A TWO-STEP VALUATION MODEL FOR PROFESSIONAL SPORTS TEAMS

Honors in Management, Advised by Dr. Barton Hamilton
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Abstract

In our paper, we value sports franchises while considering both the probability of a transaction and the price of a sale. We hypothesize that offer prices change while reservation prices stay constant, and we also hypothesize the effects of certain market, team, and ownership characteristics on both the value of a franchise and the probability of sale. First we performed a simple linear regression to model franchise values, and then we ran a Probit regression to examine the probability of a sale at any given time. Using the Heckman Selection Model to combine our first two regressions, effectively controlling for non-random selection, we take into account that we only observe a franchise price when there’s a sale.

Our results show that while franchises that generate more revenue are more valuable, higher revenues also decrease the likelihood of a sale. Franchises located in markets with greater populations and higher market median incomes are more valuable, but higher market median income decreases the likelihood of a sale. When the market is up, franchises are valued higher and the probability of a sale is greater. Additionally, while NFL teams sell at a premium compared to other leagues, NFL owners are less likely to sell. As expected, a human owner is less likely to sell a franchise, but the death of an owner increases the likelihood of a sale. Our Heckman Selection Model concludes that we tend to see sales when there is a drop in the reservation price, not necessarily when there is a high offer.

I. Introduction

Professional sports leagues have a major impact on the US economy. The combined revenues of each of the four major sports leagues, National Football League ($25B)\textsuperscript{[1]}, Major League Baseball ($8B)\textsuperscript{[2]}, National Basketball Association ($5B)\textsuperscript{[3]}, and National Hockey League
($3.2B)$^{[4]}$, is 41.2 billion dollars. If the four leagues were a single corporation, their combined revenues would rank 66 on the 2012 Fortune 500$^{[5]}$, exceeding major firms like Google (#73), Morgan Stanley (#68), and News Corp. (#91). Additionally, professional athlete salaries rival top CEOs. The highest paid athlete of all four leagues, Kobe Bryant, would rank 6th$^{[6]}$ among the 100 Highest-paid CEOs with a total income of $61.9m$^{[7]}$ in 2013. Cities benefit from sports franchises by attracting tourists and boosting public image, encouraging local investment and tax revenues, and also by creating jobs and public welfare$^{[8]}$. Host cities of major championship games also receive benefits, such Glendale, Arizona, which received $500m from the 2008 Super Bowl.$^{[9]}$ Professional sports leagues have massive viewership, for example, the 2011 Super Bowl had 113.3 million viewers, about 35% of the US population.$^{[10]}$

Each league has a limited amount of teams, usually privately held, and infrequently transacted. In our paper we will use observations of these transactions to build a valuation model for sports franchises. Our paper looks at valuation through two lenses: probability of a transaction and price of a sale. Our analysis expands on the prior literature by accounting for alternative variables that may affect franchise valuation as well as the probability of a sale. Our argument is based in the idea that franchise sales are not random and are often triggered by the current owner’s death. Our model will also investigate what drives the premium on franchise prices including market conditions like the S&P 500 and the qualitative reason for the transaction.

Several research papers have analyzed the valuation of sports teams. Many of these papers reference the Forbes reported revenues of teams to estimate the sports teams values (Vine 2004). In our paper, we believe that the revenues reported by the sports teams, the single variable of the Forbes valuation model, are potentially inaccurate due to the proprietary nature of
their model. This contention is supported by Humphreys (2008) who finds that franchises are sold at a 27% premium relative to Forbes figures. Moreover, Fort (2006) shows owners may use their sports teams as a tax shelter. For example, a $4 million profit can easily be shown as a $2 million loss, while still keeping in accordance with GAAP rules. In addition to the inaccuracies of reported revenue, additional variables should be included in team valuation. In “Determinants of Franchise Value of North American Sports Leagues,” Humphreys uses variables like the franchise age, location of the franchise, facility, and on-field success to value sports teams (Humphreys 2008). Miller (2007) reaffirms our argument by finding that new stadiums enhance team profitability and as a result increase the team value. However, he also claims that the cost of building a new stadium often offsets this increase in team value. In our literature search, we did not find research that valued sports teams based on characteristics of the franchise owners. In our paper, we will expand on different variables that could affect the value of sports teams such as market conditions and characteristics of the owners.

