COMPETITIVE BALANCE AND FAN INTEREST IN THE NATIONAL FOOTBALL LEAGUE

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ABSTRACT

The purpose of this study is to compare the interest of the National Football League (NFL) to the interest of individual teams. We will determine if structural changes in the NFL, especially the current free agency system, have had their intended impact of increasing fan interest. This study will proceed in two sections. The first section analyzes the impact of structural changes that the NFL implemented in an attempt to either create or increase competitive balance. An example of a structural change at the college level involves scholarships. Sutter and Winkler (2003) find that setting scholarship limits decreases competitive balance in college football.

INTRODUCTION

In sports leagues, pure self-interest on the part of individual teams sometimes conflicts with the overall good of the league. Each team serves its own interest by attempting to win all of its games. Each team's goal is to win enough games to compete in the championship game, and then win that championship game. The league's interest is to profit from entertaining fans. The theory of sports leagues proposes that equal competition across teams yields optimal fan interest in the sport

(Vrooman, 1995). A sustained interest in the sport essentially assures that the league has continued viability to accomplish their profit objective.

The purpose of this study is to compare the interest of the National Football League (NFL) to the interest of individual teams. We will determine if structural changes in the NFL, especially the current free agency system, have had their intended impact of increasing fan interest. This study will proceed in two sections. The first section analyzes the impact of structural changes that the NFL implemented in an attempt to either create or increase competitive balance. An example of a structural change at the college level involves scholarships. Sutter and Winkler (2003) find that setting scholarship limits decreases competitive balance in college football.

The second section examines the impact of competitive balance on fan interest. According to the uncertainty of outcome hypothesis, competitive balance has a positive impact on fan interest (Rottenberg, 1956; El-Hodiri and Quirk, 1971). Intuitively, the interest of a particular team's fans should be positively related to that team's performance. That is, better performance on the field should be linked to greater interest and enthusiasm of the fans. On the other hand, a poorly performing team may be associated with weaker fan interest or support. We will use this premise to determine the impact of a subset of teams acting in their self-interest. Without the intended effect of increased fan interest, the NFL does not benefit from having competitive balance. Humphreys (2002) concludes that competitive balance is a significant determinant in Major League Baseball (MLB) attendance. We modify his methodology to study the impact of competitive balance on fan interest in the NFL.

For typical businesses, profits and survival are enhanced with the reduction or elimination of competition. For professional sports businesses; however, increased competition is desired and is linked to financial stability (Berri, et al, 2005). Professional sports leagues operate similar to business cartels (Fort and Quirk, 1995) and so consequently, many leagues encounter incentive problems among individual teams and enforcement issues. The product that sports leagues offer to consumers is competition; however, their challenge is to create a level of competitive balance that is attractive to fans. Competitive balance implies equal competition, emphasizing uncertainty of the outcome and producing drama. Free agency, for example, is a structural change that allows talent to be reallocated across the league to both strengthen weaker teams and weaken stronger teams and thereby increase both competition among teams and fan interest.

COMPETITIVE BALANCE IN THE NFL

In the NFL, competitive balance incorporates three dimensions - within games, within seasons, and across seasons. We employ four measures of competitive balance, all presented in capital letters throughout the paper in order to easily distinguish them from the other variables we will consider later. The first measure is the average margin of victory in points (MARGIN), which Sutter and Winkler (2003) used. MARGIN measures competitive balance within games. As MARGIN increases (decreases) competitive balance decreases (increases). The second measure is the ratio of actual to ideal standard deviation of winning percentage by year (RATIO), introduced by Sutter and Winkler (2003). RATIO measures competitive balance within seasons. The ideal standard deviation equals 0.5 divided by the square root of the number of NFL games in that year. Higher (lower) values of RATIO indicate more (less) competitive balance. The third measure is the Competitive Balance Ratio (CBR), developed by Humphreys (2002). CBR measures competitive balance across seasons and is calculated as the ratio of the average time variation in winning percentage for teams to the average variation in winning percentage across seasons. A CBR of 1 (0) indicates perfect (no) competitive balance. We modify his measure to reflect a six-year moving average of the associated variations using the prior six years to calculate the current year measure. The final measure is the Hirfindahl-Hirschman Index (HHI), which both Sutter and Winkler (2003) and Humphreys (2002) use. HHI measures competitive balance across seasons by calculating the concentration of championship wins. An HHI of 10,000 (1,666.7) indicates the highest (lowest) concentration. A lower (higher) HHI is associated with greater (less) competitive balance. We modify their measure to reflect a six-year moving average of the index using the prior six years of teams who won the championship game to calculate the current year measure.

