and in computing the observations in the sales multiple model. There are 30 observations per year, one for each team in the NBA. The models use estimates since 2009 (five years after the NBA expanded from 29 to 30 teams by adding the Charlotte Bobcats – now the Hornets – as an expansion team), which yields 240 data points.[9]

[9]Five years beyond the expansion is necessary to create variables that sum the championships, playoff appearances, and wins over five years. This method is reasonable because it takes time for a franchise

There is a significant wealth disparity among NBA teams. In 2016, the average value of the top five most valuable teams ($2.7 billion) is nearly three and a half times larger than the average value of the bottom five teams ($775 million). Table 1 shows descriptive statistics of *Forbes* NBA franchise value estimates and sales multiples.

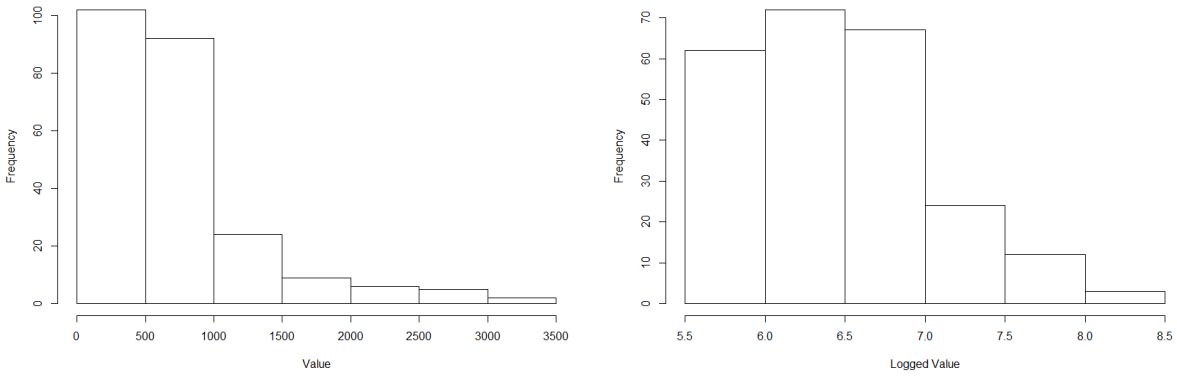
Table 1: NBA Franchise Value Descriptive Statistics

Variables	Mean	Min	Max	Standard Deviation
Franchise Value*	771	283	3300	553
Sales Multiple	4.7	1.4	11.6	2.0

*In thousands

Examination of the distribution of team values reveals that the variable is right-skewed (Figure 2a), meaning that the bulk of franchise values are located in the lower end of the distribution while a few highly valuable franchises create a long right tail. The summary statistics support the right skew of the data: the mean franchise value between 2009 and 2016 is $770 million whereas the median value is $570 million (Table 1).

Figure 2: Distribution of Franchise Values (2009-2016)



(a) Raw Franchise values

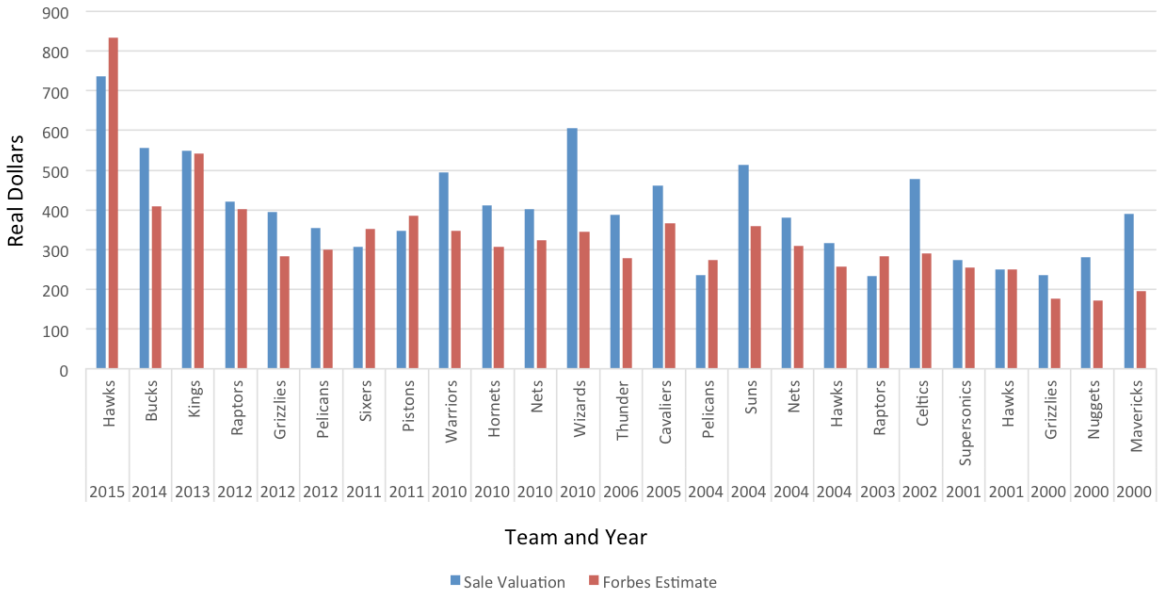
(b) Logged Franchise Values

The logged franchise values (Figure 2b) are close to being normally distributed. As a result, the hedonic model in this paper uses logged franchise values as the dependent variable. Additionally, the distribution of sales multiples across franchises is similarly right-skewed, so the sales multiple model uses logged sales multiples as the dependent variable (See Appendix C).

to build fan interest with strong team performance. Also, this technique was used in the literature, such as Humphreys and Mondello's (2008) paper, which used wins over the previous five years.

Considering Vine's (2004) findings about the ego factor, it does appear that NBA teams sell for more than *Forbes*'s value estimates. In April of 2014, the Milwaukee Bucks were sold for $550 million, a much larger figure than Forbes' $405 million valuation published 3 months prior. The Los Angeles Clippers were sold for $2 billion in August 2014; this sale price dwarfs the $575 million *Forbes* valuation from earlier that year. On the other hand, in April of 2015, the Atlanta Hawks were sold for $730 million, solidly below the $825 *Forbes* valuation (Fort, 2017). Figure 3 shows NBA team sale prices since 1998 next to their requisite *Forbes* value estimate (excluding the Clippers sale because it sold at a 350% premium to the franchise's estimated value).

Figure 3: *Forbes* Value Estimates versus Sale Prices (Excluding Clippers)



In our sample of 26 sales, 20 teams sold for more than *Forbes*'s estimate, which is about 77% of the time. Franchises sold at a 38% average premium to their estimated value. After removing the outlying Clippers sale, that premium decreases to 25%. Hence, for predicting franchise sales prices on the open market, it would be prudent to apply a premium to the *Forbes* estimates, which appear to often understate the market value of NBA franchises.

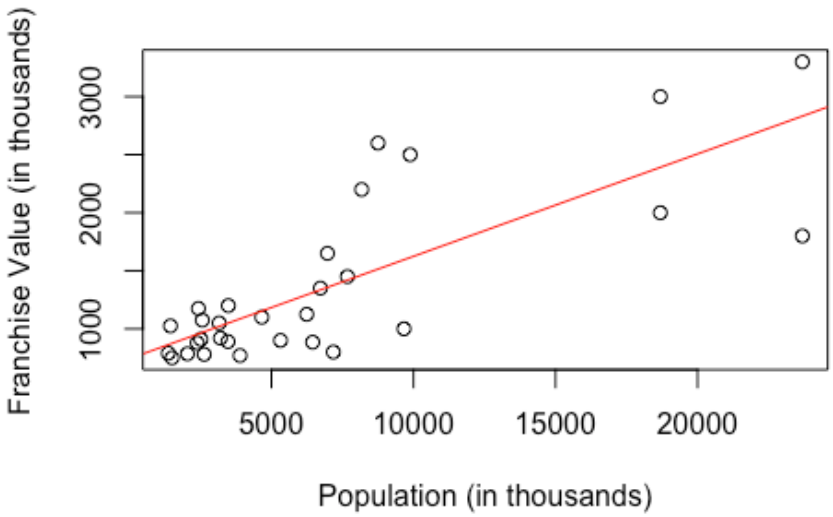
5.2 Panel Data

This paper employs panel data on franchise and league characteristics to predict value. This data was collected from a variety of sources and can be divided into two

parts: team-specific variables and league variables. Team specific characteristics include metropolitan population, team performance, superstar players, franchise brand, and capital structure.

Metropolitan population data was gathered from the U.S. Census Bureau and Canada Census program. The average metropolitan population of an NBA city is 6.8 million, about the current size of Miami, and the median is 5.0 million. The standard deviation is population is relatively large, with cities as big as New York and as small as Memphis creating a wide dispersion of values. Five of the seven most valuable franchises in the NBA are located in Chicago, Los Angeles, or New York, all having values near or above $2 billion. On the flip side, teams in smaller markets such as Memphis, Milwaukee, and New Orleans are all among the league's least valuable franchises. The correlation between franchise values and metropolitan population is 0.80; the relationship between the variables is shown in Figure 4.