Our model is based on the idea that a sports franchise will only be sold when the offer price exceeds the reservation price. First, we use market and team characteristics to estimate the franchise value, or the offer price. Given that these franchise values are based on observed non-random transactions, a simple linear regression does not accurately capture the market. Therefore, to account for the non-random sample selection, we use a Probit regression to measure the variables that affect the probability of sale without affecting the price, such as whether the franchise is owned by a person or if that person dies within the year of the transaction. We then used a Heckman Selection model, a two-step statistical approach, to take into account that we only observe a franchise price when a franchise is sold. In cases where a franchise is not sold due to an owner’s death, sports franchises are only sold when the offer price
exceeds the owner’s reservation price. Excluded from our analysis is a discussion of the ego-factor which adds an element of economic irrationality to the owner’s reservation price. We cover this nuance through the variable Owner Dies as we argue the ego dies with the owner.

Using our selection model estimates, we are able to accurately value current sports franchises. Our model can be used to value potential new franchises. Current models, like Forbes’ revenue-based model, must assume a value for revenue in order to value a potential new franchise. Our model will enable the potential investors to input simple market characteristics to create an accurate valuation. The two major applications of accurately valuing current and new franchises will offer clarity to a market plagued by ambiguity.

The remainder of the paper proceeds as follows: in Section II, we describe our data sources and present summary statistics on franchise sale prices and characteristics. We describe our model of franchise sales in Section III, which dictates our econometric approach. Section IV describes our empirical results. In Section V, we discuss the implications of our results for alternative theories of firm valuation, and Section VI presents a simulation exercise for the value of an NFL franchise in Los Angeles. We conclude in Section VII.

II. Data and Summary Statistics

To accurately price the value of NFL, NHL, MLB, and NBA sports franchises we collected data from 1990-2012 on each team’s market information, performance results, and team ownership.

We collected data on the regional fan base for individual teams to calculate the revenues that teams generate from their fans. The market data we looked at includes the local Market Population to estimate the fan base size and the Market Median Income to estimate the revenues
that fans can bring in. Furthermore, the Number of Franchises in the Market will help evaluate the proportion of loyal fans to each regional sports team. We collected this market information from the Census Bureau.

The majority of the team-specific data was compiled by Rodney Fort, University of Michigan Professor. In addition to compiling the data, Fort extrapolated the complete Franchise Price based on fractional transactions. Transactions occur at prices that do not reflect the full value of a team in instances when, for example, a 25% share is purchased. We follow Fort’s conversion method to unify our data across observations. We collected the Revenues that sports teams report each year. To verify the revenues, we also collected data on the Attendance and Ticket Prices. Next, we analyzed yearly expenses to calculate net income, including data on the Average Player Salary and Operating Expenses. Lastly, we evaluated the teams based on their season performance by looking at their Win %. We then took the natural log of these data to decrease the difference between incremental years.

To capture the economic conditions of each year, we recorded the S&P500 Average. In cases where data was missing, for example when the NHL went on lockout in 2004, we extrapolated the data based on the annual inflation rate that year collected from the US Census Bureau.

Lastly, we collected data on the characteristics of franchise owners. We recorded whether or not the team has a Human Owner because we believe this variable will have implications on the probability of a sale. We also recorded whether the Owner Died because the owner either passes on the team to family members or sells the team. The transaction prices for these two options have incremental differences.

Table 1 presents summary statistics of our data and shows that franchises are infrequently
transacted. We observe a franchise sale in 5.5% of the franchise year observations in the data, which corresponds to an average ownership tenure of 18.3 years. Of note also is that 87% of franchises are owned by individuals rather than corporations, and that we observe an owner death in almost 1% of our franchise years. We will use the latter to factors as variables that influence a sale but not the sale price.

