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Collegiate Football Attendance in El Paso: 1967-2014*

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THE UNIVERSITY OF TEXAS AT EL PASO

UTEP BORDER REGION MODELING PROJECT

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THE UNIVERSITY OF TEXAS AT EL PASO

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COLLEGIATE FOOTBALL ATTENDANCE IN EL PASO: 1967-2014*

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* A revised version of this study is forthcoming in *Journal of Sports Economics & Management.*

ABSTRACT

This study examines potential determinants of American football game attendance for the University of Texas at El Paso (UTEP) Miners program. Time series data are utilized to analyze UTEP attendance from 1967 to 2014. Parameter estimation is carried out using two-staged least squares regression analysis. Among the more notable outcomes, ticket sales are not strongly affected by the local business cycle and are not 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 that 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.

JEL Categories: Z20, Sports Economics; M21, Business Economics; R15, Regional Econometric Models
Keywords: College Football; Ticket Sales; Regional Business Cycles

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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 American football games from 1967 to 2014. El Paso is a metropolitan economy with more than 830 thousand people in which per capita income lags national per capita income by more than 25 percent (Fullerton and Walke, 2014). Given the latter, it is perhaps not surprising that UTEP generally ranks among the lower echelon of athletic departments in terms of total football revenues (ESPN, 2008). Ticket sales, thus, play a central role in Miners athletic budgets.

In prior studies of sports attendance, 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; Falls and Natke, 2016). 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 unique 48-year data set compiled for this study may provide new insights to sports attendance behavior. The sample data also include two different types of television coverage variables.

The next section reviews several previous studies in this subject area. A description of the data and methodology follow. Parameter estimation is carried out using two-staged least squares regression analysis. Empirical results are then summarized. A concluding section suggests topics for further research.

PREVIOUS RESEARCH

Prior literature on the determinants of sporting event attendance principally examines four general topics: outcome uncertainty, television broadcasts, team performance, and promotions (Pawlowski, 2013). A majority of the analyses contain similar economic, demographic, and temporal regressors (Cebula, 2013). Ordinary least squares is the most common estimation method, but maximum-likelihood estimation, and non-linear least squares methods have also been utilized (Kappe, Stadler Blank, and DeSarbo, 2014). 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 that span multi-year periods for many organizations or teams.

Outcome uncertainty refers to the unpredictability concerning individual game results. The uncertainty variable is measured several ways. Forrest, Simmons, and Buraimo (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. Both Knowles, Sherony, and Haupert (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. More recent studies (Pawlowski and Anders, 2012; Pawlowski and Nalbantis, 2015) cast doubt on that hypothesis, although not for cases in which the home team still has a chance of winning a championship. Gómez González, García Unanue, Sánchez Sánchez, Ubago Guisado, and del Corral (2016) indicates that the attendance effect of outcome uncertainty may be positive, but not statistically reliable.

Television broadcasting has been widely analyzed, but ambiguity exists regarding its overall impacts on contest attendance. 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, Denaux, and Yalcin, 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, Toma, and Carmichael, 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 contrast, 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 local labor market conditions is equally ambiguous. Most studies hypothesize an inverse relationship between unemployment rates and ticket purchases, but Baimbridge, Cameron and Dawson (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; 2016). 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 are rarely assembled 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 that includes 270 games. 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.

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 (**Figure 1**). Reported game day attendance for UTEP home games is used as the dependent variable and the data for the 270 games in the sample

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**. Descriptive statistics for the dependent variable and explanatory variables are listed in **Table 2**.

Because of revenue data constraints, average ticket prices are calculated by dividing annual revenue from ticket sales by total attendance for each season (**Figure 2**). 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.

