Collegiate Football Attendance in El Paso

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Abstract
This study examines potential determinants of attendance at University of Texas at El Paso (UTEP) Miners football games. Time series data are utilized to analyze UTEP attendance from 1967 to 2014. Among the more notable outcomes, ticket sales are found to follow the local business cycle and be inversely correlated with unemployment. Demand for tickets is also found to be upward sloping. Forecasts are generated for the 2015 season and several quantitative metrics indicate good out-of-sample simulation performance is attained. Replication of this study for football teams in more traditional "college towns" provides an intriguing opportunity for further research.

Key Words: College Football; Ticket Sales; Regional Business Cycles

1. Introduction

The popularity of collegiate sporting events in the United States is widely recognized. College sport revenue streams vary by sport and organization, but substantial cash flows are generated from television contracts and gate revenues (ticket sales). American football ticket sales routinely exceed 40 million per year (NCAA, 2014). Several studies examine different aspects of attendance for collegiate athletics and uncover interesting patterns of consumer behavior (Falls and Natke, 2014; Fizel and Bennett, 1989; Griffith, 2010).

This study examines potential determinants of attendance, measured by ticket sales, at the University of Texas at El Paso (UTEP) Miners football games from 1967 to 2014. There are multiple factors that make this football program unique. El Paso, Las Cruces, and Ciudad Juarez form the Borderplex economy, an international metropolitan area with more than 2.4 million residents (Fullerton and Walke, 2014). Although the Borderplex is more populated than 18 of the 38 American metropolitan statistical areas that have major professional sports teams (USCB, 2015), UTEP generally ranks among the lower echelon of athletic departments in terms of total football revenues (ESPN, 2008). American football is also popular in Mexico (Silver, 2014). Thus, UTEP ticket sales may be influenced by a variety of regional and cross-border economic conditions.

Relatively few time series data samples have been employed for periods covering 10 years or more of ticket sales that include multiple business cycles (Borland and Macdonald, 2003). Most prior research has been performed using cross-sectional data or panel data on entire leagues or conferences for time periods between one and five years (Falls and Natke, 2014). The data set for this study may provide new insights to attendance behavior, not only for UTEP, but for other sports organizations as well.

The next section reviews several previous studies in this subject area. A description of the data and methodology follow. Empirical results are then summarized. A concluding section suggests topics for further research.

2. Prior Research

Prior literature on the determinants of sporting event attendance examines four topics: outcome uncertainty, television broadcasts, team performance, and promotions. A majority of the analyses contain similar economic, demographic, and temporal regressors. Ordinary least squares is the most common estimation method, but maximum-likelihood estimation, and non-linear least squares methods have also been used. Time series data have been seldom analyzed, leaving a partial void in the sports economics literature. This void is likely a result of elusive, or even nonexistent, data involving individual sport organizations or teams.

Outcome uncertainty refers to the unpredictability concerning individual game results. The uncertainty variable is measured several ways. Forrest et al. (2005) and Allan and Roy (2008) use a measurement based on league standings prior to each game. However, the position in league standings neglects other factors that contribute to outcome uncertainty. Knowles et al. (1992) and Forrest and Simmons (2002) circumvent this problem by using pre-game betting odds for each individual game as a regressor and find evidence that attendance is positively related to outcome uncertainty.

Television broadcasting may be the most widely analyzed determinant of attendance, but ambiguity exists regarding its overall impacts. Kaempfer and Pacey (1986) find that live television broadcasting has a net positive effect on college football attendance in the 1975-1981 seasons, due to increases in exposure and marketing. Fizel and Bennett (1989) report evidence of a negative net effect on college football attendance from 1980-1985. Both studies utilize similar model specifications and analyze panel data for National Collegiate Athletic Association (NCAA) Division I-Football Bowl Subdivision (FBS), yet reach conflicting conclusions. Allan and Roy (2008) obtain rare ticket sales data that distinguish between season ticket sales, home-team game day sales, and visiting-team game day sales in the Scottish Premier League. Season ticket holder demand is found to be insensitive, but live broadcasting reduces home-team gate sales by 30 percent. Aggregating the various types of tickets sold may be the root of the previous disparities.

Researchers have reached a consensus that ticket sales are positively related to team performance. This relationship applies to Major League Baseball (Denaux et al., 2011; Kappe et al., 2014), NCAA Division I-FBS college football (Fitzel and Bennett, 1989; Griffith, 2010; Ahn and Lee, 2014; Falls and Natke, 2014), European soccer (Bird, 1982; Allan and Roy, 2008), and minor league baseball (Cebula, 2013). The most common explanatory variables are the winning percentages of the home and away teams, but point differentials, and other performance measures are often employed. Winning percentages are calculated on a running basis to capture the effects of a varying performance throughout a season (Cebula, 2013). Proportional winning percentages have been constructed by multiplying a team's winning percentage by the percentage of games played in a season (Rascher, 1999). This calculation attempts to correct for high volatility of winning percentages early in the season. Performance is also measured in terms of "sloppiness" variables such as the mean number of errors per game in baseball (Cebula et al, 2009). Performance variables attempt to measure potential spectator interest, or excitement, in the head-to-head matchups of individual sporting events.

One recent topic of interest in the sports industry is the effect of promotions on attendance. Various marketing and promotional activities, from fireworks shows to free figurines, exert significant positive impacts on attendance (Cebula et al., 2009; Kappe et al., 2014). Minor league baseball has been the main subject of the analysis because of its nature as a player development league where team performance is often relegated as secondary to individual player progress (Gifis and Sommers, 2006; Cebula, 2013). Interstingly, Kappe et al. (2014) also documents a similar positive effect of these special programs on Major League Baseball attendance.