### Table 1: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Franchise Price*</td>
<td>135</td>
<td>5.311</td>
<td>0.823</td>
<td>3.201</td>
<td>7.673</td>
</tr>
<tr>
<td>Revenue*</td>
<td>2467</td>
<td>4.518</td>
<td>0.636</td>
<td>0.549</td>
<td>6.29</td>
</tr>
<tr>
<td>S&amp;P Average*</td>
<td>2468</td>
<td>6.811</td>
<td>0.452</td>
<td>5.807</td>
<td>7.299</td>
</tr>
<tr>
<td>Total Franchises in Market</td>
<td>2468</td>
<td>3.706</td>
<td>1.891</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Market Population</td>
<td>2468</td>
<td>5334008</td>
<td>4857528</td>
<td>257837</td>
<td>19800000</td>
</tr>
<tr>
<td>Market Median Income</td>
<td>2468</td>
<td>55725</td>
<td>14496</td>
<td>24416</td>
<td>105700</td>
</tr>
<tr>
<td>Human Owner</td>
<td>2468</td>
<td>0.874</td>
<td>0.332</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Owner Died</td>
<td>2468</td>
<td>0.008</td>
<td>0.09</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sale</td>
<td>2468</td>
<td>0.055</td>
<td>0.227</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

### III. A Model of Franchise Sales and Values

Hedonic price models have often been used to estimate the value of goods that are infrequently traded by analyzing quantitative and qualitative attributes of the goods. A potential franchise buyer would offer a value of $V_i$ based on equation (1):

$$ (1) \quad V_i = \beta X_i + \varepsilon_i $$

The values of the $\beta$ coefficients represent the value that the potential buyer implicitly places on each individual attribute in the vector $X_i$. The error term $\varepsilon_i$ represents other factors that affect the value of the good, but are not observed in the vector $X_i$. This equation relates the offered value of a franchise to a vector of observed characteristics of the franchise, to be discussed later.
The method is similar to the method used by Humphreys and Mondello (2007) to create an index for professional sports franchise values.

Define the reservation value as the lowest price at which the owner of a franchise would be willing as:

\[ V_i^r = \alpha X_i + S_i \gamma + \varepsilon_{ir} \]

The same attributes are used in the vector \( X_i \), but it is possible that the franchise owner values them differently. The \( S_i \) variables represent factors that affect the franchise owner’s decision to sell, such as the death of an owner.

A sale of the franchise is observed when the offer value, \( V_i \), of the potential franchise buyer exceeds the reservation value of the current owner, \( V_i^r \). This equation can be rewritten and simplified as:

\[
\begin{align*}
(3) & \quad V_i \geq V_i^r \\
(4) & \quad \beta X_i + \varepsilon_i \geq \alpha X_i + S_i \gamma + \varepsilon_{ir} \\
(5) & \quad X_i (\beta - \alpha) + S_i \gamma + (\varepsilon_i - \varepsilon_{ir}) \geq 0 \\
(6) & \quad I_i^* = Z_i \delta + u_i \geq 0
\end{align*}
\]

Using equations (1) and (6), the franchise sale price model may be rewritten as:

\[
\begin{align*}
(7) & \quad V_i = \beta X_i + \varepsilon_i \text{ if } I_i^* \geq 0 \\
& \quad V_i \text{ not observed if } I_i^* < 0
\end{align*}
\]

The major challenge that occurs with these models comes from the possibility that the sales are not random samples of the population. The values of franchise prices are only observed when a sale takes place in the market. The intent of the paper is to measure the value of a sports franchise at any time, instead of only valuing it at the time a sale is made. Since sports
franchises are so infrequently traded, the events which reveal their true valuation may not occur randomly. While the hedonic model used in equation (1) accounts for the observable characteristics of a specific franchise $i$ at the time of sale, it does not account for other factors that may affect the possibility of a sale. For example, if a league is enjoying a boost in popularity, or there is a rise in stock prices which increase the wealth potential buyers, it may appear in the error term from equation (1). Taking the expected value of a sale,

\[
(8) \ E[V_i | I_i^* \geq 0] = \beta X_i + E[\epsilon_i | I_i^* \geq 0]
\]

it is possible that $E[\epsilon_i | I_i^* \geq 0]$ may not be equal to zero, as is assumed in ordinary least squares regression. If $E[\epsilon_i | I_i^* \geq 0]$ is assumed to be zero when it is not, the values for $\beta$ obtained from traditional ordinary least squares model will be biased.