Figure 4: 2016 NBA Franchise Value by Population



(a) Regression Equation: $742 + 0.088 \times$ Population

In addition to market size, team performance is thought to effect franchise value. If a team wins a large proportion of its games, fans get excited about the team, buy tickets and merchandise, and watch their games on television, all of which contribute toward revenues. For example, the San Antonio Spurs are located in the 24th largest market in the NBA, according to metropolitan population, and yet they're the 12th most valuable franchise in the league. This may be the result of their domination of the league over the last 12 years. They won 70% of their games over that span (by far the highest in the league), made the playoffs every year, and won three championships.[10] Therefore, in

[10]To give the Spurs' recent performance more context, no other team has won more than 61% of their games over the last 12 years.

addition to market size, a franchise's performance on the court is an important factor to consider when estimating franchise values in the NBA.

Data on NBA team playoff appearances, championships and wins was collected from basketball-reference.com, a reliable source for basketball statistics. In assembling the panel of data on franchise characteristics, the decision was made to use wins, playoff appearances, and championships won over the previous five years as variables. The use of these variables as cumulative effects over multiple years was chosen because it may take time for a franchise to generate fan interest and drive value.

This paper uses data on the number of Most Valuable Player (MVP) awards on the roster during the year, which is meant to capture the positive effect that superstars have on franchise values. As discussed in Section 2.3, NBA superstars have strong brand recognition and have an outsized impact on the outcome of games. Thus, they can generate significant interest in a team and increase franchise value. For example, when Lebron James left the Cleveland Cavaliers for the Miami Heat in the Summer of 2010, *Forbes* subsequently decreased its value estimate for the Cavs by 27% while average franchise values fell by just 1%. The next year *Forbes* decreased the Cavaliers value by another 10%, while the average franchise values increased by 4%. The variable is the sum of the total number of MVP awards won by all the players on a franchise's roster in any given year and was compiled using data from NBA.com.[11] The largest number of MVP awards on a franchise's roster is four (Table 2).

The total number of championships in a team's history was collected as a proxy for a franchise's brand. The idea is that championships, and being known as a championship team, increase a franchise's brand equity in the eyes of fans. In terms of franchise brand, the NBA's most recognizable teams are also among its most valuable. While it is difficult to untangle the effects of market and team performance, franchises such as the Bulls, Celtics and Lakers carry powerful brand names and are all in the top five most valuable franchises in the NBA. Compiled from basketball-reference.com, the average amount of championships is 2.33. Of the 70 total NBA championships that have been won, the Celtics (17) and Lakers (16) have combined to collect 47% of them (Table 2). As an industry, the NBA's debt levels are relatively low compared to many publicly traded companies.

A team's proportion of debt is meant to capture the association between capital structure of NBA teams and value. According to *Forbes* annual releases, the average NBA franchise's capital structure is made up of about 24% debt.[12] The maximum percentage

[11]For example, the Los Angeles Lakers in 2012 had Kobe Bryant and his one career MVP award on the roster, which meant the Lakers value for MVP in 2012 was 1. When Steph Nash and his two career MVP awards joined the team the next season, the Lakers MVP award value increased to 3.

[12]Proportions of debt and equity vary widely across the league. In 2016, the most highly levered franchise was the Milwaukee Bucks, which had 54% of its value in debt. On the other hand, there were

of franchise value in debt (105%) is noteworthy because it means that the team – the New Orleans Pelicans in 2011 – owed creditors more than what the team was worth (Table 2). Vine (2004) and Vogel (1999) wrote that *Forbes* accounts for debt percentage in their value estimates. In his regression of franchise financial metrics on estimated value, Vine (2004) found proportion of debt to be negatively associated with franchise value. Higher proportions of debt mean larger interest payments and possibly reduced cash flows, which drives down value. Larger proportions of debt mean paying more money in interest because there is simply more money to pay off and companies with relatively large debt loads pay higher interest rates to compensate creditors for taking on more risk. Thus, the franchises with large amounts of debt have less cash left over than a franchise with the same operating income and a lower debt/value ratio. On the other hand, because the cost of debt is almost always lower than the cost of equity, having a moderate amount of debt on the balance sheet can be positive for a company. Table 2 shows the descriptive statistics of team characteristics in this data set.

Table 2: NBA Franchise Panel Data Descriptive Statistics

Variables	Mean	Min	Max	Standard Deviation
Metropolitan Population*	6767	1328	23,724	6118
5-Year Playoff Appearances	2.67	0	5	1.63
MVP Awards	0.37	0	4	0.80
Total Championships	2.33	0	17	4.12
Debt/Value†	23.7	0	105.0	18.4

*In thousands
† As a percentage

The models in this paper will also use league effects to estimate drivers of franchise value appreciation. The league-wide variables are international players in the NBA, cable subscriptions, and finals viewership. The number of international players in the NBA is meant to capture the league's international appeal. This variable is an admittedly crude measure of the NBA's global appeal, but international interest is a growth driver for the NBA so any variable that hints at this effect could be useful. Variables that might do better at capturing international appeals, such as the NBA's international viewership numbers or merchandise purchasing data are not publicly available and my requests for data from the NBA were denied. Hence, the number of international players is the best way to account for global interest in the NBA. Data on the number of international players in the NBA was gathered from annual press releases on NBA.com. The number of international players increased every year in the sample except 2011, going from 72

five teams with 2% debt or less: the Chicago Bulls, Denver Nuggets, Los Angeles Lakers, Los Angeles Clippers, and New York Knicks. Franchise capital structure will also factor into the DCF model in Section 6.3

players in 2009 to 91 in 2016. It could have a spurious correlation with franchise values that also increased on average in all but one year.

Variables for cable subscriptions, finals viewership, and the new television contract are meant to account for the media as a driver for NBA franchise values. Firstly, data on cable subscriptions was collected from Federal Communications Commission yearly releases of data. With the time frame of this data set, cable subscriptions are generally declining, meaning that the cable subscription data is changing in the opposite direction that franchise values are. Secondly, finals viewership data is from Nielson.com. This variable is the sum the average finals viewership of the previous five NBA finals. Doing so is meant to account for the potentially lagged effect of viewership ratings on franchise values because television contracts tend to be long-term agreements. Finally, the NBA announced a new 9-year, $24 billion television contract with ABC, ESPN, and TNT in 2014. This agreement more than doubled the average annual value of the previous television contract and beginning with the 2016-17 season provides a substantial revenue boost for NBA franchises. Table 3 shows the descriptive statistics of the league variables (excluding the dummy variable capturing the effect of the new television contract).

Table 3: League Panel Data Descriptive Statistics

Variables	Mean	Min	Max	Standard Deviation
International Players	91	72	113	12
Cable Subscriptions*	56,194	51,875	62,100	3328
5-Year Finals Viewership*	79,576	64,090	90,160	8,704

*In thousands

6 Results and Discussion

The results section is divided into four parts. The first and second subsections consist of specification, results and interpretations of the hedonic model and the comparable company analysis. The third section presents the assumptions and results of discounted cash flow analysis. The fourth section combines and summarizes the learnings from the separate models, draws general conclusions about the determinants of franchise values in the NBA, and predicts values for hypothetical expansion franchise in Seattle — the most valuable location for an expansion team.

6.1 Hedonic Model

I estimated the parameters of the hedonic model using OLS and the White-Huber "sandwich" correction for heteroscedasticity (to provide robust standard errors). An

initial full model was built using all of the covariates in the panel data. To find the final model, I performed model selection using Akaike Information Criterion (AIC). The model specification is displayed in Equation 9.

$$\begin{aligned} ln(Value_{it}) = \alpha &+ \beta_1 Market_{it} + \beta_2 Performance_{it} + \beta_3 Market * Performance_{it} \\ &+ \beta_4 Stadium_{it} + \beta_5 Superstar_{it} + \beta_6 Brand_{it} + \beta_7 Debt_{it} \\ &+ \beta_8 Yearly\ League\ Effects_t + \epsilon_{it} \end{aligned} \tag{9}$$

There are seven variables that relate to team-specific associations with franchise value. $Market_{it}$ aims to capture the effects of market size on franchise value and is represented by metropolitan population.[13] The $Performance_{it}$ variable accounts for team performance on the court. At first, it included a vector of performance characteristics such as championships, playoff appearances, and wins. However, the only performance variable that was significant in the final model was playoff appearances over the previous five years.[14] In addition to the individual effects of market size and performance on franchise values, I also included a variable for the interaction effect between market and performance ($Market * Performance_{it}$). This variable accounts for the possibility that on-court success has a greater impact on franchise value in large markets, or vice versa. It was significant in the final model.