Figure 1. UTEP Miners Football Attendance

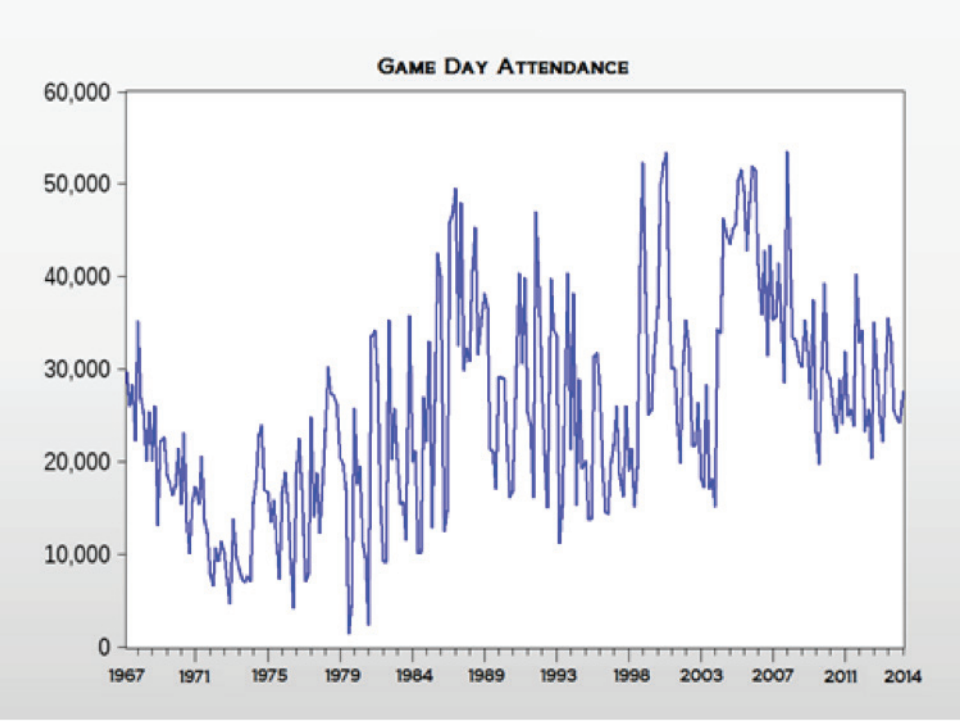
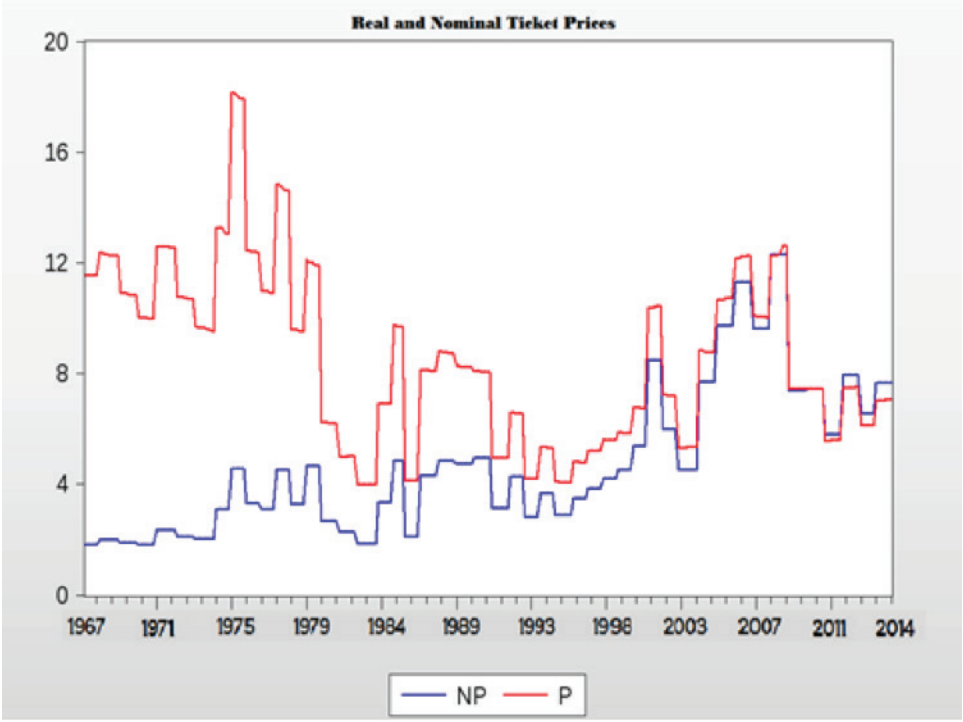


Table 1: Variables and Units

Variable	Description
ATT	Reported Game Day Attendance
P	Real Average UTEP 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 Percentage Multiplied by the Proportion of Season Completed
OPPWIN	Opponent Win Pctg. Mult. by Proportion of Opponent Season Completed
HWIN	UTEP Home Game Win Pctg. Mult. by Prop. of Home Games Completed
PREV	Outcome of Previous UTEP Game
RANK	Nationally Ranked Opponent
v HIST	Historical Number of Games Played between UTEP and Opponent
HC	Homecoming
FINALE	Last Home Game of the Season
EXPAND	Games Occurring subsequent to the 1982 Sun Bowl Expansion
WAC	Conference Game when UTEP was in the Western Athletic Conference
CUSA	Conference Game when UTEP was a Member of Conference USA
COACH	Number of Games the 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 (Number of Workers)
ENROLL	UTEP Fall Enrollment (Thousands)
USCPI	United States Consumer Price Index (Base Year = 2010)
NOMP	Nominal Average UTEP Ticket Price

Figure 2. Average UTEP Miners Football Ticket Prices



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 entered 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. A separate variable, ENROLL, is included to account for the growing UTEP alumni base in the region

Table 2: Summary Statistics

Variable	Mean	Median	Range	Std. Dev.	Skewness	Kurtos
ATT	25,423.6	24,686.5	1,407 - 53,415	11,565.6	0.38	2.56
P	8.5	8.5	4.0 - 18.1	3.1	0.55	0.55
RINC	19,841.6	20,398.4	15,082 - 23,862	2,871.6	0.27	1.55
UR	8.5%	9.0%	3.3% - 13.5%	2.4%	-0.40	2.15
WIN	17.9%	12.1%	0% - 81.8%	17.7%	1.22	4.34
OPPWIN	25.5%	20.9%	0% - 100%	21.5%	0.66	2.79
HWIN	26.3%	25.0%	0% - 100%	25.4%	0.75	3.01
PREV	0.252	0	0 - 1	0.435	-	-
RANK	0.078	0	0 - 1	0.268	-	-
HIST	19.9	11	0 - 91	22.8	1.35	3.87
HC	0.178	0	0 - 1	0.383	-	-
FINALE	0.178	0	0 - 1	0.383	-	-
EXPAND	0.685	1	0 - 1	0.465	-	-
WAC	0.500	0.500	0 - 1	0.501	-	-
CUSA	0.148	0	0 - 1	0.356	-	-
COACH	32.5	27.0	0 - 108	24.5	0.90	3.32
LASTGAME	12.8	14	0 - 42	9.3		3.03
RTV	0.111	0	0 - 1	0.315	-	-
NTV	0.015	0	0 - 1	0.121	-	-
NIGHT	0.889	1	0 - 1	0.315	-	-
TEMP	64.5	64.5	23.0 - 86.5	11.1	-0.35	2.81
PRECIP	0.022	0	0.000 - 0.510	0.073	4.09	20.59
EMP	215,294	224,700	107,900 - 304,000	62,984.8	-0.29	1.59
ENROLL	16.098	15.728	9.029 -23.079	3.608	0.19	2.48
USCPI	60.3	61.3	15.42 - 109.90	29.7	-	-
NOMP	4.7	4.3	1.8 - 12.3	2.6	1.07	3.48