To account for this bias, assume that $(\epsilon_i, u_i)$ is jointly normally distributed with mean zero and variance-covariance matrix $\Sigma$:

\[
(9) \ (\epsilon_i, u_i) \sim N(0, \Sigma)
\]

\[
(10) \ \text{Var}(\epsilon_i) = \sigma_1 \\
\text{Var}(u_i) = 1 \\
\text{Cov}(\epsilon_i, u_i) = \sigma_{1u}
\]

Under the joint normality assumption we can write:

\[
(11) \ E[\epsilon_i | I_i^* \geq 0] = \omega_i = -\sigma_{1u} \phi(Z_i \delta) / \Phi(Z_i \delta)
\]

where $\phi$ denotes the standard normal density function and $\Phi$ denotes the standard normal cumulative distribution function. Therefore, $\omega_i$ is the inverse Mills ratio, which produces unbiased estimates of the parameters of our regression when there is the possibility of non-random sample selection. By including this ratio into the valuation regression, we can account
for the potential non-zero error term in the valuation model and obtain unbiased estimates of the values of \( \beta \).

To estimate the model, we will use a two-step procedure. We will first use data on all sold and unsold franchises to estimate a probit model for whether the franchise was sold.

\[
I_i^* = Z_i \delta + u_i, \text{where } I_i = 1 \text{ if } I_i^* \geq 0; = 0 \text{ otherwise}
\]

Given the estimate of \( \delta \) obtained from equation (12), we will construct the inverse Mills ratio and estimate the model through ordinary least squares and using the data on observed sales.

\[
V_i = \beta X_i - \sigma_1 \frac{\varphi(Z_i \delta)}{\Phi(Z_i \delta)} + \zeta_i
\]

We can therefore obtain unbiased estimates of the purchase values of professional sports franchises using the non-random sample of firms for which a purchase value was actually observed.

IV. Results

In our data collection, we used Franchise Value as the dependent variable and team and market characteristics as the independent variables. Then, we determined the significance of the variables to come up with a model to value sports teams. In our analysis we took the log of the variables, indicated in our tables by the asterisks (*), whenever possible because the log of the variables will allow us to look at percentage changes.
Part one of our analysis is our OLS regression results (Table 2). We ran two separate regressions, the first including revenue and the second excluding revenue. By running the first regression with revenue, we were able to observe if revenue is a significant factor in determining franchise values. We found that a 10% increase in team revenue increases franchise value by 7.7% (p-value 0.000). In addition, we found that a 10% increase in the S&P500 Average increases the franchise value by 2.8%, which is significant at the 10% confidence level (p-value 0.056). Between the leagues, NFL teams are valued 39.58% higher than MLB teams (p-value 0.003), NHL teams are valued 24.73% lower than MLB teams (p-value 0.098), and NBA teams are valued 53.00% higher than MLB teams (p-value 0.000), holding the other variables in the regression constant.

After running the first regression with revenue, we ran a second regression excluding revenue to see which characteristics are independent of revenue. By excluding revenue, we found that two additional variables became significant. Now, we see that an increase of 100,000 people in the Market Population increases the franchise values by .0034% (p-value .029), and an increase of $1,000 in the Market Median Income increases franchise values by .0098% (p-value .028).