Most sporting event attendance studies tend to include several fundamental determinant variables. Economic conditions are measured by real ticket prices, real incomes per capita, and local unemployment rates. At present, the effects of economic variables on ticket sales are not very clear. Many studies find price to have a negative relationship with attendance (Borland, 1987; Denaux et al., 2011; Cebula, 2013), but Kaempfer and Pacey (1986) find evidence of a positive relationship. Price is often measured as the real average ticket price, but this understandable calculation has some limitations. Real average ticket prices do not accurately represent multi-price ticket sales or residual costs incurred when attending sporting events, such as parking and concessions (Borland and Macdonald, 2003; Noll, 2012).

Uncertainty also exists about the effects of income fluctuations on attendance. Bird (1982) finds that soccer in the Scottish Premier League is an inferior good, as does Borland and Lye (1992) for Australian rules football. In constrast, Cebula (2013) reports evidence that minor league baseball is a normal good. This difference in income effect may relate to the type of sport, or result from an absence of reliable data (Cairns et al., 1986). Furthermore, the relationship between attendance and the local unemployment rate is equally ambiguous. Most studies hypothesize an inverse relationship between unemployment rates and ticket purchases, but Baimbridge et al. (1996) documents a positive relationship, and many studies find no significant link (Knowles et al., 1992; Denaux et al., 2011; Cebula, 2013).

Population is a common demographic regressor and much evidence supports a positive relationship with attendance (Schofield, 1983; Kaempfer and Pacey, 1986). Fizel and Bennett (1989) report conflicting results and hypothesize more populous regions have more substitute goods available to residents. Climatic and temporal variables employed differ among studies, but generally include the day of the week, month, game time, and temperature (Cebula et al., 2009; Denaux et al., 2011; Cebula, 2013). The day and month variables are more relevant to sports that play games during the week and during the summer. Minor league baseball games played on weekends and during the popular vacation months (June and July) generally attract more fans than weeknight or May and September games (Cebula, 2013).

Much of the recent research on sporting event attendance employs panel data methods (Borland and Macdonald, 2003; Cebula, 2013; Falls and Natke, 2014). Among the few studies that are able to collect time series data, Kappe et al. (2014) uses ordinary least squares, maximum-likelihood, and instrumental variable estimation. Bird (1982) assembles a 29 year time series on aggregate league attendance for English soccer and utilizes non-linear least squares estimation.

Time series data on ticket sales and attendance for individual organizations have not been assembled very often for studies in sports economics. The few efforts that have been

performed are limited to samples that span less than a decade. This study attempts to at least partially fill that gap in the sports economics literature by analyzing a fairly unique data sample collected for NCAA football attendance for one program over the course of a 48-year period. The sample period is long enough to include complete information for multiple business cycle phases as well as changing collective team fortunes and conference re-alignments.

3. Data and Methodology

This study examines the effects of different variables on UTEP Miner football attendance (ATT) during a sample period from 1967 through 2014. Reported game day attendance for UTEP home games is used as the dependent variable and the data are obtained from the 2015 UTEP Fact Book (UTEP Football, 2015). Miner home games are played at Sun Bowl Stadium. The Sun Bowl original seating capacity was 30,000. In 1982, the stadium seating capacity was increased to 52,000. Subsequent facility renovations in 2001 reduced seating capacity to 51,500. Full capacity was reached 7 times between 1967 through 2014, and 5 of those games are subsequent to the 1982 expansion. A list of the employed variables and their descriptions are provided in Table 1.

Average ticket prices are calculated by dividing annual revenue from ticket sales by total attendance for each season. These nominal prices are converted to real terms using the United States consumer price index (USCPI). Annual revenue data from 1967 through 2000 are obtained from various schedules in the University of Texas at El Paso Annual Financial Reports (UTEP AFR, 2000). Data from 2001 through 2014 are obtained directly from the University of Texas at El Paso Office of Auditing and Consulting Services because the relevant revenue schedules are not directly included in the annual financial reports. Eleven of the nominal average ticket price observations, from the 1982 and 1997 seasons, are generated by averaging the preceding and succeeding season nominal ticket prices. That step was taken because annual revenue data are not available for those years.

Real personal income (RINC) per capita for El Paso is included as an indicator for local economic conditions. Bird (1982) and Cebula (2013) both find income to affect attendance, but with the former study indicating that professional soccer is an inferior good and the latter concluding that minor league baseball is a normal good. Annual income and employment data for El Paso County are obtained from the Bureau of Economic Analysis (BEA, 2015). RINC is generated by deflating annual personal income per capita using USCPI. Monthly frequency income estimates are calculated by regressing annual real per capita income on annual employment data for El Paso County. Monthly employment data from the Texas Workforce Commission (TWC, 2015) are then input into Equation (1), in order to approximate El Paso monthly real per capita income. The RINC equation is:

$$RINC_t = 10{,}223.22 + 0.044864 * EMP_t \quad (1)$$

where EMP_t is annual employment data for El Paso County (BEA, 2015).

Baimbridge et al. (1996) concludes that sporting event attendance is positively related to the unemployment rate of a city. To examine if this is the case for collegiate football attendance, monthly unemployment rates for El Paso County are obtained from the Texas

Workforce Commission (TWC, 2015). The local unemployment rate provides another proxy for local economic conditions.