Note: Sample period historical data used for parameter estimation are for September 1967 - November 2014 and cover 270 games.

Contest quality is perceived from multiple vantage points by sports fans (Pawlowski, 2013). Five regressors are included in the sample 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 by 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).

Eight 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. HIST is the historical number of games that UTEP has played against each of the visiting teams (**Figure 3**). Longtime rivalry games are expected to generate greater volumes of ticket sales. Additionally, the COACH variable measures the longevity of the UTEP head coach as a Miner (Figure 4). 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 270. Data for these eight 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 markets.
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

Figure 3. Rivalries by the Numbers

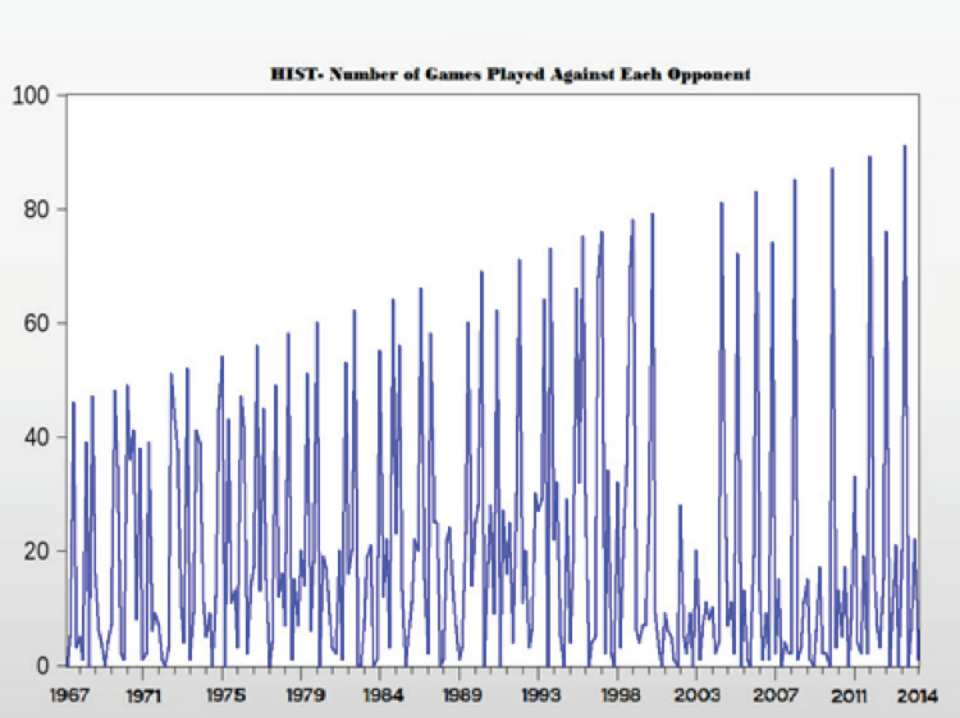
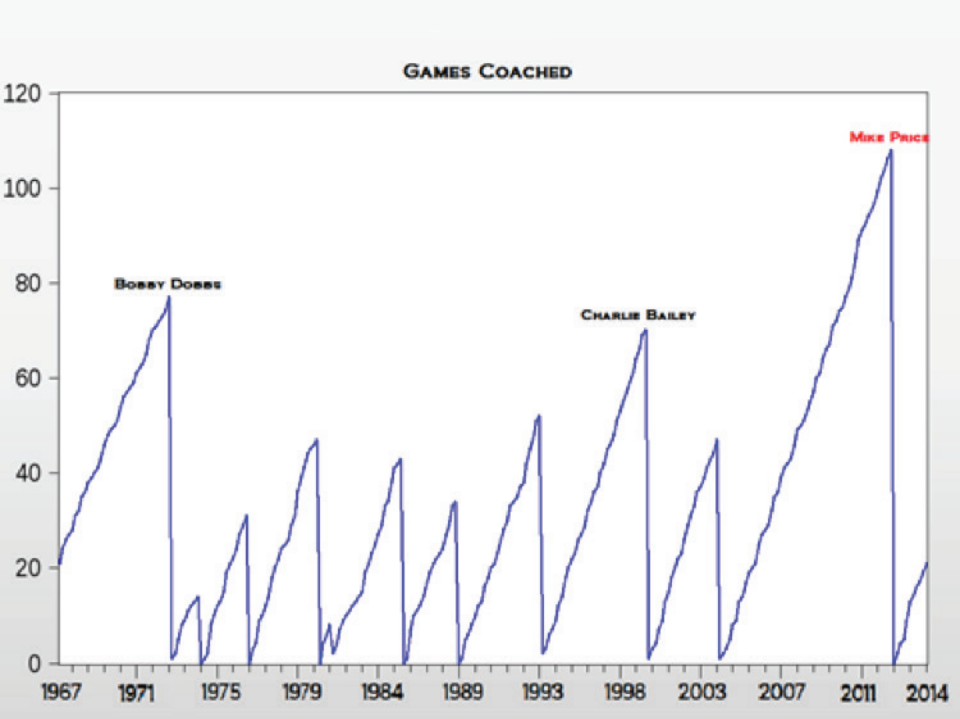