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1) Coef</th>
<th>Std. Err.</th>
<th>t-stat</th>
<th>p-val</th>
<th>(2) Coef</th>
<th>Std. Err.</th>
<th>t-stat</th>
<th>p-val</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFL</td>
<td>0.3958315</td>
<td>0.1296028</td>
<td>3.05</td>
<td>0.003</td>
<td>0.5861117</td>
<td>0.1377636</td>
<td>4.25</td>
<td>0.000</td>
</tr>
<tr>
<td>NHL</td>
<td>-0.2473279</td>
<td>0.1482326</td>
<td>-1.67</td>
<td>0.098</td>
<td>-0.7326078</td>
<td>0.1296936</td>
<td>-5.65</td>
<td>0.000</td>
</tr>
<tr>
<td>NBA</td>
<td>0.5299705</td>
<td>0.1283255</td>
<td>4.13</td>
<td>0.000</td>
<td>0.2284503</td>
<td>0.1274677</td>
<td>1.79</td>
<td>0.076</td>
</tr>
<tr>
<td>Revenue*</td>
<td>0.7692746</td>
<td>0.1435837</td>
<td>5.36</td>
<td>0.000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Win Percentage*</td>
<td>0.0200475</td>
<td>0.1495613</td>
<td>0.13</td>
<td>0.894</td>
<td>0.0856534</td>
<td>0.1647517</td>
<td>0.52</td>
<td>0.604</td>
</tr>
<tr>
<td>S&amp;P Average*</td>
<td>0.2819356</td>
<td>0.1460048</td>
<td>1.93</td>
<td>0.056</td>
<td>0.7177344</td>
<td>0.1340124</td>
<td>5.36</td>
<td>0.000</td>
</tr>
<tr>
<td>Total Franchises in Market</td>
<td>0.0341922</td>
<td>0.0386975</td>
<td>0.88</td>
<td>0.379</td>
<td>0.0114936</td>
<td>0.0425143</td>
<td>0.27</td>
<td>0.787</td>
</tr>
<tr>
<td>Market Population</td>
<td>1.53E-08</td>
<td>1.43E-08</td>
<td>1.06</td>
<td>0.289</td>
<td>3.39E-08</td>
<td>1.54E-08</td>
<td>2.21</td>
<td>0.029</td>
</tr>
<tr>
<td>Market Median Income</td>
<td>-1.52E-06</td>
<td>4.52E-06</td>
<td>-0.34</td>
<td>0.738</td>
<td>9.79E-06</td>
<td>4.41E-06</td>
<td>2.22</td>
<td>0.028</td>
</tr>
<tr>
<td>Cons</td>
<td>-0.2211433</td>
<td>0.7497136</td>
<td>-0.29</td>
<td>0.769</td>
<td>-0.2509876</td>
<td>0.8286184</td>
<td>-0.30</td>
<td>0.762</td>
</tr>
</tbody>
</table>
.028). Similar to our first regression, we see that a 10% increase in the \( S&P500 \)\textit{Average} increases franchise values by 7.2% (p-value 0.000). NFL teams are still valued 58.61% higher than MLB teams (p-value 0.000), NHL teams are valued 73.26% lower than MLB teams (p-value 0.000), and NBA teams are valued 22.85% higher than MLB teams holding the other variables in the regression constant (p-value 0.076). Comparison of models (1) and (2) suggest that market population and median income drive franchise revenues.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|c|c|c|c|c|}
\hline
Variable & (1) & & & (2) & & & \\
\hline
NFL & -0.1894356 & 0.1272483 & -1.49 & 0.137 & -0.2942713 & 0.1226475 & -2.40 & 0.016 \\
NHL & -0.2143746 & 0.1427152 & -1.50 & 0.133 & 0.0498323 & 0.1187030 & 0.42 & 0.650 \\
NBA & -0.1702110 & 0.1260344 & -1.35 & 0.177 & -0.0006954 & 0.1142747 & -0.01 & 0.995 \\
Revenue* & -0.4549552 & 0.1363765 & -3.34 & 0.001 & - & - & - & - \\
S&P Average* & 0.5007838 & 0.1505818 & 3.33 & 0.001 & 0.2322143 & 0.1290279 & 1.80 & 0.072 \\
Total Franchises in Market & 0.0297716 & 0.0429760 & 0.69 & 0.488 & 0.0476107 & 0.0433742 & 1.10 & 0.272 \\
Market Population & -7.62E-09 & 1.62E-08 & -0.47 & 0.639 & -1.90E-08 & 1.61E-08 & -1.18 & 0.239 \\
Market Median Income & -3.22E-06 & 4.90E-06 & -0.66 & 0.511 & -1.07E-05 & 4.43E-05 & -2.41 & 0.016 \\
Human Owner & -0.2085310 & 0.1201162 & -1.74 & 0.083 & -0.2049944 & 0.1198203 & -1.71 & 0.087 \\
Owner Died & 0.7149903 & 0.3532058 & 2.02 & 0.043 & 0.6972066 & 0.3477664 & 2.00 & 0.045 \\
Cons & -2.5799520 & 0.7565820 & -3.41 & 0.001 & -2.4502050 & 0.7621104 & -3.22 & 0.001 \\
\hline
\end{tabular}
\caption{Probability of Sale}
\end{table}

In the second part of our analysis (Table 3), we estimated Probit regressions with and without revenue, keeping in line with the first part of our analysis. The Probit regression examines the probability of sale. The sign of the coefficient gives the direction of the effect, but it does not directly tell the magnitude of the effect. In our regression with revenue, we found that higher revenue teams are less likely to be sold (p-value 0.001). In addition, an increase in the \( S&P500 \)\textit{Average} increases the probability that the team will be sold (p-value 0.001). We also found that a team with a \textit{Human Owner} is less likely to be sold than a team owned by a corporation (p-value 0.083). The last significant variable was the death of an owner, which increases the probability of a sale (p-value 0.043). This is consistent with the notion that estate
tax concerns may trigger a sale after an owner’s death.