The $Stadium_{it}$ variable is a vector of two characteristics, stadium age and stadium ownership, which was not included in the final model. Previous literature found these stadium variables to be significant predictors of franchise value, but were removed through variable selection. The $Superstar_{it}$ variable is meant to account for the extreme importance of superstar players in the NBA and is measured as the number of MVP awards on the roster. It was significant in the final model. The $Brand_{it}$ variable attempts to account for a franchise's history, brand recognition and equity, and the level of fan connection to the team. It is observed as a franchise's total number of championships and was significant in the final model. $Debt_{it}$ is the proportion of a franchise's value that is made up of debt. It could be negatively associated with franchise values due to higher interest expense and thus lower free cash flow. It was significant in the final model.

[13] Median household income was initially included in the model as a market characteristic, but was not significant in the final model. I also tested variables to account for the number of major professional sports teams in a market by creating a variable ($\frac{Metro.Pop}{Prof\ Teams}$) for population divided by the number of teams in the market. The variable was meant to capture the effect of New York Knicks and Brooklyn Nets sharing the New York market with each other as well as the seven other professional sports teams in city.

[14] I also combined the three variables for team performance using the first principal component in a principal component analysis (See Appendix D). However, the playoffs variable alone led to a more favorable model fit than the combined performance principal component variable, so playoffs over the previous five years was the only on-court performance variable included in the final model.

In the time series data for this paper, average franchise values increase every year aside from between 2009 and 2010. The *Yearly League Effects*$_t$ vector of variables attempts to account for variation in franchise values at the league level which is left unexplained by the team-specific predictors. NBA franchise values grew by 18% on average between 2009 and 2016. The significant league variables in the final model are a dummy variable for when the NBA's new television contract was announced, a variable for the number of international players in the league, and a year variable.[15] The results from both the full and final models are shown in Table 4.

The regression coefficients in the full model are largely counterintuitive. The full model includes too many parameters and as a result is overfitting the data. In other words, the model is picking up on random noise as opposed to real relationships between variables. To get a model that not only isolates the important determinants of franchise value, but also is able to make reasonable predictions out-of-sample, I performed variable selection according to AIC to obtain a model with a reduced number of parameters. I iterated through models by dropping variables that decreased the model's fit according to AIC. The result was a model with nine parameters. This reduced model is of higher quality than the full model according to AIC (-105.7 as opposed to -101.6) and explains variation in franchise values about as well as the model according to r-squared (both models have r-squared values around 0.89) while using half of the variables. The nine parameters included in the final model were metropolitan population, playoff appearances, the interaction effect between population and playoff appearances, mvp awards, total championships, debt percentage, the television deal, international players, and year (Table 4).

Overall, the final model fits the data reasonably well. According to r-squared, the predictors explain 89% of the variation in franchise values. Furthermore, the coefficients from the model align with prior hypotheses (and previous research) about the sign of each respective variable's relationship with franchise values. For a franchise with an average number of playoff appearances, a one million person increase in metropolitan population is associated with a 3.1% increase in franchise values. According to the coefficient for the playoff appearances, given a median population, an additional playoff appearance is associated with a 3.5% increase in franchise values. The results that show market size and team success are significantly and positively associated with franchise values confirm that they are significant determinants of NBA franchise values. Additionally, the significant and positive slope of the interaction effect between population and playoff appearances indicates that having a winning team in a big market has a greater positive impact on franchise values than having a strong team in a small market.

[15]Variables for cable subscriptions and finals viewership were not significant in the final model and were dropped.

Table 4: 2009-2016 Hedonic Model Regression Results

	Full Model	Final Model
Variable	Parameter	Parameter
metro.pop	1.75e-05***	1.93e-05***
	(5.17e-06)	(4.62e-06)
playoffs.5years	-2.93e-03	1.35e-02
	(1.63e-02)	(1.07e-02)
metro.pop∗playoffs.5years	4.87e-06***	4.10e-06**
	(1.57e-06)	(1.58e-06)
mvp	8.23e-02***	6.41e-02***
	(1.47e-02)	(1.35e-02)
total.championships	-2.11e-02***	1.97e-02***
	(4.17e-03)	(3.67e-03)
debt.pct	-4.73e-01***	-4.73e-01***
	(9.53e-02)	(8.49e-02)
year	3.73e-01	7.79e-02***
	(2.67e-01)	(1.15e-02)
tv.deal	2.94e-01)***	3.60e-01***
	(1.09e-01	(5.11e-02)
international.players	8.80e-03***	6.20e-03***
	(2.60e-03)	(2.24e-03)
income	2.84e-06	
	(2.17e-06)	
championships.5years	-7.35e-02**	
	(3.64e-02)	
wins.5years	8.14e-04	
	(5.31e-04)	
stadium.age	-5.28e-04	
	(2.29e-03)	
stadium.ownership	-2.96e-02	
	(3.01e-02)	
franchise.age	3.33e-04	
	(9.84e-04)	
finals.5year.viewership	2.17e-03	
	(1.69e-02)	
cable	8.81e-08	
	(6.45e-08)	
Adjusted R-Squared	0.8924	0.8904
Observations	240	240
Robust standard errors in parentheses		
*** Significant at 1%, ** Significant at 5%, * Significant at 10%		

One additional MVP award won by a player on a franchise's roster is associated with a 6.6% increase in franchise values. One additional championship in a franchise's history is associated with a 2.0% increase in franchise values. A 1% increase in a franchise's proportion of value made up in debt is associated with a 0.47% decrease in franchise values. There is reason to be slightly dubious of the debt percentage result because the two most valuable franchises in the NBA, the Lakers and Knicks, have essentially zero debt and one of the league's least valuable franchises, the Milwaukee Bucks, have 54% of its value in debt (Forbes, 2017). Thus, the model could be picking up on a spurious correlation where the most valuable franchises happen to be nearly entirely equity funded and one of the least valuable teams is highly levered.

The television contract is associated with a 43.3% increase in franchise values, which is reasonable given that average franchise value increased by 71% in the year the television contract was announced. Thus, according to the model, the television contract explains 60% of the leap in franchise values in 2014, the year the contract was announced. Furthermore, each additional international player in the league is associated with a 0.62% increase in franchise values. Because the number of international players in the NBA is a proxy for international following in the league, there is some theoretical basis to support to positive association between international players and franchise values. However, it might be dangerous to draw strong conclusions based on this association because international players and franchise values are both generally increasing in the data set. Regress any two variables that are changing in the same direction and there will probably be a significant relationship between the two. Nonetheless, inclusion of the international players variable significantly improved the model fit (at the 1% level) according to a nested F test. It is also a proxy for international following, which is an economically significant growth driver for the NBA. Thus, it is worthwhile to include in the final model. After controlling for the league and team effects, an additional year was associated with 8.1% increase in franchise vales.

In addition to the general interpretation of the model parameters, an examination into the results from the $Market_{it}$ variable leads to the finding that small market teams may increases their franchise's value by moving to the biggest cities in the United States, despite (multiple) franchises already being located in those cities. Raw metropolitan population is a better predictor of franchise values than population divided by the number of professional sports teams in the market. This result may mean that franchises in small markets ought to consider moving to New York, Los Angeles, or Chicago, which have the largest populations in the United States but already have multiple professional teams. Furthermore, even when examining the population-per-team metric, the argument to move from a small market to a big market is compelling. Consider the New Orleans Pelicans moving to New York. In such a case the population-per-professional-team metric

would increase from 750,000 people per team (the Pelicans share New Orleans and its 1.5 million population with the New Orleans Saints) to 2,600,000 people per team (New York's population divided by 10 – the nine teams currently located there plus the hypothetical tenth). While there is no direct evidence that a city in the United States could credibly support three NBA teams because no U.S. city currently does so, relocating to a bigger market, even if there are already teams there, is an idea that small market teams, especially those that are struggling financially, could consider.[16]

To verify the model fit and to test the out-of-sample predictive accuracy of the model, the panel data was divided into a training set (data for learning the model parameters) and a testing set (data for testing the predictive accuracy of the model). The model was built on the data from 2009 to 2015 and out-of-sample predictions on 2016 franchise values from this model were compared to the 2016 data that was held out from the training model. Table 5 shows the predicted values versus the actual franchise value estimates from *Forbes*.