Table 1: Variables and Units

Variable	Description
ATT	Reported Game Day Attendance
P	Real Average Ticket Price in 2010 Dollars
RINC	El Paso Monthly Real Per Capita Income in 2010 Dollars
UR	El Paso County Monthly Unemployment Rate
WIN	UTEP Win Pctg. Mult. by Proportion of Season Completed
OPPWIN	Opponent Win Pctg. Mult. by Prop. of Opp. Season Comp.
HWIN	UTEP Home W. Pctg. Mult. by Prop. Home Games Comp.
PREV	Outcome of Previous UTEP Game
RANK	Nationally Ranked Opponent
HIST	Hist. No. of Prior Games Played between UTEP and Opp.
HC	Homecoming
OPEN	First Home Game of the Season
FINALE	Last Home Game of the Season
EXPAND	Games following 1982 Sun Bowl Expansion
WAC	Conference Game when UTEP in Western Athletic Conf.
CUSA	Conference Game when UTEP in Conference USA
COACH	No. of Games UTEP Head Coach has led the Miners
LASTGAME	Number of Days since Prior UTEP Home Game
RTV	Regionally Televised Game
NTV	Nationally Televised Game
NIGHT	Kickoff at 5pm or Later
TEMP	Mean Daily Temperature in El Paso on Game Day
PRECIP	Inches of Rain in El Paso on Game Day
EMP	Annual Employment in El Paso County (No. of Workers)
REX	Real Peso/Dollar Exchange Rate in 2010 Dollars
EPPOP	Population of El Paso County (Thousands)
CJPOP	Population of Ciudad Juarez (Thousands)
USCPI	United States Consumer Price Index (Base Year=2010)
NOMP	Nominal Average Ticket Price

Five regressors are included to account for the prospective quality of each game. The current season winning percentage is calculated on a running basis for the Miners and then multiplied by the proportion of games played in that season (WIN). The same process is utilized for each of their opponents (OPPWIN). Additionally, the current season home game winning percentage for UTEP is multiplied by the proportion of home games completed that season (HWIN) and is generated to account for victories that are actually observed by fans. The converted winning percentages are utilized because standard winning percentages can be deceptive. For example, the standard winning percentage does not differentiate between a team that is undefeated after 1 game or one that is undefeated after 11 games. Also included are dichotomous variables that represent the outcome of the immediate preceding game played the Miners (PREV) and if the Miners played a ranked opponent (RANK) in that contest. All these data are obtained from the UTEP Football Fact Book (UTEP Football, 2015).

Seven explanatory variables that measure residual fan excitement that is not determined by the quality of play on the field are included in the model specification. Dummy

variables are included for homecoming (HC), the first home game of the season (OPEN), the last home game of the season (FINALE), Western Athletic Conference games (WAC), and Conference USA games (CUSA). UTEP had no conference affiliation in 1967, was a member of the WAC from 1968 to 2004, and has been a member of CUSA since 2005. Additionally, the COACH variable measures the longevity of the UTEP head coach as a Miner. The LASTGAME variable measures the number of days since the last home game was played within each season. The first game of each season has a value of 0. Data for these seven independent variables are obtained from the UTEP Football Media Guide (UTEP Football, 2015).

Kaempfer and Pacey (1986) and Fizel and Bennett (1989) present conflicting evidence for the effects of live television broadcasting on game day attendance. The first live televised UTEP home game took place on 25 November 1995. Several other home games were televised during the 1990s, but only in the opposing team regional market. Two binary variables are used to capture the effects of live television broadcasting of UTEP home games.

Regional broadcasting (RTV) in El Paso is hypothesized to decrease attendance because it is a substitute for attending the game. RTV is assigned a value of 1 if the game is televised regionally. Similarly, nationally televised games (NTV) also provide an alternative to attendance, but generate considerable excitement that is hypothesized to outweigh the substitution effect. NTV takes a value of 1 if the game is televised nationally. Game day media data for 2007 through 2014 are obtained from the UTEP football website (UTEP Athletics, 2015). Media data for 1967 through 2006 are obtained from the University of Texas at El Paso athletic department archives (UTEP Game Notes, 2006).

Denaux et al. (2011) finds night games to significantly increase Major League baseball attendance. To allow for a similar effect, a dummy variable (NIGHT) takes a value of 1 for any game that begins at 5:00PM or later. Additionally, Cebula et al. (2009) finds inclement weather decreases attendance at minor league baseball games by as much as 16 percent. Two climatic variables are included to capture analogous outcomes on football attendance. First, mean daily temperature (TEMP) in El Paso is derived by taking the arithmetic mean of the high and low temperature values for each game day (Meehan et al., 2007). Second, the precipitation variable (PRECIP) is measured in inches of rain observed on game day. These data are retrieved from the National Weather Service (NOAA, 2015). Because El Paso climate data for 9 November 1996 are not available the National Weather Service, the temperature and precipitation information for that day are from the El Paso Times newspaper (AccuWeather, 1996).