In our regression without revenue, we found that more variables became significant. We found that NFL franchises are less likely to be sold in a given year relative to MLB franchises, holding all other variables constant (p-value 0.016). Additionally, this model found that with a higher Market Median Income, the probability of a sale decreases (p-value 0.016). The following results remained constant from the regressions with revenue and without revenue: increase in S&P500 Average increases probability of sale (p-value 0.072), team with Human Owner is less likely to be sold (p-value 0.087), and Owner Dies increases probability of a sale (p-value 0.087).

However, something to keep in mind is that the p-values of these three variables increased, meaning that the model with revenue is stronger.

Table 4: Selection-Corrected Regression Results

<table>
<thead>
<tr>
<th>Franchise Price* Variable</th>
<th>(1)</th>
<th></th>
<th></th>
<th></th>
<th>(2)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef</td>
<td>Std. Err.</td>
<td>z-stat</td>
<td>p-val</td>
<td>Coef</td>
<td>Std. Err.</td>
<td>z-stat</td>
<td>p-val</td>
</tr>
<tr>
<td>NFL</td>
<td>0.4245132</td>
<td>0.1476425</td>
<td>2.88</td>
<td>0.004</td>
<td>0.6631861</td>
<td>0.1733790</td>
<td>3.83</td>
<td>0.000</td>
</tr>
<tr>
<td>NHL</td>
<td>-0.1454490</td>
<td>0.1763453</td>
<td>-0.82</td>
<td>0.409</td>
<td>-0.7546120</td>
<td>0.1367194</td>
<td>-5.52</td>
<td>0.000</td>
</tr>
<tr>
<td>NBA</td>
<td>0.6113422</td>
<td>0.1513257</td>
<td>4.04</td>
<td>0.000</td>
<td>0.2291629</td>
<td>0.1321610</td>
<td>1.73</td>
<td>0.083</td>
</tr>
<tr>
<td>Revenue*</td>
<td>0.9859826</td>
<td>0.2294698</td>
<td>4.30</td>
<td>0.000</td>
<td>0.0807159</td>
<td>0.1602</td>
<td>0.50</td>
<td>0.615</td>
</tr>
<tr>
<td>Win*</td>
<td>0.0099785</td>
<td>0.1443136</td>
<td>0.07</td>
<td>0.945</td>
<td>-0.0080906</td>
<td>0.0493374</td>
<td>-0.16</td>
<td>0.160</td>
</tr>
<tr>
<td>S&amp;P Average*</td>
<td>0.0461828</td>
<td>0.2459622</td>
<td>0.19</td>
<td>0.851</td>
<td>0.6163842</td>
<td>0.1713934</td>
<td>3.60</td>
<td>0.000</td>
</tr>
<tr>
<td>Total Franchises in Market</td>
<td>0.0220851</td>
<td>0.0434597</td>
<td>0.51</td>
<td>0.611</td>
<td>3.77E-08</td>
<td>1.68E-08</td>
<td>2.24</td>
<td>0.025</td>
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<tr>
<td>Market Population</td>
<td>1.37E-08</td>
<td>1.56E-08</td>
<td>0.88</td>
<td>0.378</td>
<td>1.46E-05</td>
<td>6.74E-06</td>
<td>2.16</td>
<td>0.031</td>
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<tr>
<td>Market Median Income</td>
<td>-5.77E-08</td>
<td>5.13E-06</td>
<td>-0.01</td>
<td>0.991</td>
<td>1.1957850</td>
<td>1.6475010</td>
<td>0.73</td>
<td>0.468</td>
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<td>Cons</td>
<td>1.3940620</td>
<td>1.5466780</td>
<td>0.90</td>
<td>0.367</td>
<td>-0.0708820</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rho</td>
<td>-0.7809700</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</table>