Table 5: 2016 Franchise Value Estimates and Hedonic Model Predictions*†

Team	*Forbes*	Hedonic	Team	*Forbes*	Hedonic
Atlanta Hawks	885	1306	Miami Heat	1350	1476
Boston Celtics	2200	1963	Milwaukee Bucks	785	934
Brooklyn Nets	1800	2149	Minnesota Timberwolves	770	1131
Charlotte Hornets	780	1089	New Orleans Pelicans	750	1045
Chicago Bulls	2500	1868	New York Knicks	3300	2117
Cleveland Cavaliers	1200	1464	Oklahoma City Thunder	1025	1217
Dallas Mavericks	1450	1546	Orlando Magic	920	1089
Denver Nuggets	890	1210	Philadelphia 76ers	800	1235
Detroit Pistons	900	1175	Phoenix Suns	1100	1082
Golden State Warriors	2600	1783	Portland Trail Blazers	1050	1201
Houston Rockets	1650	1444	Sacramento Kings	1075	929
Indiana Pacers	880	1146	San Antonio Spurs	1175	1525
Los Angeles Clippers	2000	2363	Toronto Raptors	1125	1295
Los Angeles Lakers	3000	2513	Utah Jazz	910	1112
Memphis Grizzlies	790	1104	Washington Wizards	1000	1365

*Predictions made out-of-sample
†Team values in thousands of dollars

Broadly, the hedonic model's out-of-sample predicted values on 2016 are relatively close to the actual *Forbes* estimates. The correlation between them is 0.88. The root mean square error (RMSE) of the model is 393, meaning that, on average, the predicted values

[16]There is evidence that cities outside the United States can support more than two professional sports teams of the same league. The English Premier League (EPL) has six teams in London. However, the EPL, unlike the NBA, does not really compete with other sports leagues because soccer dominates sports fandom in England.

differed from the Forbes estimates by $393,000. The most valuable franchises according to *Forbes* (Knicks, Lakers, Warriors, Bulls, Celtics, and Clippers) largely coincide with the most valuable franchises in the model predictions (Lakers, Clippers, Nets, Knicks, Celtics, and Bulls). However, there are team values that the model was not able to capture. The predicted value for the Knicks is more than a $1 billion less than *Forbes*' estimate. Predicted values for relatively less valuable teams such as the Bucks, Grizzlies, Hornets, Pelicans, and Timberwolves all exceed the *Forbes* estimate.

In summation, the hedonic model fits the data relatively well, the parameters are economically statistically significant and align with intuitive notions of NBA franchise value drivers, and the model makes reasonable predictions out-of-sample. The hedonic model in this paper improves upon previous research by using covariates that are tailored to drivers of franchise value and growth in the NBA. Furthermore, the general technique of using league-wide variables to estimate franchise value growth over time is unique in the literature of valuation of professional sports franchises.

6.2 Comparable Company Analysis

The second modeling technique to analyze the determinants of NBA franchise values is similar to the hedonic model. The comparables analysis used OLS modeling, the same cross-section panel data of predictors, but uses sales multiple instead of franchise value as the dependent variable in the regression. To calculate estimated franchise value from this model, the estimates from the regression are multiplied by a team's revenue. This method considers a measure of the current financial health of the team in addition to the observable determinants of value from the panel data. As with the hedonic model, robust standard errors are determined using the White-Huber "sandwich" correction for heteroscedasticity and variable selection using AIC was performed to find the final model. The specification of the regression on franchise sales multiples is shown in Equation 10.[17]

$$\begin{aligned} ln(Sales\ Multiple_{it}) = \alpha + \beta_1 Market_{it} + \beta_2 Performance_{it} + \beta_3 Market * Performance_{it} \\ + \beta_4 Brand_{it} + \beta_5 Debt_{it} + \beta_6\, Yearly\ League\ Effects_t + \epsilon_{it} \end{aligned} \tag{10}$$

The $ln(Sales\ Multiple_{it})$ is the value of each franchise in the NBA divided by its revenue for each of the years in the panel data (2009-2016). The panel data of predictors is the same as in the hedonic model (refer section 6.1 for discussion of the independent

[17]Variables not included in the final model were left out of the final sales multiple model specification because they have already been explained in hedonic model results (Section 6.1) and need not be repeated without being particularly relevant to the sales multiple model.

variables). I used variable selection according to AIC to determine a final model with only the significant determinants of NBA franchise sales multiples. The parameters included in the final model were metropolitan population, playoffs over the previous five years, the interaction between population and playoffs, total team championships, franchise proportion of debt, the television contract, finals viewership, and cable subscriptions (Table 6).

Table 6: 2009-2016 Sales Multiple Model Regression Results

Variable	Coefficient (SE)
metro.pop	3.983e-06
	(4.944e-06)
playoffs.5years	-4.687e-03
	(1.111e-02)
metro.pop*playoffs.5years	3.766e-06 ***
	(1.765e-06)
total.championships	9.881e-03 **
	(3.604e-03)
debt.pct	-1.858e-01 ***
	(8.032e-02)
tv.deal	5.027e-01 ***
	(3.439e-02)
finals.viewership	6.603e-02 ***
	(1.067e-02)
cable	1.383e-07 **
	(3.017e-08)
Adjusted R-Squared	0.8516
Observations	240
Robust standard errors in parentheses	
*** Significant at 1%, ** Significant at 5%, * Significant at 10%	

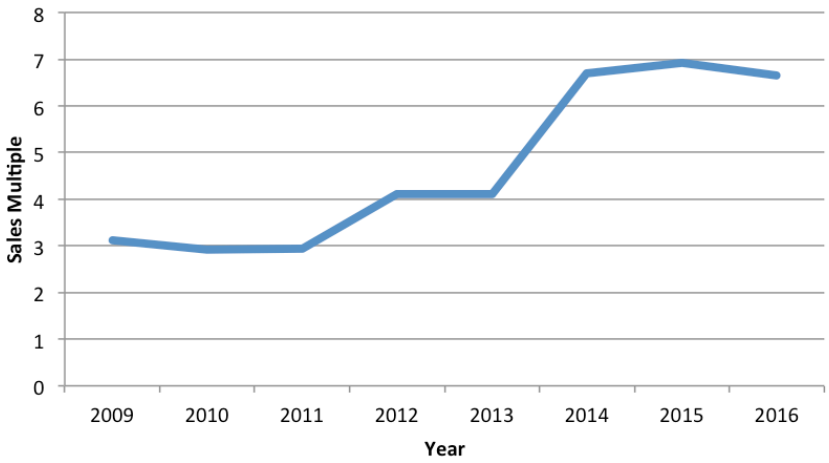
The regression on sales multiples yields slightly different results than the hedonic model. Firstly, number of MVP awards won by players on a franchise's roster is not a significant predictor of franchise sales multiples. The significance of superstar players in the hedonic model but not the sales multiple model suggests that having superstar players drives increased revenue (and thus is a significant determinant when estimating franchise values directly) but it does not necessarily increase the premium over revenue that a franchise is worth. Secondly, it is noteworthy that the individual effect for playoff appearances has a negative coefficient whereas it had a positive (albeit insignificant) coefficient in the hedonic model. However, when considering the combined effect of the individual coefficient and the interaction coefficient, given the median metropolitan pop-

ulation, one more playoff appearance is associated with a 1.4% increase in sales multiple. On the tail end of the market size distribution is the Memphis Grizzlies with 1.4 million metropolitan population. For the Grizzlies, one additional playoff appearance would only be associated with a 0.05% increase in sales multiple. Nonetheless, even for the minimum metropolitan population in the league, the effect of making the playoffs is still positively associated with sales multiples, despite the individual coefficient for playoff appearances being negative.

While some of the results in this regression are different from the hedonic model, many of the franchise-specific parameters have similar effects. For example, while holding the other variables in the model constant and given an average amount of playoff appearances, a one million person increase in metropolitan population is associated with a 1.4% increase in sales multiple. Holding revenue constant, according to the sales multiple model, a one million person increase in metropolitan population is also associated with a 1.4% increase in franchise values, not very different from the 3.1% estimated impact from the hedonic model. Furthermore, one additional championship in a team's history is associated with a 1% increase in sales multiple.

Similar to franchise values, franchise sales multiples also increased over time between 2009 and 2016. Average NBA franchise sales multiples grew by 14% annually with the biggest jump (similarly to the franchise values) occurring in 2014 (Figure 5).

Figure 5: Average Real NBA Franchise Sales Multiple Over Time



The final sales model included the three league effects — TV deal, finals viewership over the previous five years, and cable subscriptions. The television contract has a similarly large, significant and positive effect on franchise sales multiples as it has on franchise values. It is associated with a 65% increase in sales multiples. This result can be justified because sales multiples grew 63% in the year the television deal was announced while the team-specific characteristics stayed largely the same and total cable subscriptions in

the U.S. declined. Furthermore, a 100,000 unit decline in cable subscriptions is associated with a 1.38% decline in franchise sales multiples. For finals viewership, a one unit increase in rating was associated with a 6.8% increase in franchise sales multiples. The cable and viewership results are questionable because they may be the result of spurious correlations. However, in theory, it makes sense that these variables would be positively associated with franchise values.