Figure 4. UTEP Miner Football Coach Longevities



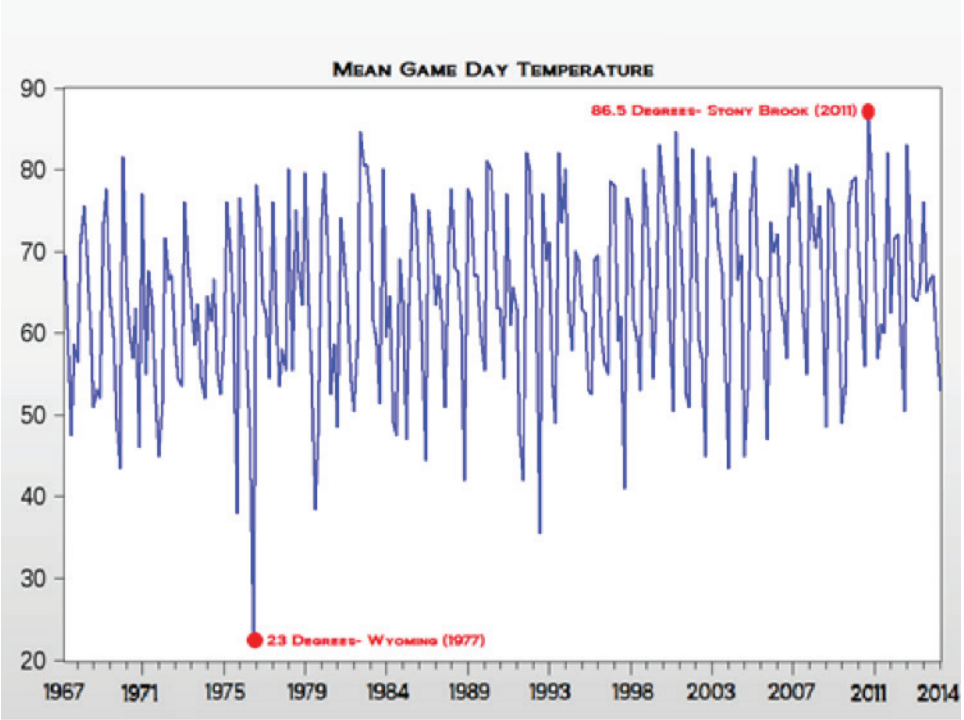
substitution effect. NTV takes a value of 1 if the game is televised nationally. Game day media data for 2007 through 2014 are obtained from the UTEP football website (UTEP Athletics, 2015). Media data for 1967 through 2006 are obtained from the University of Texas at El Paso athletic department archives (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, Nelson, and Richardson, 2007; **Figure 5**). 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. In order to allow for diminishing marginal utility, all of the continuous variables with non-zero, positive "amount" values are transformed using natural logarithms prior to parameter estimation. For example, warmer temperatures tend to increase ticket sales, but it would be unreasonable to expect that type of effect to never taper off. Because those amount data take only positive values, logarithmic transformations help insure normality, even though results interpretation requires transformation back to the original scale (Tukey, 1977).

$$\begin{aligned} Log(ATT_t) = {} & \beta_0 + \beta_1 LOG(P)_t + \beta 2 LOG(RINC)t + \beta_3 URt + \beta_4 WINt + \beta_5 OPPWIN_t \\ & + \beta_6 HWIN_t + \beta_7 PREV_t + \beta_8 RANK_t + \beta_9 LOG(HIST)_t + \beta_{10} HC_t \\ & + \beta_{11} FINALE_t + \beta_{12} EXPAND_t + \beta_{13} WAC_t + \beta_{14} CUSA_t + \beta 15 LOG(COACH)_t \\ & + \beta_{16} RTV_t + \beta_{17} NTV_t + \beta_{18} LOG(LASTGAME)_t + \beta_{19} NIGHT_t \\ & + \beta_{20} LOG(TEMP)_t + \beta_{21} PRECIP_t + \beta_{22} LOG(ENROLL)_t + \varepsilon_t \end{aligned} \quad (2)$$

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: $\beta_0, \beta_2, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{17}, \beta_{18}, \beta_{19}, \beta_{20}, \beta_{22} > 0$ and $\beta_1, \beta_3, \beta_{15}, \beta_{16}, \beta_{21} < 0$.

Figure 5. UTEP Miners Football Historical Weather



As robustness checks, several alternative specifications including additional variables such as a time trend, a peso per dollar real exchange rate index, total real personal income, El Paso population, and Ciudad Juarez population were also employed. Those specifications are not as successful in explaining the variation of the dependent variable about its mean and those results are not reported. Estimation results for **Equation (2)** are discussed in the next section.