The specification shown in Equation (2) is utilized to model UTEP football game day attendance:

$$\begin{aligned} ATT_t = {} & \beta_0 + \beta_1 P_t + \beta_2 RINC_t + \beta_3 UR_t + \beta_4 WIN_t + \beta_5 OPPWIN_t + \beta_6 HWIN_t + \beta_7 PREV_t \\ & + \beta_8 RANK_t + \beta_9 HIST_t + \beta_{10} HC_t + \beta_{11} OPEN_t + \beta_{12} FINALE_t + \beta_{13} EXPAND_t \\ & + \beta_{14} WAC_t + \beta_{15} CUSA_t + \beta_{16} COACH_t + \beta_{17} RTV_t + \beta_{18} NTV_t + \beta_{19} LASTGAME_t \\ & + \beta_{20} NIGHT_t + \beta_{21} TEMP_t + \beta_{22} PRECIP_t + \varepsilon_t \end{aligned} \quad (2)$$

In Equation (2), β_0 is the constant term and ε_t is a random disturbance term. Hypothesized signs of the parameters in Equation (2) are listed below: $\beta_0, \beta_2, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}, \beta_{18}, \beta_{19}, \beta_{20}, \beta_{21} > 0$ and

$\beta_1, \beta_3, \beta_{16}, \beta_{17}, \beta_{22} < 0$.
Several alternative specifications that are not as successful in explaining the variation of the dependent variable about its mean include additional variables such as a time trend, a peso per dollar real exchange rate index, and Ciudad Juarez population. Estimation results for Equation (2) are discussed in the next section.

4. Empirical Results

Estimation results for Equation (2) appear in Table 2. Twenty two regressors are included in the specification. The majority, 14 of 22, of the explanatory variable slope coefficients have computed t-statistics that satisfy the 5-percent significance criterion. Several of the estimation results have interesting implications associated with them.

The real average price (P) parameter is positive and significant, with a magnitude of 717.47. The positive sign implies that UTEP football attendance has an upward sloping demand curve, where approximately 717 more fans attend UTEP games for each dollar increase in ticket prices. Because the estimated parameter for real per capita income is also positive, UTEP football game attendance is treated as a normal good cannot be considered a Giffen good (Baruch and Kannai, 2001). Consequently, this upward sloping demand curve may be a result of a bandwagon effect (Becker, 1991), a conspicuous consumption effect (Leibenstein, 1950), the common consumption habit of judging the quality of a good by how high its price is (Scitovsky, 1944-1945), or the income effect outweighing the substitution effect (Vandermeulen, 1972). A consensus has yet to reached on the relationship between ticket prices and game day attendance (Noll, 2012), but this result provides evidence in favor of the positive price effect side of the debate on the basis of fairly extensive historical data.

The coefficient for El Paso real income per capita does not satisfy the standard significance criterion, but the positive sign and coefficient magnitude are economically plausible (McCloskey and Ziliak, 1996). The parameter estimate suggests that UTEP football game attendance is a normal good. Ticket sales increase by approximately 5 fans for every 10 dollar increase in real income per capita. These results are similar to those observed in Australian rules football (Borland, 1987) and major league baseball (Denaux et al., 2011).

The estimated coefficient for the El Paso unemployment rate has a negative sign and is statistically different from zero. While many studies hypothesize a negative effect of unemployment on game day attendance (Baimbridge et al., 1996; Cebula et al., 2009; Denaux et al., 2011; Cebula, 2013), this result is rarely observed. The coefficient magnitude suggests that, when the local unemployment rate increases by 1 percentage point, UTEP game day attendance drops by than 386 fans. This uncommon result may be unique to college football. However, it is more probable that confirmation of the inverse relationship stems from the availability of time series data that cover multiple phases of the metropolitan business cycle allowing the impacts of local economic conditions on the demand for UTEP football tickets to be accurately quantified.

The three proportional winning percentage variables are expected to be positively correlated with football attendance. The parameter for WIN is statistically significant and the magnitude suggests that, as UTEP's proportional winning percentage increases by 10 percent, attendance rises by 1,862 fans. The estimated coefficient for OPPWIN is statistically significant but has a negative impact on attendance. The coefficient

magnitude indicates that as UTEP's opponent's proportional winning percentage increases by 10 percent, attendance decreases by 487 fans. This result is potentially due to fan discouragement regarding prospective losses and contradicts the hypothesized positive relationship, as well as the findings for National Basketball Association games reported by Jane (2014). The parameter for HWIN is statistically significant and positively correlated with attendance. The magnitude of HWIN implies that, as UTEP's home game proportional winning percentage increases by 10 percent, UTEP attendance swells by 776 fans. The results of the proportional winning percentage calculations align with alternative winning percentage formulas used in other studies (Kaempfer and Pacey, 1986; Meehan et al., 2007; Cebula, 2013; Ahn and Lee, 2014).

The slope parameter for the PREV dummy variable is statistically significant and positively affects attendance. The magnitude of PREV indicates that a 3,659 person increase in attendance occurs whenever the Miners win the preceding game in the schedule. This corroborates the hypothesis that fans are attracted to successful teams. Although the RANK coefficient is positive, as hypothesized, the impact on ticket sales is not statistically reliable. The lack of significance is surprising, as ranked opponents, a priori, are thought to generate greater fan interest.

The HIST coefficient is positive and statistically significant. The coefficient magnitude of 95.3 indicates that attendance increases by almost 100 fans for every additional game matchup between UTEP and the game day opponent. If UTEP plays an opponent for just the second time, attendance is expected to rise by 95 fans. For an historical rival like New Mexico State University, who the Miners have played more than 90 times, ticket sales are likely to increase by more than 8,000 relative to brand new opponents. This result is comparable to the finding in Allan and Roy (2008) that derby matches increase Scottish Premier League soccer attendance by greater than 50 percent.