In similar fashion to the hedonic model, the out-of-sample predictive accuracy of the sales multiple model was tested to further examine the model's fit. The panel data was divided into training (2009-2015) and testing sets (2016) and the parameters from the training model were used to predict franchise values in 2016 from the testing set of 2016 NBA franchise data. Table 7 shows the predicted values from the sales model versus the actual franchise value estimates from *Forbes*.[18]

Table 7: 2016 Franchise Value Estimates and Sales Multiple Model Predictions*†

Team	*Forbes*	Sales	Team	*Forbes*	Sales
Atlanta Hawks	885	1145	Miami Heat	1350	1501
Boston Celtics	2200	1643	Milwaukee Bucks	785	861
Brooklyn Nets	1800	1899	Minnesota Timberwolves	770	961
Charlotte Hornets	780	990	New Orleans Pelicans	750	968
Chicago Bulls	2500	1806	New York Knicks	3300	3095
Cleveland Cavaliers	1200	1491	Oklahoma City Thunder	1025	1181
Dallas Mavericks	1450	1379	Orlando Magic	920	1045
Denver Nuggets	890	1027	Philadelphia 76ers	800	925
Detroit Pistons	900	1117	Phoenix Suns	1100	1085
Golden State Warriors	2600	2256	Portland Trail Blazers	1050	1158
Houston Rockets	1650	1728	Sacramento Kings	1075	975
Indiana Pacers	880	994	San Antonio Spurs	1175	1266
Los Angeles Clippers	2000	1697	Toronto Raptors	1125	1299
Los Angeles Lakers	3000	2921	Utah Jazz	910	1042
Memphis Grizzlies	790	956	Washington Wizards	1000	1066

*Predictions made out-of-sample
†Team values in thousands of dollars

The sales model effective predicts *Forbes*' 2016 NBA franchise value estimates out-of-sample. The correlation between the sales model's predicted values and *Forbes*' estimates 0.96, higher than the correlation between the hedonic model and *Forbes* estimates. The RMSE of the sales multiple model is 232, meaning that, on average, the predicted values differed from the Forbes estimates by $232,000. According to RMSE, the sales model decidedly outperformed the hedonic model (RMSE of 393) regarding out-of-sample

[18] Predicted 2016 franchise values were obtained by multiplying the predicted sales multiple by 2016 revenue.

prediction. It significantly improves upon the hedonic model in terms of predicting the values of the NBA's most valuable franchises, the Lakers and Knicks. This is most likely because the model directly accounts for these teams' large revenues while the hedonic model cannot.

The sales multiple model's estimates are closer to *Forbes*'s valuations of least valuable franchises than the hedonic model's predictions. The hedonic model overestimated the *Forbes* estimate of the five least valuable franchises — the Pelicans, Timberwolves, Hornets, Bucks, and Grizzlies — by 40% on average whereas the sales multiple only overestimated the value of those teams by 22%. It seems that the combination of a team's intrinsic characteristics and financial health is a better method of valuing professional sports franchises than team characteristics alone. No literature on the topic has used the sales multiple method of estimating professional sports franchise values. This paper may have significantly improved upon the previous research in terms of predictive accuracy. Furthermore, because the models are being trained and tested on *Forbes* franchise value estimates, it may be that *Forbes* estimates franchises values using a method similar to the sales multiple model.

6.3 Discounted Cash Flow Analysis

The third valuation technique, a discounted cash flow analysis, can be expressed in a formula (Equation 11) in the form of a DDM.

$$Present\ Value_{2016} = \frac{UFCF_{2017}}{WACC - g} \tag{11}$$

$UFCF_{2017}$ is 2017 unlevered free cash flow, $WACC$ is the weighted average cost of capital (the discount rate), and g is the growth rate of cash flows. The first step in calculating $UFCF_{2017}$ from 2016 EBITDA (the most available metric from *Forbes*) is to project each team's 2017 EBITDA. To do so, I simply multiplied each team's 2016 EBITDA by the average growth rate of NBA franchise EBITDA since 1999 — 15.8%. Because Cleveland Cavaliers, Los Angeles Clippers, and Oklahoma City Thunder all had negative operating income in 2016, I used the average EBITDA over the previous five years as a proxy for 2016 EBITDA and the growth rate was applied to this five-year average. Next, while calculating UFCF from EBITDA is typically straightforward, it requires financial statements for information on CAPEX and change in working capital (See Appendix E). Because financial statements for NBA teams are unavailable, the UCFC must be estimated. Equation 12 shows how this paper estimates UCFC from EBITDA.

$$UCFC \approx EBITDA * (1 - t) \tag{12}$$

t is the U.S. corporate income tax rate, assumed to be 35%.[19] Furthermore, the WACC for each NBA team can be estimated using the following formula,

$$WACC = \frac{debt}{debt + equity} * r_d + \frac{equity}{debt + equity} * r_e \tag{13}$$

Forbes releases the proportions of debt and equity for all 30 NBA teams and these numbers are easily plugged into the formula. In this way, the model accounts for the varying capital structures of NBA franchises. Estimating the debt cost of capital (r_d) for each NBA team is an impossible task without each team's financial statements. Therefore, it is reasonable to assume that the r_d for the NBA as a whole is a good proxy for the r_d of individual franchises.[20] One reason this assumption has merit is that NBA teams have the ability and often do borrow from the NBA's credit facility because the league gets more favorable interest rates than individual teams (Walker, 2011). To make an informed guess of the r_d for the NBA, I got a quote from investment banker at Goldman Sachs who works with investment-grade debt. Based on the NBA being a private company with an A- credit rating (recently upgraded from BBB+), the estimated return on debt was the U.S. 10-Year Treasury bill plus 125 basis points, which is about 3.5%.

To estimate return on equity (r_e), it is conventional to use CAPM:

$$CAPM = r_f + \beta(r_m - r_f) \tag{14}$$

CAPM is return on equity (r_e). The risk-free rate of return (r_f) is approximated by the U.S. 10-Year Treasury Bill, currently about 2.25%. The market return (r_m) is often approximated by the historical returns of the S&P 500. I examined the average S&P returns over the various time frames ranging from the previous 30 years to the previous 100 and found the average return to be 7.9%. As a result, I estimated that r_m is 7.9%.

Calculating the β of the NBA is more difficult since publications such as *Bloomberg* that typically provide estimates of β for public companies do not publish such estimates for private enterprises. As a result, it must be done by hand. The procedure for estimating β is to perform a straightforward linear regression that compares returns of the investment to the returns of the market, specified in Equation 15.

$$r_{NBAi} = \alpha + \beta_1 r_{mi} \tag{15}$$

[19]The U.S. corporate income tax rate is 39.1%, but many companies pay a much lower effective tax rate. Regarding professional basketball teams, it may be that this 35% tax rate is actually too high given special tax codes regarding purchases of professional sports franchises (Davidson, 2014).

[20]The small sample of financial statements made available by Fort offer little help on this front. Taking interest expense divided by long term debt suggests the New Orleans Hornets' cost of debt (r_d) was 8.06% between 2008 and 2009. The same calculation says the Charlotte Bobcats cost of debt between 2001 and 2012 was 2.36%.

r_{NBAi} is annual return of an NBA team between the years 1999 and 2016 according to *Forbes* annual estimates of franchise value. r_{mi} is the annual return for the S&P 500 during each of the specified years. The estimated β came out to be 0.19, which is extremely low when compared to standard βs of equities.[21] This relatively low β implies that owning an NBA team carries very little market risk. That is, if the equities market drops significantly in value, the value of an NBA franchise will only drop a small amount (or about 19% of it according to the β). As a result, an investment in an NBA team requires relatively smaller returns than the stock market to be a valuable investment.[22] However, more concerning, the low β of the NBA may be exaggerated because the NBA is a private company and the franchise values are estimates (or mark-to-model) rather than actual traded values (mark-to-market). Naturally, value estimates from *Forbes* are going to be more stable than NBA franchise values if they were traded on public markets. As a result, some or most of the β can be explained by the way the values are determined. One way to improve upon this work would be to estimate the mark-to-model beta of the NBA to the mark-to-model beta of the S&P 500 or a weighted average of analyst public company valuations. To remedy this issue, I used a β that is half-way in between the downwardly biased β estimate from Equation 14, and the β of the market (1) — 0.6. Thus, using long-run S&P returns as the market return (r_m), 7.9%, the U.S. 10-year treasury bill (2.25%) as the risk-free return (r_f), and a β of 0.6, the return on equity (r_e) of each NBA team can be calculated using Equation 14.