EMPIRICAL RESULTS

Estimation results for **Equation (2)** appear in **Table 3**. Twenty regressors are included in the specification. From a strict estimation perspective, only 10 of the 20 explanatory variable slope coefficients have computed t-statistics that satisfy the 5-percent significance criterion. Most of the parameter estimates, however, have interesting implications associated with them. Even though a fairly large number of independent variables are included, autoregressive terms at lags 1 and 6 are required for serial correlation correction. Because the dependent variable also appears on the right-hand side of the specification, in the denominator of the average price variable, P = Ticket Revenues / ATT, two-staged least squares estimation is employed. Two instrumental variables are used along with the other exogenous variables. The first instrument is the ratio of the consumer price index for recreational activities to USCPI and it is used as an instrument for P. Because ticket revenues may be correlated with Fall enrollments at UTEP, the population of El Paso is also used as an instrument for that regressor.

The real average price (P) parameter of 0.383 is positive and statistically significant. The positive sign implies that UTEP football attendance has an upward sloping demand curve, where each one dollar increase in ticket prices is correlated with an attendance increase of approximately 1,144 more fans at UTEP home games. Because the estimated parameter for real per capita income is also positive, UTEP football game attendance is treated as a normal good and 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 as a consequence of 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 coefficient side of the debate on the basis of fairly extensive historical data. It should be noted that this appears to be a fairly reliable estimate with a small standard deviation associated with it.

The coefficient for El Paso real income per capita (RINC) does not satisfy the standard 5-percent significance criterion, but the positive sign and coefficient magnitude for it 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 28 fans for every 100 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 (UR) has a positive sign, but is not statistically or economically different from zero. While many studies posit 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 often not observed. The 0.001 coefficient magnitude suggests that, when the local unemployment rate increases by 1 percentage point, UTEP game day attendance grows by about 35 fans. In absolute terms, a marginal effect this small for an explanatory variable with a range from 3.3 percent to 13.5, seems implausibly small. Thus, even in a study with time series data covering multiple phases of the metropolitan business cycle, clear confirmation of any type of meaningful relationship between local labor market conditions and ticket sales remains elusive. In practical terms, the limited marginal effect and seemingly tenuous reliability of the parameter estimate provide evidence that collegiate football game attendance in El Paso is basically recession proof (Freeman, 2001; Zheng, Farrish, Lee, and Yu, 2013). The latter possibility is eminently believable for an urban economy in a state like Texas where football reigns supreme among spectator sports. Wann (1997) also notes that consumers regard sporting events as good entertainment options during economic downturns.

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 percentage points, attendance rises by 1,633 fans. That outcome corroborates national evidence reported on the basis of pooled data panels (Falls and Natke, 2016) and illustrates how winning records really help propel tickets sales at Sun Bowl Stadium in El Paso.

The estimated coefficient for OPPWIN indicates that better opponent win/loss records are inversely correlated with game day attendance. The coefficient magnitude indicates that as UTEP's opponent's proportional winning percentage increases by 10 percent, 492 fewer fans purchase tickets. 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 computed t-statistic for this parameter estimate does not, however, quite satisfy the standard 5-percent criterion.

The HWIN coefficient is positively correlated with attendance. The magnitude of HWIN implies that, as UTEP's home game proportional winning percentage increases by 10 percent, UTEP attendance grows by 711 fans. Although, the t-statistic for this estimate falls below the classical significance threshold, the results of the proportional winning percentage calculations align with alternative winning percentage formulas discussed 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 3,405 person increase in attendance occurs whenever the Miners win the preceding game in the schedule. This corroborates the hypothesis that fans are attracted by successful team efforts (Falls and Natke, 2016). As hypothesized, the RANK coefficient is positive, but that impact on ticket sales has a fairly large standard deviation and is not very reliable. The marginal effect of bringing ranked opponents into the Sun Bowl to play the Miners is to boost ticket sales by 501, presumably by generating greater fan interest and confirms some of the results documented for German Bundelsliga soccer matches (Pawlowski and Andres, 2012).

The HIST coefficient is positive and statistically significant. The elasticity of 0.047 indicates that the size of the crowd inside Sun Bowl Stadium increases by 60 fans for every additional matchup between UTEP and the game day opponent. That parameter estimate easily surpasses the conventional significance threshold, indicating that the link is empirically dependable. For an historical rival like New Mexico State University,

Table 3: Estimation Results

Dependent Variable: ATT

Method: Two Staged Least Squares

Sample Period: September 1967 – November 2014 ; 270 Included Observations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.491	6.719	0.371	0.711
LOG(P)	0.383	0.126	3.034	0.003
LOG(RINC)	0.220	0.748	0.294	0.769
UR	0.001	0.019	0.074	0.941
WIN	0.006	0.003	2.176	0.031
OPPWIN	-0.002	0.001	-1.740	0.083
HWIN	0.003	0.002	1.525	0.129
PREV	0.134	0.046	2.943	0.004
RANK	0.020	0.069	0.285	0.776
LOG(HIST)	0.047	0.014	3.423	0.001
HC	0.171	0.043	4.022	0.000
FINALE	-0.043	0.060	-0.717	0.474
EXPAND	0.736	0.172	4.279	0.000
WAC	-0.149	0.051	-2.918	0.004
CUSA	-0.137	0.083	-1.648	0.101
LOG(COACH)	-0.046	0.024	-1.940	0.054
LOG(LASTGAME)	0.043	0.018	2.426	0.016
RTV	0.078	0.065	1.205	0.229
NTV	0.289	0.142	2.030	0.043
NIGHT	0.049	0.068	-1.940	0.472
LOG(TEMP)	0.970	0.154	2.426	0.000
PRECIP	-0.405	0.244	-1.664	0.098
LOG(ENROLL)	-0.089	0.364	-0.245	0.806
AR(1)	0.338	0.064	5.308	0.000
AR(6)	0.163	0.063	2.610	0.010