Homecoming weeks are hypothesized to positively affect attendance because of alumni ticket demand associated with special half time ceremonies and other pre-game celebrations. Similar fan excitement is anticipated for the first and last home games of each season. The HC slope coefficient is statistically significant and indicates that homecoming generates a 3,718 fan increase in attendance. The parameter estimate for OPEN, measuring the effect of the first game of the season, is also statistically significant and positive. The coefficient magnitude indicates that ticket sales are boosted by 5,790 by the first home game each season. The parameter for FINALE is positive, but is not statistically reliable. The coefficient magnitude of 152 is relatively small, indicating an historical lack of enthusiasm over season ending games.

The 1982 Sun Bowl expansion increased stadium capacity by 22,000 seats. The estimated parameter for the discrete variable, EXPAND, implies a substantial impact on football attendance. The magnitude indicates a post-expansion sales increment of more than 11,400 tickets per game. Similarly, Ahn and Lee (2014) finds that a one thousand seat increase in stadium capacity for Major League Baseball teams stimulates a 4 percent to 9 percent increase in annual attendance. Inclusion of EXPAND in the equation specification successfully accounts for the post-1981 structural change in the dependent variable.

Both of the estimated coefficients for conference affiliation are statistically significant, but have signs that run counter to what is hypothesized. Outcomes in Table 2 indicate that Western Athletic Conference and Conference USA games attract fewer spectators

than contests against non-affiliated opponents, with Conference USA games attracting the fewest fans. These results imply that Miner supporters prefer non-conference to conference games. UTEP often schedules non-conference opponents who are historical rivals or come from higher profile conferences. Additionally, non-conference games are frequently played early in the season. Consequently, the conference variables may also capture the effect of waning fan interest as the season progresses (Falls and Natke, 2014).

Table 2: Estimation Results
Dependent Variable: ATT
Method: Least Squares
Sample Period: September 1967 – November 2014
Included Observations: 270

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-24797.55	7683.483	-3.227385	0.0014
P	717.4736	180.0086	3.985773	0.0001
RINC	0.518239	0.333755	1.552754	0.1218
UR	-386.4308	212.8007	-1.815928	0.0706
WIN	186.2865	51.68535	3.604243	0.0004
OPPWIN	-48.73578	24.63994	-1.977918	0.0490
HWIN	77.63974	33.45013	2.321060	0.0211
PREV	3659.457	1041.999	3.511957	0.0005
RANK	1397.428	1572.141	0.888869	0.3749
HIST	95.31304	18.21013	5.234066	0.0000
HC	3718.969	1071.020	3.472363	0.0006
OPEN	5790.411	1579.072	3.666972	0.0003
FINALE	152.4650	1372.718	0.111068	0.9117
EXPAND	11432.43	2144.854	5.330169	0.0000
WAC	-3610.666	1065.555	-3.388531	0.0008
CUSA	-4541.302	1635.616	-2.776508	0.0059
COACH	-56.27063	17.25588	-3.260954	0.0013
LASTGAME	96.28876	57.70620	1.668603	0.0965
RTV	1452.340	1461.861	0.993487	0.3214
NTV	12600.31	3365.439	3.744032	0.0002
NIGHT	541.6310	1404.953	0.385515	0.7002
TEMP	351.1381	60.18801	5.833020	0.0000
PRECIP	5184.054	5642.886	0.918688	0.3592

R-squared	0.732619	Mean dependent var	25423.64
Adjusted R-squared	0.708804	S.D. dependent var	11565.58
S.E. of regression	6241.089	Akaike info criterion	20.39703
Sum squared resid	9.62E+09	Schwarz criterion	20.70357
Log likelihood	-2730.600	Hannan-Quinn criter.	20.52012
F-statistic	30.76252	Prob(F-statistic)	0.000000
Durbin-Watson stat	1.302691		

The COACH coefficient is negative and statistically significant. The magnitude of this parameter indicates that attendance decreases by 56 fans for every game a UTEP head coach has led the Miners. This decrease is likely the result of the fading novelty of any head coach and probably occurs for the majority of all NCAA football programs throughout the country.

Although it does not surpass the 5-percent significance threshold, the LASTGAME coefficient is positive and has a plausible magnitude. The size of this parameter estimate suggests that UTEP attendance increases by slightly more than 96 spectators for every day that fans must wait to watch the Miners play in El Paso. If the Miners play a home game following one month of road games, ticket sales increase by nearly 2,900. However, when home games are separated by only a week, only a 674 fan increase is observed. While this is a novel result, it does not come close to matching the effect of victories on ticket sales. If long stretches of consecutive road games engender multiple losses, attendance will suffer.

One of the surprises in Table 2 is that regionally televised games are not inversely correlated with ticket. While the RTV parameter is positive, it has a relatively large standard deviation associated with it. UTEP games are often televised regionally if the opponent presents an interesting matchup, but does not generate national level excitement. The enthusiasm for these games is apparently sufficient to outweigh the comforts of home and still attract fans to the stadium. Historically, that effect has a fair amount of statistical uncertainty associated with it, but a 1,450 bump in ticket sales is welcome news for a program with a limited athletic budget.