The introduction of free agency in 1989 changed the structure of the NFL and produced the potential to equalize the quality of teams within the league. Consequently, 1989 is a pivotal year in measuring if the free agency decision impacted on competitive balance. Table 1 presents the means of the four measures of competitive balance for the periods prior to (1966-1988) and during (1989-2002) free agency. MARGIN is smaller in the free agency period (1989-2002); reflecting a decrease in the margins of victory and indicating that free agency may have produced more competitive balance in the league. In addition, the HHI value is lower in the free agency period, indicating that the concentration of championships is lower and more competitive balance is present. This evidence suggests that

perhaps the structural shift of free agency is associated with the desired increase in competitive balance. On the other hand, essentially no changes in RATIO and CBR are observed, indicating that free agency may have had no impact on these measures of competitive balance. However, CBR is high in both periods indicating an already high level of competitive balance prior to and during free agency. The four measures of competitive balance, therefore, provide some evidence that the structural changes induced by free agency may have contributed to increasing competitive balance where there was still room to move – margins of victory and concentration of championships.

Table 1: Comparison of Means of Competitive Balance Measures Before and During Free Agency

Measure	*1966-1988 (Before)*	*1989-2002 (During)*
MARGIN	12.36	11.39
RATIO	5.72	5.67
CBR	0.76	0.82
HHI	3,043.48	2,817.46

Figures 1 through 3 present time series behavior of the competitive balance measures spanning the entire sample period. Figure 1 shows MARGIN and RATIO. When considering MARGIN, three distinct periods emerge. From 1966 – 1976 the average margin of victory is greater than the average margin of victory for the entire sample period and hence shows a larger winner in contests during this period. During this period, MARGIN ranges from 11 points to 15 points and has a great deal of volatility. The second period, 1977 – 1988, is less volatile with an average margin of victory of around 12 points. During this period the NFL experienced a league expansion and there were also draft rule changes – additional structural shifts that may have contributed to a period of increased competition. The third period, 1988 - 2002 covers the free agency and here MARGIN trends even lower to 11 points and with less volatility. The general direction of MARGIN over the entire period is consistent with greater competitive balance. Similar to Table 1, RATIO does not appear to exhibit any radical changes throughout the period, although the average does drop slightly after the advent of free agency.

Figure 2 shows the competitive balance ratio (CBR) and the general trend of CBR is upward throughout the period, especially from 1977 (0.65) through 2002

(0.91). With perfect competitive balance reflected in a CBR of 1.0, the steady increase in CBR since free agency indicates that an optimal level of competitive balance is almost attained. This trend is not obvious in the summary measures found in Table 1.