I estimated the growth rate of NBA cash flows using the average real growth rate of NBA franchise EBITDA since 1998 (the first year *Forbes* released such estimates). This growth rate was 15.8%. Simply plugging in this number as the growth rate in the DDM formula (Equation 11) would be problematic for a multitude of reasons. First, to model NBA franchises and their cash flows as if they will grow at a 15.8% rate (even in the short term) would be making a strong (and most likely faulty) assumption.[23] Secondly, assuming franchises grow at a 15.8% rate would cause the DCF model to value each NBA franchise infinitely highly because this growth rate exceeds the discount rate (WACC) of all 30 teams. It would imply that NBA franchise operating incomes will more than triple over the length of the NBA's television contract (eight years).

To loosen the growth rate assumption, I use a multi-stage DDM, which takes dif-

[21]The interpretation of β that if the investment moves in lockstep with the market, it will have a β of 1. If it fluctuates more than the market, it will have a β greater than 1. If it is more stable than the market, it will be less than 1. In this case, the NBA team seems to be a much more stable asset than the market.

[22]Estimating the β of the NBA as a whole could understate the β of individual teams. To confirm if individual NBA team values did in fact have similar βs to the NBA as a whole, I calculated the β of the Oklahoma City Thunder, which was about 0.20 — roughly the same as the NBA as a whole. As a result, using 0.19 seemed to be a fair approximation for the β of all 30 NBA teams.

[23]Relaxing the growth rate assumption makes even more sense given the NBA recently slightly reduced its revenue projections for the 2017-18 season (Nahmad 2017).

ferent stages of growth into account. In this case, there will be two stages of growth. The first stage will last eight years — the length of time until television deal expires — and will have a growth rate (g_1) of 5.9% per year, which is the projected annual increase in television revenue over the life of the contract (See Appendix F). Relating the initial growth period to the new television contract is reasonable because it is guaranteed revenue stream for the league, and thus allows for reasonable projection of cash flows. Additionally, while the 15.8% growth rate assumes operating incomes will triple over the next eight years, a 5.9% growth rate projects that operating income will increase by 58% over that time span, a more reasonable estimate. However, after the eight-year period, revenues are extremely uncertain. The growth rate in this second stage of the DDM model (g_2) is assumed to be 2%, a relatively conservative estimate for the long-term rate of inflation.[24] The model is specified below in Equation 16.

$$PV = \frac{UFCF_{2017}}{r - g_1} * \left[1 - \left(\frac{1+g_1}{1+r}\right)^8\right] + \frac{1}{(1+r)^8} * \frac{UFCF_{2017} * (1+g_1)^8}{r - g_2} \tag{16}$$

The first part of the equation determines the present value of the franchise in stage one of the model with a growth rate (g_1) of 5.9%. The second part of the equation estimates the present value from the second stage of the model with a growth rate (g_2) of 2.0%. Each franchise's $UFCF_{2017}$ was calculated by multiplying 2016 EBITDA by 1.158 ($1 + g_1$) and then adjusting for estimated taxes using Equation 11. The discount rate (r) is WACC. Therefore, using the formulas and assumptions laid out, the present values of all 30 NBA teams can be calculated (Table 8).

The DCF franchise value estimates are relatively different from the hedonic and sales multiple model estimates. The DCF similarly predicts the Knicks and Lakers to be the most valuable teams, but overestimates their value relative to *Forbes*' estimations. Given that the model made relatively conservative assumptions throughout, it may actually be that *Forbes* is undervaluing the Lakers and Knicks's ability to generate cash flow. Other big-market teams such as the Celtics, Bulls, Mavericks, Warriors, Rockets, and Raptors are relatively valuable according to the DCF and have valuations close to the estimates from the other models, which is a promising sign. However, there are some anomalies with the DCF valuations. The Nets, Cavaliers, and Clippers are in the bottom five in value according to the DCF, while they are all among the top 11 most valuable franchises according to *Forbes*' estimates.[25] These anomalies can be explained by high player costs,

[24] g_2 was assumed to be 2% because a relatively large percentage of a franchise's value was derived from the second stage of the DDM model when g_2 was assumed to be 3% and because the estimates with a 2% g_2 are more reasonable.

[25] The Cavaliers and Clippers are two of the teams that had negative EBITDA in 2016. It seems that using average EBITDA over the previous five years still did not lead to UFCF estimates that properly

which significantly reduces profitability and thus projected cash flows. All four teams have spent significantly on player salaries and luxury taxes in the recent past, which is dragging down their cash flow estimates.

Table 8: 2016 Franchise Value Estimates and DCF Valuation

Team	*Forbes*	DCF	Team	*Forbes*	DCF
Atlanta Hawks	885	639	Miami Heat	1350	583
Boston Celtics	2200	1681	Milwaukee Bucks	785	953
Brooklyn Nets	1800	460	Minnesota Timberwolves	770	779
Charlotte Hornets	780	285	New Orleans Pelicans	750	499
Chicago Bulls	2500	1234	New York Knicks	3300	3782
Cleveland Cavaliers	1200	217	Oklahoma City Thunder	1025	641
Dallas Mavericks	1450	1135	Orlando Magic	920	1326
Denver Nuggets	890	568	Philadelphia 76ers	800	551
Detroit Pistons	900	669	Phoenix Suns	1100	786
Golden State Warriors	2600	2116	Portland Trail Blazers	1050	1175
Houston Rockets	1650	1765	Sacramento Kings	1075	688
Indiana Pacers	880	714	San Antonio Spurs	1175	512
Los Angeles Clippers	2000	291	Toronto Raptors	1125	1315
Los Angeles Lakers	3000	3212	Utah Jazz	910	1014
Memphis Grizzlies	790	618	Washington Wizards	1000	192

*Team values in thousands of dollars

On the other hand, teams such as the Milwaukee Bucks, Orlando Magic, and Utah Jazz have significantly larger valuations than the values from the other models. The Bucks valuation can be explained be the franchise's capital structure. Its value is 54% debt, which in turn makes its WACC lower because r_d is smaller than r_e. The team's value is probably overstated because as a company's debt load increases, so does the cost of debt, and this model assumed each franchise's cost of debt to be equal. The Magic and Jazz have relatively high valuations because they have both have high 2016 EBITDAs, and thus high unlevered free cash flow estimates. The Orlando Magic, in the 33rd percentile in terms of metropolitan population, are in the 73rd percentile in operating income. While this estimate was based solely on their 2016 EBITDA and the league average expected growth rate, both teams have a history of above-average operating incomes. It seems that they simply earn more money than what would be expected given their respective markets.

Overall, the DCF model is important to include in the suite of franchise value predictors, but it's franchise value predictions were much further away from *Forbes*'s estimates than the other two models. While the DCF model can uncover individual

valued these franchises. Perhaps using each franchise's typical income/revenue ratio would have been a better solution. Testing this hypothesis will be left for future research.

instances where the other models may be insufficient, the model's 602 RMSE suggests more work can be done to tune the model's parameters and create more accurate valuation estimates. Further research can build upon the findings from this paper by re-examining the assumptions in DCF model such as the future cash flow projections, the cost of debt and equity estimates, as well as the growth rate assumptions.

6.4 Combined Results

To summarize how well the presented methods performed at predicting franchise value, Table 11 shows the out-of-sample predicted values from each model compared to the *Forbes* franchise value estimates in 2016. Generally, the sales multiple model's predictions are closest to *Forbes*'s estimates. This result makes sense because the hedonic model relies upon franchise characteristics and excludes a franchise's ability earn money. For example, it undervalues franchises that have strong revenues and cash flows, such as the Golden State Warriors and Houston Rockets. Effectively, the model undervalues teams that make more money than expected given their characteristics. On the other hand, while the DCF model incorporates financial information, it disregards a franchise's characteristics that may make it more or less valuable in terms of earning potential. For example, the DCF model severely undervalues the Los Angeles Clippers because they have spent significantly on player salaries in recent years to retain a talented group of players and have not earned very much money as a result. However, it is reasonable to expect the Clippers to have significant future earning potential because they are located in the second largest market in the NBA and the team has performed well on the court. The sales multiple model incorporates franchise money-generating ability as well as the characteristics that can determine its potential to grow earnings in the future. As a result, it often yields estimates that are between the hedonic and DCF models (which occurred for 70% of teams) and closer to *Forbes*'s estimate than the other models.

Table 10 shows the RMSE of each of the models, which explains how far, on average, each model's estimate of franchise value differed from *Forbes*'s estimate. The sales multiple model produced estimates that were closest to *Forbes*'s according to RMSE. The hedonic model's estimates were moderately close as well. The DCF model performed substantially worse and it is an area where this paper can be improved (Table 10). In particular, future research on a better method to project future cash flows for franchises that have been relatively less profitable in recent years would improve the outlying underestimated values for teams such as the Cavaliers, Clippers, Nets, and Wizards.