As expected, nationally televised games have a significant positive impact on UTEP football game attendance. The NTV effect is much larger than RTV effect. The NTV coefficient magnitude implies that nationally televised games attract 12,600 more fans than non-televised contests. Falls and Natke (2014) find a positive relationship between nationally televised games and college football attendance in a panel data sample, but with a much lower magnitude. Taking advantage of extensive historical team records such as those assembled for this study potentially allows for greater estimation accuracy than the pooling of data across programs that occurs with panel approaches. The absence of detailed information, of course, may not allow some programs to be analyzed by anything but panel methods.

The night game estimated coefficient is positive, with a magnitude of 541, but is not statistically significant. Knowles et al. (1992) find night games increase Major League Baseball attendance by over 3,000 fans. Using more recent data, Denaux et al. (2011) find night games increase Major League Baseball attendance by about 775 fans. Despite playing a majority of their games at night, UTEP schedules some day games late in the season because of colder weather.

The mean daily temperature is the only climatic variable that is found to reliably affect ticket sales. The coefficient magnitude implies that football attendance increases by 351 fans for every one degree Fahrenheit increase in the mean daily temperature on game day. The predilection for warmer weather compensates for potential attendance decrements related to game kickoff times. Meehan et al. (2007) document a similar result for Major League Baseball attendance; but observe a smaller coefficient magnitude. The TEMP parameter may also be capturing some effects of fan discouragement, as the Miners have generally struggled late in the season, when mean daily temperatures are generally lower.

The positive sign and large magnitude for the precipitation coefficient is counterintuitive, but it fails to satisfy the significance criterion. This may be a consequence of historically little inclement weather during game days. The mean rainfall level over the course of the

sample period is only 0.022 inches and the median is 0 inches! The parameter estimate for PRECIP is probably unrealistic.

As noted above, football is popular throughout much of Mexico. However, expanding the specification with the population of Ciudad Juarez (CJPOP) and a real exchange rate index (REX) does not increase the log likelihood statistic or help explain the variations in ticket sales in a measurably better manner. Collegiate football attendance in El Paso seems to be influenced only by north of the border economic and demographic variables.

The next step in the analysis is the calculation of elasticities of demand with respect to each of the continuous explanatory variables. The elasticity estimates are presented in Table 3. UTEP ticket sales are inelastic with respect to all of the continuous explanatory variables. The variables that lead to the greatest percentage changes in attendance are real per capita income and temperature.

Table 3: Elasticity Estimates

Explanatory Variable	**Elasticity**
P, Real Average Ticket Price in 2010 Dollars	0.24
RINC, El Paso Monthly Real Per Capita Income in 2010 Dollars	0.40
UR, El Paso County Monthly Unemployment Rate	-0.13
WIN, UTEP Win Pctg. Mult. by Proportion of Season Completed	0.13
OPPWIN, Opponent Win Pctg. Mult. by Prop. of Opp. Season Comp.	-0.05
HWIN, UTEP Home Game W. Pctg. Mult. by Prop. Home Games Comp.	0.08
HIST, Historical Number of Prior Games Played between UTEP and Opp.	0.07
COACH, Number of Games the UTEP Head Coach has led the Miners	-0.07
LASTGAME, Number of Days since Prior UTEP Home Game	0.05
TEMP, Mean Daily Temperature in El Paso on Game Day	0.89
PRECIP, Inches of Rain in El Paso on Game Day	0.00

As an additional empirical check of model reliability, out-of-sample simulations are used to predict ticket sales for home games during the 2015 football season at UTEP. The historical mean is used to forecast the real average ticket price variable. Income and unemployment forecasts are from Fullerton and Walke (2014). Forecasts are generated for the following variables by using a two season lag: WIN, OPPWIN, HWIN, PREV, and NIGHT. A two season lag is employed because the Miners played an equal number of home games in 2013 and 2015, but played one more home game in 2014.

Actual values are used for the following variables because they can be ascertained months prior to the season: RANK, HIST, HC, OPEN, FINALE, EXPAND, WAC, CUSA, COACH, and LASTGAME. Because a majority of the UTEP conference games are televised regionally, all four conference games for 2015 season are assumed to be regionally televised and RTV = 1. Furthermore, there are usually one or more UTEP games that are nationally televised, but that is difficult to predict a priori. Therefore, all of the 2015 season games are assumed to *not* be televised nationally and NTV = 0 for simulation purposes. Lastly, forecasts are generated for the TEMP and PRECIP variables by calculating historical monthly averages over the course of the historical sample. Results are shown below.