R-squared	0.758	Mean dependent variable	10.012
Adjusted R-squared	0.733	Std. Dev. dependent var.	0.558
S.E. of regression	0.288	Sum squared residuals	19.821
Durbin-Watson stat	2.005	Instrument Rank	69
J-statistic	0.063	Prob(J-statistic)	0.064

who the Miners have played more than 90 times, ticket sales are likely to increase by more than 5,400 relative to brand new opponents. This result is similar, albeit proportionately smaller, to the finding in Allan and Roy (2008) that "derby matches" (between geographically neighboring teams) 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. As with the summer holiday gate increases in professional baseball (Cebula, 2013), the HC slope coefficient is statistically significant and indicates that homecoming festivities hike attendance by a whopping 4,350 fans for those games. A similar effect is hypothesized for the last game of the season, but the parameter estimate for the binary variable, FINALE, is neither statistically significant nor positive. This outcome reflects an historical lack of enthusiasm over season ending games, in all likelihood due to the large number of losing records posted during the sample period.

The 1982 Sun Bowl expansion increased stadium capacity by 22,000 seats. The estimated parameter for the discrete variable, EXPAND, documents a substantial impact on football attendance. Based on pre-1982 attendance data, the magnitude of the coefficient for this variable indicates a post-expansion sales increment of approximately 12,270 tickets per game. That finding is not unique to college football. Ahn and Lee (2014) reports 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 levels. Love, Kavazis, Morse, and Mayer (2013) documents a "novelty effect" for ticket sales at new soccer stadiums, but the computed t-statistic for this coefficient in **Table 3** probably implies a more persistent phenomenon than that.

Surprisingly, both of the estimated coefficients for conference affiliation exhibit negative signs that run counter to what is hypothesized. The results in Table 3 indicate that Western Athletic Conference and Conference USA games attract fewer spectators than contests against non-conference opponents. WAC games attracted 3,788 fewer fans than non-WAC home games for the Miners. CUSA games are associated with a nearly identical 3,496 decline in ticket sales for UTEP. These results imply that Miner supporters have historically preferred non-conference contests over conference games. UTEP often schedules non-conference opponents who are historical rivals or come from higher profile conferences. Additionally, non-conference games are generally played early in the season. Consequently, the conference variables may also capture the historical effects of waning fan interest as win-loss records deteriorated during the sample period (Falls and Natke, 2014).

The COACH coefficient is negative as anticipated, but not quite statistically significant. The magnitude of this parameter indicates that attendance falls by 110 fans for every game that a UTEP head coach has led the Miners. Fans often have strong opinions regarding local or regional athletic programs and the positions are fraught with political pressures (Potrac and Jones, 2009). 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.

One of the surprises in Table 3 is that regionally televised games are not inversely correlated with ticket sales. While the RTV parameter is positive, it also 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 viewing and these contests still attract fans to the stadium. Historically, that effect has a fair amount of statistical uncertainty associated with it, but a 1,987 bump in ticket sales is welcome news for a program supported by a relatively limited athletic budget.

As expected, nationally televised games have a significant and 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 7,356 more fans than non-televised matches. Falls and Natke (2014) also documents a positive relationship between televised games and college football attendance in a panel data sample, but with a much lower magnitude. That study does not, however, include separate qualitative variables for regional and national telecasts. Taking advantage of extensive historical team records such as those assembled for this study may also allow for greater estimation accuracy than the pooling of data across programs that occurs with panel approaches. The absence of detailed information for some programs, of course, may necessitate the analysis of those schools by employing panel methods after pooling the available data with those for other campuses.

The LASTGAME coefficient is positive and surpasses the 5-percent significance threshold. The size of this parameter estimate suggests that UTEP attendance increases by nearly 85 spectators for every additional day that devotees must wait to watch the Miners play in El Paso. If the Miners play a home game following four weeks of road games, ticket purchases grow by 2,379. However, when home games are scheduled on back-to-back weekends, the effect is substantially muted. This novel result can only be measured with time series data of the type that is assembled in this sample. While it confirms that absence makes the heart grow fonder, it does not come close to matching the impact of victories on ticket sales. If a home game follows a victory the previous week, attendance will benefit by an even greater amount.

The NIGHT game estimated coefficient is positive, but does not differ from zero in a statistically meaningful manner. The estimated parameter in Table 3 indicates that scheduling night time kickoffs helps increase attendance by 1,238. 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. Thus, even though it is has a large standard deviation associated with it, the marginal effect seems to be economically plausible. Despite playing a majority of their games at night, UTEP schedules some day games late in the season because of colder weather. That practice should continue.