Table 9: 2016 Franchise Value Predictions by Model

Team	*Forbes*	Hedonic	Sales Multiple	DCF
Atlanta Hawks	885	1306	1145	639
Boston Celtics	2200	1963	1643	1681
Brooklyn Nets	1800	2149	1899	460
Charlotte Hornets	780	1089	990	285
Chicago Bulls	2500	1868	1806	1234
Cleveland Cavaliers	1200	1464	1491	217
Dallas Mavericks	1450	1546	1379	1135
Denver Nuggets	890	1210	1027	568
Detroit Pistons	900	1175	1117	669
Golden State Warriors	2600	1783	2256	2116
Houston Rockets	1650	1444	1728	1765
Indiana Pacers	880	1146	994	714
Los Angeles Clippers	2000	2363	1697	291
Los Angeles Lakers	3000	2513	2921	3212
Memphis Grizzlies	790	1104	956	618
Miami Heat	1350	1476	1501	583
Milwaukee Bucks	785	934	861	953
Minnesota Timberwolves	770	1131	961	779
New Orleans Pelicans	750	1045	968	499
New York Knicks	3300	2117	3095	3782
Oklahoma City Thunder	1025	1217	1181	641
Orlando Magic	920	1089	1045	1326
Philadelphia 76ers	800	1235	925	551
Phoenix Suns	1100	1082	1085	786
Portland Trail Blazers	1050	1201	1158	1175
Sacramento Kings	1075	929	975	688
San Antonio Spurs	1175	1525	1266	512
Toronto Raptors	1125	1295	1299	1315
Utah Jazz	910	1112	1042	1014
Washington Wizards	1000	1365	1066	192

*Predictions made out-of-sample
†Team values in thousands of dollars

Additionally, because the sales multiple model performed the best in predicting *Forbes* estimates – 41% better than the hedonic model and 159% better than the DCF model according to RMSE – this paper provides evidence to support Vine's (2004) and Vogel's (1999) claims that *Forbes*'s methodology for valuing NBA franchises is similar to a sales multiple model (Table 10).

Table 10: Root Mean Square Error by Model

Model	RMSE
Hedonic	393
Sales Multiple	232
DCF	602

To use these results to analyze the value of potential expansion franchises, the three models were used to predict the values of a hypothetical franchise in five locations currently without NBA teams – Las Vegas, San Diego, Seattle, St. Louis and Tampa Bay. To make these predictions, a number of assumptions were made because population is the only true known variable for the hypothetical franchise locations. The two regression models were modified to have television deal and year as the only overarching league effects because estimating cable subscriptions or international players in the league would unnecessarily complicate the assumptions. For all franchises, I assumed playoffs over the previous five years to be one and the number of MVPs on the roster to be zero. Each team was assumed to have the average amount of debt. I gave Seattle credit for the Seattle Supersonics championship in 1979. Since the goal of that variable is to account for a franchise's brand, it seems fair to acknowledge the Supersonics' brand and history in Seattle. Because the other cities have no such NBA history, they were assigned a zero for total championships.[26] To get estimates for revenue and operating income, I regressed those variables against population and applied the output to each city's population. Table 11 shows the predicted values from the three models multiplied by 125% to account for the franchise sale price premium.

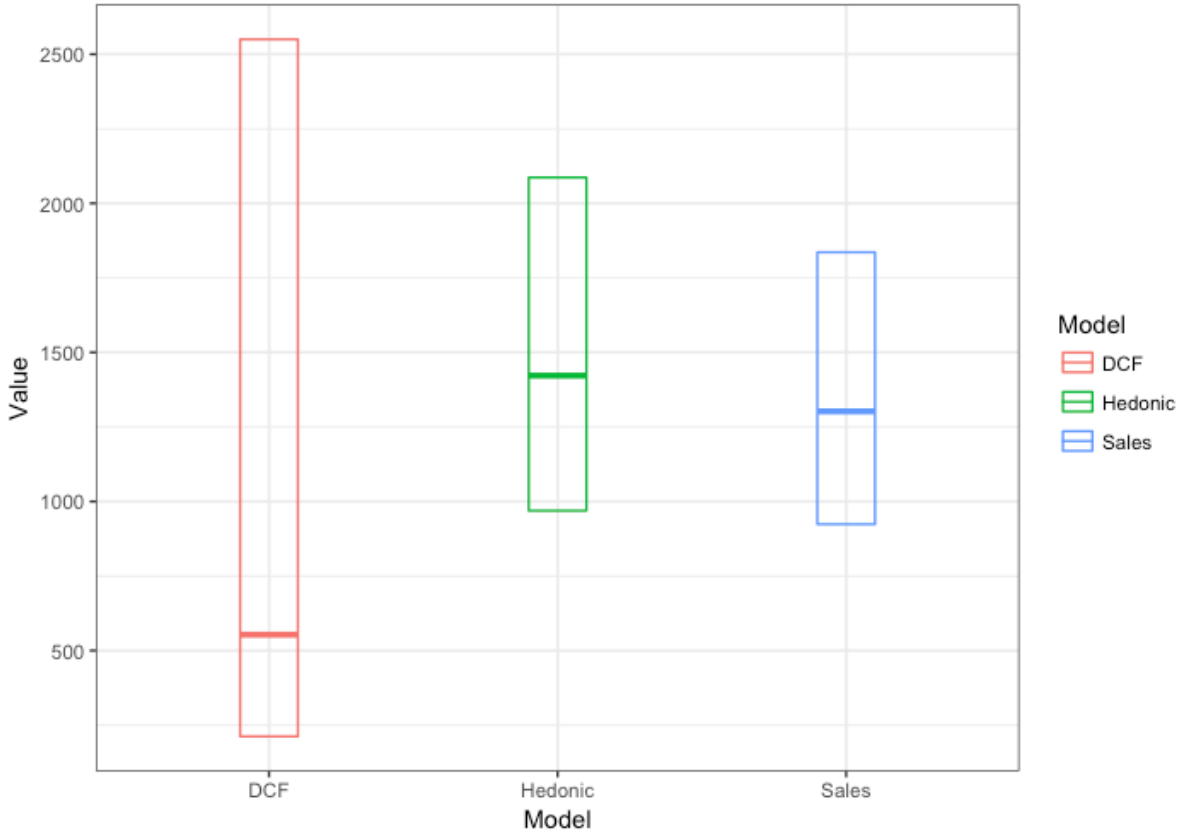
Table 11: Potential Expansion Franchise Values by Model

Team	Hedonic	Sales Multiple	DCF
Las Vegas	1321	1184	429
San Diego	1349	1224	476
Seattle	1422	1302	553
St. Louis	1337	1206	455
Tampa Bay	1341	1212	461

[26]If the variable to capture franchise brand was franchise age instead of total championships, St. Louis would have received credit for the St. Louis Spirits' two seasons in the ABA.

The primary issue with these predictions is that they are almost entirely based on one parameter, population. Nonetheless, Seattle is the most valuable franchise in all three of the models, which implies it would be the best location for the NBA to introduce an expansion franchise. The NBA would still have to weigh the opportunity costs of expansion to the price the league could charge as an expansion fee. To further examine value estimates of an NBA team in Seattle, I created a football field of predicted values. Figure 6 displays the predicted values and confidence intervals of a franchise in Seattle in 2017 from the hedonic model, sales model, and DCF model after applying the 25% average premium above estimated values that NBA franchises typically command on the open market.

Figure 6: Football Field of Seattle Franchise Predicted Values



The upper and lower bounds for the hedonic and sales multiple model predictions are the prediction intervals. The confidence interval for the DCF model was constructed from a sensitivity analysis of the model assumptions (see Appendix G). The benefit of combining the results from the three models is to create a range of estimates and be more certain when those ranges overlap. Given the point estimates and prediction error intervals, it is reasonable to conclude that the franchise in Seattle would be worth about $1.4 billion and would almost certainly be between $1 and $2 billion. Therefore, this

paper's recommendation for the league would be that, if the opportunity cost of the revenues that each owner is giving up is substantially less than $1.4 billion, then the league should strongly consider expanding to Seattle.

7 Conclusion

This study analyzes the determinants of NBA franchise value using three valuation techniques: a hedonic model, a comparable company analysis, and a discounted cash flow analysis. This paper finds that the significant determinants of franchise value at the NBA team level are market size, on-court performance, superstar players, team brand, franchise capital structure, and the pure ability of a franchise to make money. As opposed to previous literature on sports franchise values, characteristics such as stadium age and ownership and the number of other professional sports teams in the market were not significant predictors of franchise value in the NBA. This paper's finding that superstar players and total championships are significant determinants of franchise value was not seen in earlier research. While these results may be specific to NBA franchises, the significance of these variables in other professional sports franchise valuation problems can be tested in future research.

In addition to team-specific effects, this paper finds that the most significant league effect was the NBA's new television contract, which, according to the models, was associated with up to a 60% increase in franchise values and is the primary driver of franchise value growth over time. The estimation of league-wide drivers of franchise appreciation over time is a technique that has not been used in existing literature and can be applied to future analyses of professional sports franchise values.