Figure 1: Out-of-Sample 2015 Attendance Simulation Results

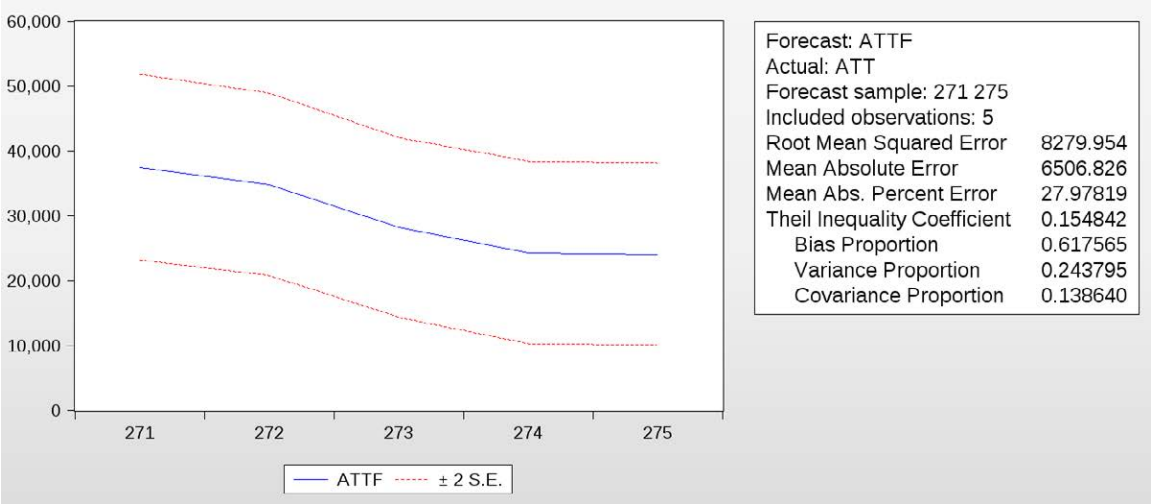

Figure 1 graphs predicted ticket sales over the course of the 2015 football season. Also included are Theil inequality coefficient and second moment error decompositions for the forecasts. The U-statistic is bounded by values of 0 and 1, with 0 representing perfect forecasts (Theil, 1961). The computed U-statistic in Figure 1 indicates that the out-of-sample attendance simulations exhibit a good degree of accuracy. That does not imply that the simulations are without shortcomings. The second moment error decompositions indicate that the sources of the 2015 forecast errors are primarily systematic instead of random.

Ideally, the second moment U-statistic proportions will have values of 0, 0, 1. The first value is the bias proportion which measures the deviation between the average values of the simulated and actual series (Theil, 1961). Although the forecast errors are small, the bias proportion of approximately 0.62 indicates that the simulations overlook systematic movements in ticket sales. The second value is the variance proportion. At approximately 0.24, it indicates that the model simulations successfully replicate most of the variability associated with 2015 UTEP game day attendance. Finally, the third value is known as the covariance proportion of the forecast error due to random movements in the dependent variable. At only 0.14, the covariance proportion indicates that only a small proportion of forecast error is random. Although the bias and variance proportions are non-zero and the covariance proportion is substantially below unity, small forecast errors are still preferred over large forecast errors.

5. Conclusion

This study analyzes the determinants of UTEP game day attendance over a 48-year period. The analysis of ticket sales for one individual athletic organization, using time series data from a multi-decade data set, is not very common. Several estimation outcomes differ from has previously been documented. Out-of-sample simulation results confirm the potential utility of the model in forecasting season ticket sales.

One notable outcome is empirical support for the hypothesis that ticket sales improve during expansionary phases of the regional business cycle. Usage of the total number of prior games played against each foe is found to provide a continuous regressor alternative to the discrete rivalry variable that is frequently constructed. Nationally televised

football games boost ticket sales by approximately 12,600 fans. Lastly, opponent proportional winning percentages are inversely correlated with game day turnouts, indicating that fans prefer games that the Miners are more likely to win.

The El Paso metropolitan area is larger than most "college towns." Ticket sales for teams in smaller areas may benefit from having fewer entertainment substitutes. Replicating this analysis for football programs located in college towns might yield different results. Ticket sales for those schools will likely be less elastic with respect to variations in the explanatory variables than in El Paso.

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References

AccuWeather (1996). "Weather." *El Paso Times*, 10 November 1996, A2 (print edition).

Ahn, S., & Lee, Y. (2014) Major League Baseball Attendance: Long-Term Analysis Using Factor Models. *Journal of Sports Economics*, 15(5), 451-477.

Allan, G., & Roy, G. (2008). Does Television Crowd Out Spectators? New Evidence from the Scottish Premier League. *Journal of Sports Economics*, 9(6), 592-605.

Baimbridge, M., Cameron, S., & Dawson, P. (1996). Satellite Television and the Demand for Football: A Whole New Ball Game? *Scottish Journal of Political Economy*, 43(3), 317-333.

Baruch, S., & Kannai, Y. (2001). Inferior Goods, Giffen Goods, and Shochu. Chapter 3 in G. Debreu, W. Neuefeind and W. Trockel (eds.), *Economic Essays, A Festschrift for Werner Hildenbrand*, Heidelberg, GE: Springer.

BEA (2015). *Local Area Personal Income and Employment* (CA1-3). Washington, DC: U.S. Bureau of EconomicAnalysis.

Becker, G.S. (1991). A Note on Restaurant Pricing and Other Examples of Social Influences on Price. *Journal of Political Economy*, 99(5), 1109-1116.

Bird, P.J.W.N. (1982). The Demand for League Football. *Applied Economics*, 14(6), 637-649.

Borland, J. (1987). The Demand for Australian Rules Football. *Economic Record*, 63(182), 220-230.

Borland, J., & Lye, J. (1992) Attendance at Australian Rules Football- A Panel Study. *Applied Economics*, 24(9), 1053-1058.

Borland, J., & Macdonald, R. (2003). "Demand for Sport." *Oxford Review of Economic Policy*, 19(4), 478-502.

Cebula, R.J. (2013). A Panel Data Analysis of the Impacts of Regional Economic Factors, Marketing and Promotions, and Team Performance on Minor League Baseball Attendance. *Annals of Regional Science*, 51(3), 695-710.

Cebula, R.J., Toma, M., & Carmichael, J. (2009). Attendance and Promotions in Minor League Baseball: The Carolina League. *Applied Economics*, 41(25), 3209-3214.