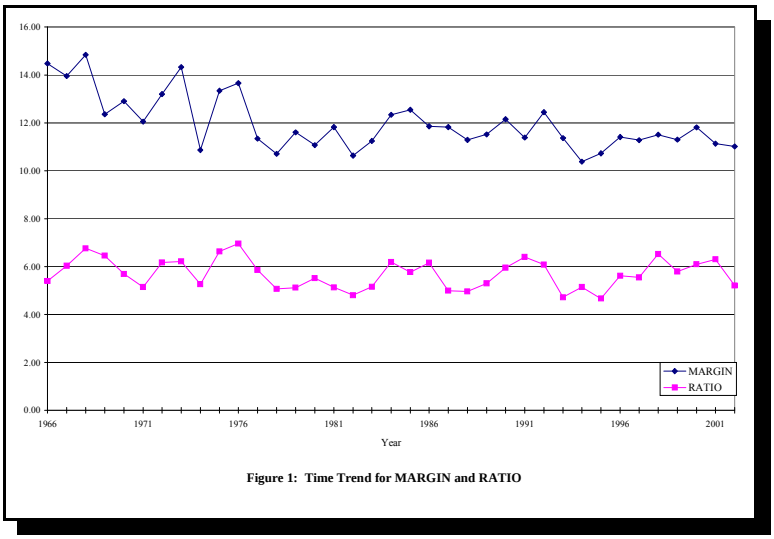

Figure 1: Time Trend for MARGIN and RATIO

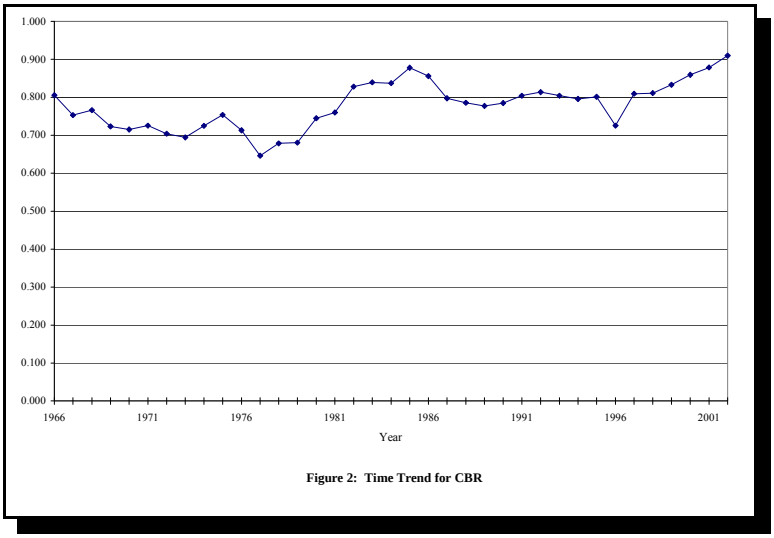

Figure 2: Time Trend for CBR

Figure 3 shows a great deal of volatility in the concentration index (HHI) until 1989-2002, the period of free agency. Evidence indicates that the relative stability may have started in 1983 when other structural shifts not explored in this study were implemented. Nevertheless, the free agency period indicates lower concentration of championship wins throughout the period, which is consistent with greater competitive balance. In summary, all four measures provide evidence that competitive balance was enhanced with the advent of free agency.

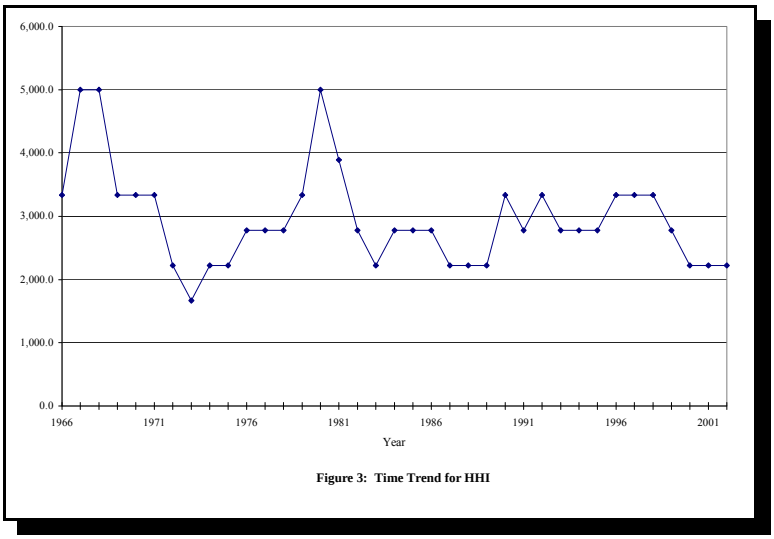

Figure 3: Time Trend for HHI

FAN INTEREST IN THE NFL

The main focus of the remainder of this study is to determine if the increased competitive balance associated with the advent of free agency has lead to higher fan interest. Without fan interest in the NFL, there is no revenue and without revenue, there is no profit. Finally, without profit, the NFL would soon collapse. Consequently, fan interest is critical to the NFL's success. Fan interest is difficult to quantify as it is manifested in expressions of interest such as attendance, merchandise sales and television revenue. Szymanski (2001) does not find a linkage between competitive balance and attendance at English soccer matches. On the other hand, according to Dobson and Goddard (1998), structural changes impact competitive markets, especially in those markets with a smaller fan base. On a more anecdotal level, the signing of free agents in the NFL is often accompanied with a great deal of speculation concerning the impact of the signing. For example, the

signing of Terrell Owens by the Dallas Cowboys in 2006 left fans uneasy speculating about his impact on team chemistry. At the same time, fan interest in the Cowboys was intensified as a result of the signing as measured by sales, marketing and advertising. In fact, Owens' jersey became one of the top sellers of the season.