<table>
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<th>Sales Variable</th>
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<th>(2)</th>
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<td></td>
<td>Coef</td>
<td>Std. Err.</td>
<td>z-stat</td>
<td>p-val</td>
<td>Coef</td>
<td>Std. Err.</td>
<td>z-stat</td>
<td>p-val</td>
</tr>
<tr>
<td>NFL</td>
<td>-0.1899898</td>
<td>0.1274444</td>
<td>-1.49</td>
<td>0.136</td>
<td>-0.2956740</td>
<td>0.1228119</td>
<td>-2.41</td>
<td>0.016</td>
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<td>NHL</td>
<td>-0.2280439</td>
<td>0.1434002</td>
<td>-1.59</td>
<td>0.112</td>
<td>0.0361905</td>
<td>0.1195390</td>
<td>0.30</td>
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<td>NBA</td>
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<td>0.175</td>
<td>-0.0007765</td>
<td>0.1142948</td>
<td>-0.01</td>
<td>0.995</td>
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<tr>
<td>Revenue*</td>
<td>-0.4562905</td>
<td>0.1366187</td>
<td>-3.34</td>
<td>0.001</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Win*</td>
<td>-0.0056899</td>
<td>0.0174628</td>
<td>-0.33</td>
<td>0.745</td>
<td>-0.0063522</td>
<td>0.0162209</td>
<td>-0.39</td>
<td>0.695</td>
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<tr>
<td>S&amp;P Average*</td>
<td>0.5171602</td>
<td>0.1511653</td>
<td>3.42</td>
<td>0.001</td>
<td>0.2489649</td>
<td>0.1298497</td>
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<td>0.055</td>
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<td>Total Franchises in Market</td>
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<td>0.0430110</td>
<td>0.64</td>
<td>0.524</td>
<td>0.0452975</td>
<td>0.0434117</td>
<td>1.04</td>
<td>0.297</td>
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12
In the third part of our analysis (Table 4), we estimated a Heckman selection model, based on our model in Section III, to control for the sample selection. Again, we first ran our Heckman selection model including revenue. Accounting for non-random selection increases the value of an NFL franchise relative to an MLB franchise from 39.58% (p-value 0.003) to 42.45% (p-value 0.004), and also increases the value of an NBA franchise relative to an MLB franchise from 53.00% (p-value 0.000) to 61.13% (p-value 0.000). However, after accounting for non-random selection, the value of NHL franchises are not significantly different than MLB franchises. Additionally, accounting for non-random selection increases the impact of a 10% increase in revenue on franchise value from 7.7% (p-value 0.000) to 9.9% (p-value 0.000). From the Sales section in Table 4, we can see that after accounting for non-random selection, higher revenue teams are still more likely to be sold (p-value 0.001), increases in the S&P500 Average still increase the probability that the team will be sold (p-value 0.001), a team with a Human Owner is still less likely to be sold (p-value 0.075), and Owner Dies still increases the probability of a sale (p-value 0.042).

We then ran a second regression excluding revenue. Accounting for non-random selection increases the value of an NFL franchise relative to an MLB franchise from 58.61% (p-value 0.000) to 66.32% (p-value 0.000), decreases the value of an NHL franchise relative to an MLB franchise from a 73.26% discount (p-value 0.000) to a 75.46% discount (p-value 0.000), and increases the value of an NBA franchise relative to an MLB franchise from 22.85% (p-value .076) to 22.92% (p-value 0.083). Additionally, accounting for non-random selection decreases
the impact of a 10% increase in the *S&P500 Average* on franchise value from 7.2% (p-value 0.000) to 6.2% (p-value 0.000), increases the impact of a *Market Population* increase of 100,000 people on franchise values from .0034% (p-value 0.029) to .0038% (p-value 0.025), and increases the impact of a $1,000 increase in *Market Median Income* on franchise values from .0098% (p-value 0.028) to .0146% (p-value 0.031). From the Sales section in Table 4, we can see that after accounting for non-random selection, NFL franchises are still less likely to be sold in a given year relative to MLB franchises (p-value 0.016), increases in the *S&P500 Average* still increase the probability that the team will be sold (p-value 0.055), a team with a *Human Owner* is still less likely to be sold (p-value 0.079), *Owner Dies* still increases the probability of a sale (p-value 0.044), and higher *Market Median Income* still decreases the probability of a sale (p-value 0.016). The negative rho implies that the observed sale prices tend to understate the actual value of a franchise in a given year.