Denaux, Z.S., Denaux, D.A. & Yalcin, Y. (2011). Factors Affecting Attendance of Major League Baseball: Revisited. *Atlantic Economic Journal*, 39(2), 117-127.

ESPN (2008). *College Football Revenues and Expenses*. Bristol, CT: ESPN Inc.

Falls, G.A., & Natke, P.A. (2014). College Football Attendance: A Panel Study of the Football Bowl Subdivision. *Applied Economics*, 46(10), 1093-1107.

Fizel, J.L., and Bennett, R.W. (1989) The Impact of College Football Attendance. *Social Science Quarterly*, 7(4), 980-988.

Forrest, D., & Simmons, R. (2002) Outcome Uncertainty and Attendance Demand in Sport: The Case of English Soccer. *Journal of Royal Statistical Society Series-D*, 51(2), 229-241.

Forrest, D., Simmons, R., & Buraimo, B. (2005) Outcome Uncertainty and the Couch Potato Audience. *Scottish Journal of Political Economy*, 52(4), 641-666.

Fullerton, T.M, Jr., & Walke, A. (2014). *Borderplex Economic Outlook to 2016*. El Paso, TX: University of Texas at El Paso Border Region Modeling Project.

Gifis, L.S., & Sommers, P. (2006) Promotions and Attendance in Minor League Baseball. *Atlantic Economic Journal*, 34(4), 513-514.

Griffith, D.A. (2010) An Analytical Perspective on Sporting Event Attendance: The 2007-2008 US NCAA College Bowl Games. *Applied Geography*, 30(2), 203-209.

Hart, R.A., Hutton J., & Sharot, T. (1975) Statistical-Analysis of Association Football Attendances. *Journal of the Royal Statistical Society Series C*, 24(1), 17-27.

IMF (2015). *International Financial Statistics*. Washington, DC: International Monetary Fund.

Jane, W.J. (2014). The Relationship between Outcome Uncertainties and Match Attendance: New Evidence in the National Basketball Association. *Review of Industrial Organization*, 45(2), 177-200.

Kaempfer, W.H., & Pacey, P.L. (1986). Televising College Football: The Complementarity of Attendance and Viewing. *Social Science Quarterly*, 67(1), 176.

Kappe, E., Stadler Blank, A., & DeSarbo, W.S. (2014). A General Multiple Distributed Lag Framework for Estimating the Dynamic Effects of Promotions. *Management Science*, 60(6), 1489-1510.

Knowles, G., Sherony, K., & Haupert, M. (1992). The Demand for Major League Baseball: A Test of the Uncertainty of Outcome Hypothesis. *American Economist*, 36(2), 72-80.

Leibenstein, H. (1950). Bandwagon, Snob and Veblen Effects in the Theory of Consumers' Demand. *Quarterly Journal of Economics*, 64(2), 183-207.

McCloskey, D.N., & Ziliak, S.T. (1996). The Standard Error of Regressions. *Journal of Economic Literature*, 34(1), 97-114.

Meehan, J.W., Jr., Nelson, R.A., & Richardson, T.V. (2007). Competitive Balance and Game Attendance in Major League Baseball. *Journal of Sports Economics*, 8(6), 563-580.

NCAA (2014). *2013 National College Football Attendance*. Indianapolis, IN: National Collegiate Athletic Association.

NOAA (2015). *National Weather Service Climatological Data for El Paso*. Washington, DC: National Oceanic and Atmospheric Administration.

Noll, R. (2012). Endogeneity in Attendance Demand Models. Chapter 7 in P. Rodríguez, S. Késenne, & J. García (eds.), *The Econometrics of Sport*, Cheltenham, UK: Edward Elgar Publishing.

Rascher, D. (1999). A Test of the Optimal Positive Production Network Externality in Major League Baseball. Chapter 3 in J. Fizel, E. Gustafson, & L. Hadley (eds.), *Sports Economics: Current Research*, Westport: CT: Praeger Publishers.

Schofield, J.A. (1983). Performance and Attendance at Professional Team Sports. *Journal of Sport Behavior*, 6(4), 196-206.

Scitovsky, T. (1944-1945). Some Consequences of the Habit of Judging Quality by Price. *Review of Economic Studies*, 12(2), 100-105.

Silver, N. (2014). The NFL Should Expand to London. But First: Canada, Mexico, and LA. *FiveThirtyEight*, 11 November.

Theil, H. (1961). *Economic Forecasts and Policy*, 2nd ed., New York, NY: North-Holland.

TWC (2015). *Texas Labor Market Review*. Austin, TX: Texas Workforce Commission.

USCB (2015). *American Fact Finder*. Washington, DC: United States Census Bureau.

UTEP AFR (2000). *University of Texas at El Paso Annual Financial Report*. El Paso, TX: University of Texas at El Paso.

UTEP Athletics (2015). *Football Schedule/Results*. El Paso, TX: University of Texas at El Paso.

UTEP Football (2015). *2015 UTEP Fact Book*. El Paso, TX: University of Texas at El Paso.

UTEP Game Notes (2006). *University of Texas at El Paso Football Post-Game Notes*. El Paso, TX: University of Texas at El Paso Athletic Department Archives.

Vandermeulen, D.C. (1972). Upward Sloping Demand Curves without the Giffen Paradox. *American Economic Review*, 62(3), 453-458.

Zhang, J.J., Pease, D.G., & Smith, D.W. (1998). Relationship between Broadcasting Media and Minor League Hockey Game Attendance. *Journal of Sport Management*, 12(2), 103-122.