In this study, we use two variables to measure the level of fan interest. The first variable, Sellout Rate, measures fan interest in attending games. The Sellout Rate is the ratio of the total number of tickets sold to the cumulative number of seats (stadium capacity) for the year. Our variable is a modification of Humphrey's (2002) attendance measure of fan interest. The higher (lower) the Sellout Rate, the greater (lower) the fan interest in the product. The second variable, TV Share, measures fan interest in watching games on TV. TV Share is measured by the average annual percent of television households tuning in to Monday Night Football (MNF) as reported by Nielsen's. The higher (lower) the rating, the greater (smaller) the fan interest in watching football.

Table 2 presents the means of the Sellout Rate and TV Share measures for the period prior to free agency (1966-1988) and the period during free agency (1989-2002). [Due to data limitations furnished by Nielsen's, the data on TV Share does not include the years 1966-1972]. The Sellout Rate during free agency is higher than in the earlier period indicating that fan interest is higher. This is confirmed in Figure 4 as the trend line since 1989 for the Sellout Rate steadily drifts higher to almost 95%. Prior to the free agency period, the Sellout Rate is more erratic ranging from 70% to 93%. As seen in Table 2, TV Share is lower during the free agency period. The trend line for TV Share in Figure 5 shows a consistently erratic behavior both prior to free agency and during free agency. Consequently, changes in overall fan interest are difficult to determine. It appears that fan interest in attending games increased during the free agency period, while fan interest in watching Monday Night Football decreased.

Table 2:
Comparison of Means of Fan Interest Measures Before and During Free Agency

Measure	*1966-1988 (Before)*	*1989-2002 (During)*
SellOutRate	82.39%	87.60%
TV Share	19.61%	17.62%

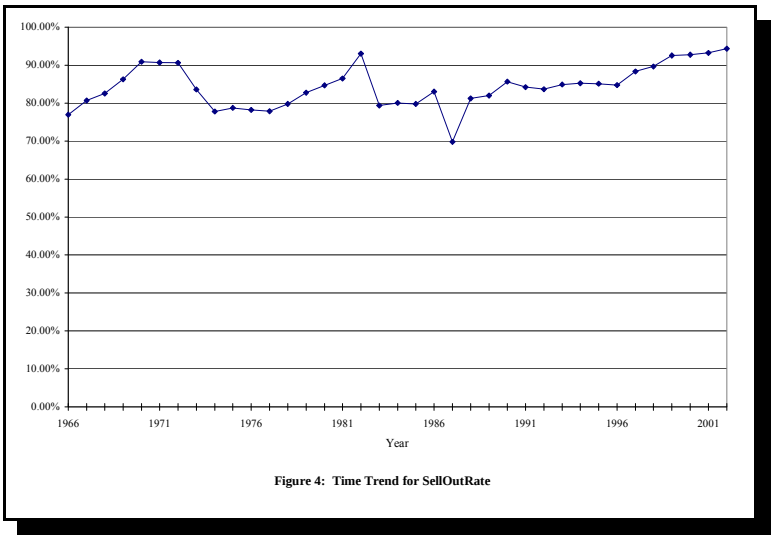

Figure 4: Time Trend for SellOutRate

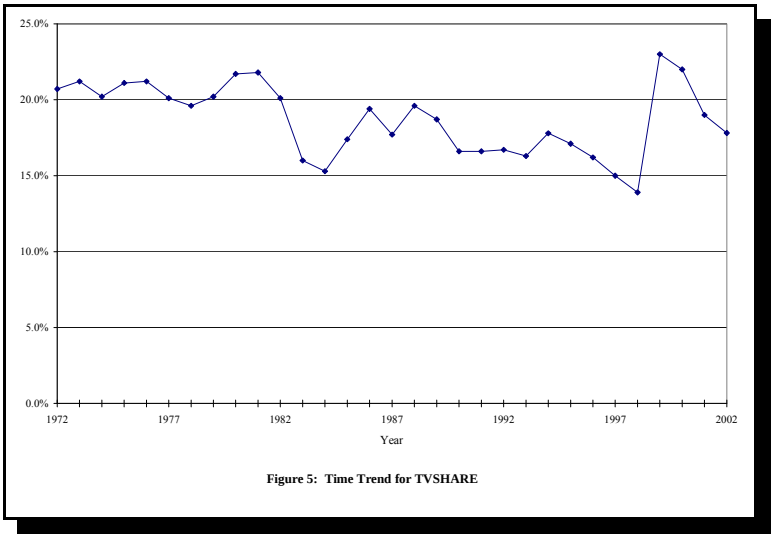

Figure 5: Time Trend for TVSHARE

DATA AND MODEL SPECIFICATIONS

Definitions and data sources of all sixteen variables measuring the different dimensions of competitive balance and fan interest are provided in Appendix 1. Summary statistics for each variable are presented in Appendix 2. Several statistical