The mean daily temperature is the only climatic variable that is found to reliably affect ticket sales. The parameter magnitude for TEMP implies that football attendance increases by 382 fans for every one degree Fahrenheit increase in game day mean daily temperatures. Meehan et al. (2007) document a similar result for Major League Baseball attendance; but report a smaller coefficient magnitude. The strength of the temperature effect is fairly impressive given that lower mean daily temperatures coincide with the latter stages of each when fan interest for most college football teams wanes and attendance suffers (Falls and Natke, 2016).

The negative sign for the PRECIP coefficient matches what has been chronicled for college teams nationwide (Falls and Natke, 2014). The impact of rain on game day ticket sales is much more pronounced in El Paso than elsewhere, with a 10,303 decline in the number of people trekking out to Sun Bowl Stadium. While UTEP Miner faithful are undoubtedly spoiled by a mild Autumn climate and are, literally, fair-weather fans, it should be pointed out that this parameter does not quite satisfy the standard significance criterion. This may be a consequence of historically little inclement weather during game days. The mean rainfall level in **Table 2** is only 0.022 inches and the median is 0 inches.

The last regressor included in **Table 3** is ENROLL, the number of students that matriculate at UTEP each Fall semester. That slope coefficient appears statistically indistinguishable from zero. That outcome may not be surprising. As a commuter campus, enrollments at UTEP are strongly correlated with the population of El Paso and at least one study indicates that larger populations tend to be inversely correlated with NCAA football attendance (Falls and Natke, 2016). A separate study, however, reports evidence that, all else equal, larger enrollments tend to boost gridiron ticket sales (DeSchriver and Jensen, 2002).

As an additional empirical check that goes beyond the in-sample fit diagnostics, elasticities, and marginal effects discussed above, out-of-sample simulations are used to predict ticket sales for home games during the 2015

football season at UTEP (Hart, Hutton, and Sharot, 1975). For tight athletic department budgets, the predictive performance of equations such as that shown in **Table 3** is important to assess. The September 1967 – November 2014 historical mean is used as the real average ticket price forecast. Explanatory variable forecasts are extracted from Fullerton and Walke (2014) for real income per capita and the unemployment rate. Forecasts are generated for the following variables by using a two season lag: WIN, OPPWIN, HWIN, PREV, and NIGHT. A two season lag is preferred to a one season lag because the Miners played an equal number of home games in 2013 and 2015, while an additional home game was offered during the 2014 season (UTEP Football, 2015).

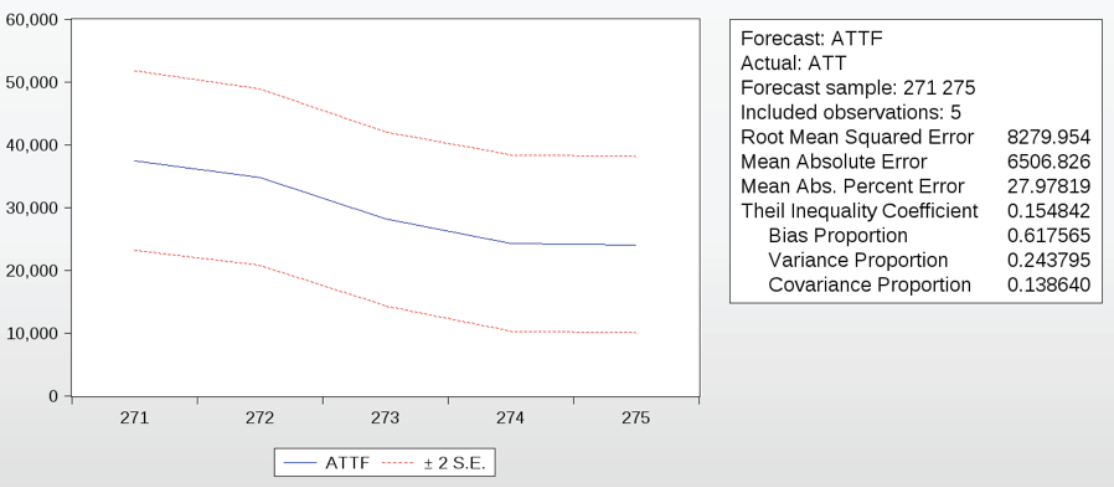
Actual values are used for the following variables because they can be ascertained months prior to the season: RANK, HIST, HC, FINALE, EXPAND, WAC, CUSA, COACH, and LASTGAME. Because a majority of the UTEP conference games are televised regionally, all four conference games in the 2015 season are assumed to be regionally televised with RTV = 1 for the simulation exercise. It should be noted that the season home opener is a non-conference game and RTV = 0 for that contest. 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 practicality. Lastly, forecasts are generated for the TEMP and PRECIP variables by calculating historical monthly averages over the course of the historical sample. Analytical forecast diagnostics are summarized in **Figure 6**.

Figure 6 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 2015 out-of-sample attendance simulations exhibit a good degree of accuracy. That does not imply that the simulations are completely without shortcomings. The second moment error decompositions indicate that the sources of the 2015 forecast errors are primarily systematic instead of random. It is also interesting to note that alternative equation specifications not reported here also generate favorable U-statistics.

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 some of the 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 inherent 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 ticket sales forecast error is unsystematic. Although the bias and variance proportions are non-zero and the covariance proportion is substantially below unity, small forecast errors, regardless of the distribution of the inequality proportions, are preferred over large forecast errors.