The results from the three valuation techniques reveal that the significant determinants of NBA franchise value cannot be captured by one model alone. For example, the DCF model not only substantiates the lofty valuations of the Lakers and Knicks, but also suggests that the two other models may undervalue the sheer money-making ability of the two franchises. On the other hand, while the DCF model values the Jazz and Magic highly because of they have been among the most profitable NBA franchises in recent years, the hedonic and sales multiple models estimate that these teams have lower potential for profit growth in the future and thus give them lower valuations. The best model according to RMSE is the sales multiple model, which factors in both economic franchise characteristics and its ability to earn revenue and is similar to the methodology that *Forbes* uses to determine its franchise value estimates. The football field valuation technique improves upon existing research by accounting for potentially high variance of any model alone, providing more definitive results than those in previous literature.

This paper's findings about the significant determinants of NBA franchise value,

especially characteristics that account for league-wide drivers of franchise growth over time, and substantiation of results by creating multiple valuation models can be applied to future research on franchise valuation in the NBA and other professional sports leagues. In particular, further research on the drivers of franchise value appreciation over time can considerably advance the findings from this paper.

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Appendices

A The NBA Collective Bargaining Agreement

The rapid increases in franchise values, team revenues, and growth forecasts are of considerable relevance to the NBA's collective bargaining agreement (CBA) between the owners and players. Taking a step back, the league's CBA is a contract between the owners and the players that establishes specific elements of how the league will operate, such as division of revenues between the owners and players, caps on team team salary and exceptions, and player and team discipline. Such contracts are typically between five and ten years in length, and upon expiration require the owners and players to renegotiate the next deal. The most important aspect for this paper is the breakdown of league revenue, or what the league defines as "basketball-related income" or BRI.

Examining the proportion of BRI allocated to the owners and players in different CBAs across time give a sense of the negotiating leverage of each side. The players share of BRI was 57% in the CBA that was in negotiated in 2005 and was in place through the 2010-2011 season. In 2011, during the negotiation of the next CBA, the NBA owners argued that many of the league's teams were losing money. Consequently, they were able to negotiate the players' share of BRI down from 57% to 51% in the next CBA. However, in the years since the negotiation of the decrease in the players' share of the league's income, it appears NBA franchise ownership has become substantially more profitable. Today, unlike in 2011, owners can no longer credibly contend to be losing money given the large operating profits and considerable capital gains that NBA franchises are currently yielding. With these recent developments in mind, it is possible to analyze the new CBA that the players and owners signed on January 19th, 2017. Consensus belief had it that the league's strong financial standing would swing the negotiating power in the players union's favor, potentially necessitating a renegotiation of the players' share of BRI upward. However, leaked information on the contents of the CBA suggest that the split of BRI between the players and owners will remain unchanged (Wojnarowski 2016). While the specifics of the new agreement have yet to be released, a robust determination of the present values of NBA franchises could shed light on whether or not the players negotiated a fair contract.

B Hedonic Price Index Method

The hedonic price index method, introduced by Humphreys and Mondello (2008), is a valuation technique that uses past franchise transactions and team characteristics to es-

timate franchise value. It is similar to the hedonic model, but substitutes real transaction prices in for *Forbes* value estimates. They called the technique the hedonic price index method because they use historical franchise transaction prices as the response variable in their model, which occur over a long period of time, such that they include a time variable (or index) as a predictor in their model in addition to franchise characteristics. The general model offered by Humphreys and Mondello is as follows,

$$ln(P_{it}) = \alpha_t C_t + \beta_t \mathbf{S}_{it} + \epsilon_{it} \tag{17}$$

The only difference between the model specification in this model versus the hedonic model laid out in section 4.1 is that the variable for $Value_i$ represents actual franchise transaction prices rather than *Forbes* estimates of franchise values. Adopting Humphreys and Mondello's (2008) work to a model more specific to the NBA would look similar to Equation 15.

$$ln(Price_{it}) = \alpha_t C_t + \beta_1 Wins_i + \beta_2 \mathbf{Market}_i + \beta_3 Stadium_i + \epsilon_{it} \tag{18}$$

The variable for the vector of market characteristics $\mathbf{Market}_i$ may include such factors as metropolitan population, number of teams in the market, television homes, and/or demographic traits such as average age. I expect most if not all of the characteristics to be significant determinants of team value when estimating it directly. The time varying intercept $\alpha_t C_t$ account for changes in franchise value over time that are not accounted for by the parameters in the model.

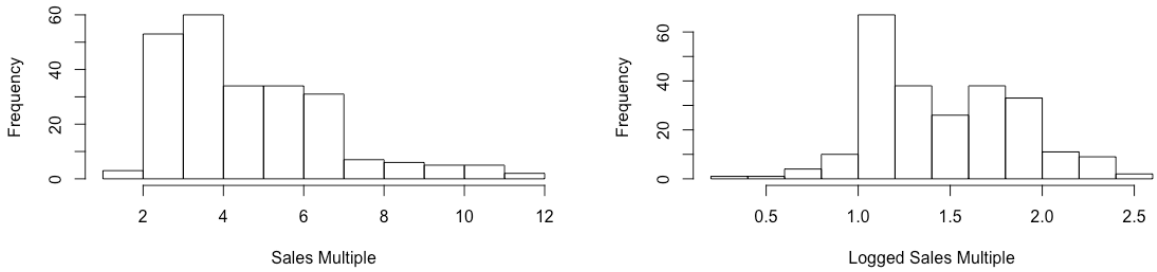
C Transformation of Sales Multiple Variable

The transformation of the sales multiple variable was done because of the same justification as the transformation of the franchise values variable. The distribution is right-skewed, so taking the log of sales multiples creates a more normally distributed variable. Figure 6 shows the distribution of raw and logged sales multiples.

D Principal Component Analysis

Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. This transformation is defined in such a way that the first principal component accounts for as much

Figure 7: Distribution of Franchise Sales Multiples (2009-2016)



(a) Raw Franchise Sales Multiples

(b) Logged Franchise Sales Multiples

of the variability in the data as possible, and each succeeding component in turn explains less and less of the variability. In practice, the first principal component is used to represent the combined effect of multiple correlated variables. In this paper, PCA was used to find the first principal component of the combined effect from three correlated variables explaining franchise performance on the court: wins, playoff appearances and championships.

E Calculating UFCF From EBITDA

The following equation is used to calculate unlevered free cash flow from EBITDA:

$$UFCF = EBITDA - CAPEX - \Delta Working\,Capital - Taxes \tag{19}$$

CAPEX is capital expenditures, change in working capital ($\Delta Working\,Capital$) is the change in current assets subtracted by current liabilities, and Taxes is simply the amount paid in taxes. This paper assumes away $\Delta Working\,Capital$ and uses $EBITDA * 0.6$ to account for CAPEX and Taxes.

F Projection of NBA Future Cash Flows

In 2016-17, the first year of the television deal, NBA revenues from television are more than double the year prior. Additionally, estimating the payout structure of the contract (See Equation 22 and Table 12 below) reveals that the NBA's revenues from the deal will grow somewhere around 6% per year for the length of the contract (through the 2024-2025 season). The NBA's television deal with ABC, ESPN, and TNT goes from the 2016-17 season through the 2024-25 season — 9 years — and pays a total of $24 billion. Additionally, the first season's payout (2016-17) is $2.1 billion (Coon 2014,

Nahmad 2014). Using these estimates, I projected the payment schedule of the television contract throughout the life of the deal using a formula for a growing annuity:

$$PV = \frac{P}{r-g} * \left[1 - \left(\frac{1+g}{1+r}\right)^{n}\right] \tag{20}$$

P is the payment. r is the discount rate and g is the growth rate. Table 12 shows the projected yearly payouts.

Table 12: Projected Yearly Payouts

2017	2018	2019	2020	2021	2022	2023	2024	2025
2.10	2.22	2.35	2.49	2.64	2.79	2.96	3.13	3.31

Table 13 shows the estimated growth rate in the revenue from the television contract. The model suggests that the payouts will increase by 5.87% per year over the contract. This growth is in addition to increased expected revenue from other sources such as the sale of logo rights on jerseys. Thus, there are reasons to believe the NBA's 15.8% real growth of EBITDA will continue over the next eight years.

Table 13: Implied Annual Revenue Growth

Years	Raises (g)	Total Value
9	5.87%	$24 B

G DCF Sensitivity Analysis

Sensitivity analysis is the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs. In this case, sensitivity analysis on the DCF is a way to verify if reasonable changes to the assumptions have large effect on the valuation. I changed the following to get the upper and lower bounds for the DCF predicted value for Seattle were the following: increased operating income to average and decreased it by 50%, decreased β to 0.4, increased it to 1, increased g_2 to 3%.