V. Discussion

The results of our analysis can help us interpret the value of a franchise based on several factors. Significant factors that carried through our regression include characteristics of the owner, team revenue, and the market. A negative rho tells us that we see sales when there is a drop in the reservation price, not necessarily when there is a high offer, which is inconsistent with the hypothesis that sales occur only when an extremely high offer is made. In that case, we would expect to see that unobserved factors influences a sale are positively correlated with the error term in the valuation equation. Instead, the negative rho implies that unobserved factors that increase the likelihood of a sale are negatively correlated with the sale price. From our model in Section III, this occurs when the reservation price declines. Consequently, owner-
specific changes in the reservation price, perhaps arising from declines in the owner’s financial position, appear to trigger sales.

The regression showed that teams with human owners are less likely to sell compared to those owned by corporations. However, once the owner dies, the probability of sale increases. Our findings suggest that human owners have a certain loyalty to their teams that corporation executives do not have, making it less likely for human owners to sell their teams because their reservation prices are irrationally high. This also explains why teams are more likely to be sold when the owner dies. Surprisingly, we found that higher revenue teams are less likely to be sold, even though the value model showed that higher revenue teams could be sold at a higher franchise price. We find that owners hold on to their team when the team is doing well, even though they can sell it for a higher price, which is perhaps an ego factor that should be further evaluated. However, teams are more likely to sell the franchise when the market has a higher S&P500 Average, so they are more likely to sell when market conditions allow for teams to be sold at a higher price.

VI. Simulating the Value of a Los Angeles NFL Franchise

In the following example, we will estimate the franchise value of a Los Angeles NFL team using the Heckman Selection Model without Revenue.

\[
\ln (\text{Value of Franchise}) = 0.66 \text{ (NFL)} - 0.75 \text{ (NHL)} + 0.23 \text{ (NBA)} + 0.08 \ln(\text{Win}) + 0.62 \ln(\text{S&P Average}) - 0.01 \text{ (Total Franchises in Market)} + 3.77 \times 10^{-8} \text{ (Market Population)} + 1.46 \times 10^{-5} \text{ (Market Median Income)} + 1.20
\]

\[
\ln(\text{Value of LA Team}) = 0.66 \times 1 + 0.08 \ln(50\%) + 0.62 \ln(1652.23) - 0.01 \times 7 + \ldots
\]
3.77E-08 (12,828,837) + 1.46E-05 (65,749.16) + 1.20 = 7.7723

\[
Value\ of\ LA\ Team = \exp (7.7723 + 0.5*\sigma^2)
\]

\[
= \exp (7.7723 + 0.05*(.614^2)) = \$2,866.36\ million
\]

This value of $2.374 million for a Los Angeles NFL team rivals the current Los Angeles MLB team, the LA Dodgers. The LA Dodgers was sold for a record price of $2,150 million in 2012 to Guggenheim Partners. We predicted in our analysis that NFL teams are sold at a premium compared to MLB teams, which is proven in this estimate.

### VII. Conclusion

In conclusion, we gathered team, market, and ownership data about each American franchise in the NFL, NBA, MLB and NHL between the years 1990-2012. With this data we performed a simple linear regression to model franchise values using transaction data. We advanced this model by taking into account the non-random quality of franchise transactions. Using a Probit model we found the significant factors that affect the likelihood of observing a sale. Combining these models with a Heckman Selection Model, we created a final model for valuing professional sports teams based on a team’s league and its revenue. We used the negative rho from the Heckman model to show that sales tend to occur when the owners’ reservation price decreases, as opposed to the receipt of an extreme offer. To assess the value of potential teams we created an additional model without revenue and found that local and larger market factors were relevant. We concluded that these market forces roll into revenue and used this second model to price a potential new NFL franchise in Los Angeles. Our simulation suggests that a Los Angeles NFL franchise would be valued at $2.866 billion.
References


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