Figure 6. Out-of-Sample 2015 Attendance Simulation Results



CONCLUSION

This study examines UTEP football 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 in sports economic research. The introduction of continuous variables in place of the dummy variables historically employed in this type of analysis is found to be a useful step. Several of the estimation outcomes also differ from what has previously been documented and out-of-sample simulation results confirm the potential utility of this model for ticket sales forecasting efforts and athletic department budget planning.

Ticket purchases are found to be fairly recession proof as well as unrelated to student enrollments. Although attendance is not found to be reliably influenced by regional business cycle fluctuations, it does respond to other stimuli. The total number of games played against each foe is found to provide a continuous regressor alternative to the discrete rivalry variable that is frequently constructed. Employing the historical number of games played against an opponent appears to allow the model to more precisely capture the excitement generated at different stages in a rivalry. Differentiation between regional and national television coverage helps accommodate the evolving broadcasting environment. Nationally

televised football games boost ticket sales by approximately 7,356 fans. The attendance impacts from regionally televising a game is both lower and less dependable. Lastly, stadium crowds increase substantially in response to victories and the expectation of additional on-field success.

Results in this study suggest various avenues for further research. The El Paso metropolitan area is larger and more diverse than most traditional "college towns." Ticket sales for football programs in less populated areas may benefit from having fewer substitutes available to potential spectators. Replicating this analysis for football programs located in college town settings might yield results that differ from those reported herein. Examples of potential programs of interest include: Missouri (Columbia, MO), Texas Tech (Lubbock, TX), and Wyoming (Cheyenne, WY). It is expected that ticket sales will be less elastic with respect to variations in the explanatory variables in these environments because of fewer entertainment substitutes. Potential spectators in smaller metropolitan economies may also respond differently to changes in economic conditions than what is documented above for El Paso.

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The authors of this publication are UTEP Professor & Trade in the Americas Chair Tom Fullerton and UTEP Associate Economist Adam Walke. Dr. Fullerton holds degrees from UTEP, Iowa State University, Wharton School of Finance at the University of Pennsylvania, and University of Florida. Prior experience includes positions as Economist in the Executive Office of the Governor of Idaho, International Economist in the Latin America Service of Wharton Econometrics, and Senior Economist at the Bureau of Economic and Business Research at the University of Florida. Adam Walke holds an M.S. in Economics from UTEP and has published research on energy economics, mass transit demand, and cross-border regional growth patterns.

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The authors of this publication are UTEP Professor & Trade in the Americas Chair Tom Fullerton and former UTEP Associate Economist Angel Molina. Dr. Fullerton holds degrees from UTEP, Iowa State University, Wharton School of Finance at the University of Pennsylvania, and University of Florida. Prior experience includes positions as Economist in the Executive Office of the Governor of Idaho, International Economist in the Latin America Service of Wharton Econometrics, and Senior Economist at the Bureau of Economic and Business Research at the University of Florida. Angel Molina holds an M.S. Economics degree from UTEP and has conducted econometric research on international bridge traffic, peso exchange rate fluctuations, and cross-border economic growth patterns.

The long-term border business outlook through 2029 can be purchased for $10 per copy. Please indicate to what address the report(s) should be mailed (also include telephone, fax, and email address):

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The UTEP Border Region Modeling Project & UACJ Press

Announce the Availability of

Basic Border Econometrics

The University of Texas at El Paso Border Region Modeling Project is pleased to announce **Basic Border Econometrics**, a publication from Universidad Autónoma de Ciudad Juárez. Editors of this new collection are Martha Patricia Barraza de Anda of the Department of Economics at Universidad Autónoma de Ciudad Juárez and Tom Fullerton of the Department of Economics & Finance at the University of Texas at El Paso.

Professor Barraza is an award winning economist who has taught at several universities in Mexico and has published in academic research journals in Mexico, Europe, and the United States. Dr. Barraza currently serves as Research Provost at UACJ. Professor Fullerton has authored econometric studies published in academic research journals of North America, Europe, South America, Asia, Africa, and Australia. Dr. Fullerton has delivered economics lectures in Canada, Colombia, Ecuador, Finland, Germany, Japan, Korea, Mexico, the United Kingdom, the United States, and Venezuela.

Border economics is a field in which many contradictory claims are often voiced, but careful empirical documentation is rarely attempted. **Basic Border Econometrics** is a unique collection of ten separate studies that empirically assess carefully assembled data and econometric evidence for a variety of different topics. Among the latter are peso fluctuations and cross-border retail impacts, border crime and boundary enforcement, educational attainment and border income performance, pre- and post-NAFTA retail patterns, self-employed Mexican-American earnings, maquiladora employment patterns, merchandise trade flows, and Texas border business cycles.

Contributors to the book include economic researchers from the University of Texas at El Paso, New Mexico State University, University of Texas Pan American, Texas A&M International University, El Colegio de la Frontera Norte, and the Federal Reserve Bank of Dallas. Their research interests cover a wide range of fields and provide multi-faceted angles from which to examine border economic trends and issues.

A limited number of **Basic Border Econometrics** can be purchased for $10 per copy. Please contact Professor Servando Pineda of Universidad Autónoma de Ciudad Juárez at spineda@uacj.mx to order copies of the book. Additional information for placing orders is also available from Professor Martha Patricia Barraza de Anda at mbarraza@uacj.mx.

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