tests, whose details are not reported here, were performed in order to establish the characteristics of the data. The Augmented Dickey-Fuller test indicates all data series are stationary. The White test indicates that the data series have the property of homoscedasticity. A correlation matrix shows no multicollinearity issues. A test of means and variances of the four competitive balance measures (RATIO, MARGIN, CBR, HHI), and the two fan interest measures (Sellout Rate, TV Share) indicates some significant differences between the period prior to free agency (1966-1988) and during free agency (1989 – 2002). Though there is no significant difference in the means of these variables and no significant difference in the variances of RATIO and TV Share, there is a significant decrease in the variances of all the other variables. This result indicates that the distributions of Sellout Rate, MARGIN, CBR, and HHI allow for fewer extreme values during free agency than prior to free agency.

There are four models of competitive balance, one for each measure, which were adapted from Sutter and Winkler (2003). Equation 1 presents the generalized model

$$CB_t = \beta_0 + \beta_1 * FreeAgency_t + \beta_2 * Parity\ Schedule_t + \beta_3 * Merged_t + \beta_4 * Teams_t + \varepsilon_t \quad (1)$$

where CB_t is the competitive balance measure in question (MARGIN, RATIO, CBR, or HHI) for time t. $FreeAgency_t$ is a dummy variable that equals 1 for the years in which free agency was in effect (1989-2002) and 0 otherwise. Parity $Schedule_t$ is a dummy variable that equals 1 for the years in which the parity scheduling scheme was in effect (1978-2001) and 0 otherwise. Parity scheduling is an NFL scheduling policy in which the stronger teams from the prior year play each other in the current year while the weaker teams from the prior year play each other in the current year. The intention of this policy is to schedule teams of equal strength against each other in an effort to create (or increase) competitive balance. $Merged_t$ is a dummy variable that equals 1 for the years in which the American Football League (AFL) merged with the old National Football League (NFL) to form the new NFL (1970-2002) and 0 otherwise. $Teams_t$ is the number of teams playing in the NFL for time t. These models, and the others that follow, are all estimated using ordinary least squares regressions.

There are five models explaining the Sellout Rate to gain insight into fan interest – four models adding the competitive balance measures individually as independent variables (CB) and one model adding all four of the competitive

balance measures together as collective independent variables. Equations 2 and 3 present these models:

$$\text{Sellout Rate}_t = \beta_0 + \beta_1 * \text{UPop}_{t-1} + \beta_2 * \text{Strike1}_{t-1} + \beta_3 * \text{Strike7}_{t-1} + \beta_4 * \text{UPI}_{t-1} + \beta_5 * \text{Points}_{t-1} + \beta_6 * \text{CB}_{t-1} + \varepsilon_t \quad (2)$$

$$\text{Sellout Rate}_t = \beta_0 + \beta_1 * \text{UPop}_{t-1} + \beta_2 * \text{Strike1}_{t-1} + \beta_3 * \text{Strike7}_{t-1} + \beta_4 * \text{UPI}_{t-1} + \beta_5 * \text{Points}_{t-1} + \beta_6 * \text{MARGIN}_{t1} + \beta_7 * \text{RATIO}_{t-1} + \beta_8 * \text{CBR}_{t-1} + \beta_9 * \text{HHI}_{t-1} + \varepsilon_t \quad (3)$$

There are also 22 models of individual team Sellout Rate. These models are modified from Humphreys (2002). A generalized version of these models is presented in Equation 4.

$$\text{Sellout Rate}_{t,I} = \beta_0 + \beta_1 * \text{PopUrban}_{t-1,I} + \beta_2 * \text{Strike1}_{t-1} + \beta_3 * \text{Strike7}_{t-1} + \beta_4 * \text{PIUrban}_{t-1,I} + \beta_5 * \text{WP}_{t-1,I} + \varepsilon_{t,I} \quad (4)$$

Sellout Rate_t is the NFL Sellout Rate for time t. $\text{Sellout Rate}_{t,i}$ is the Sellout Rate of team i for time t. UPop_{t-1} is the one-year lag of the relevant total urban population in millions of persons where an NFL team plays. Strike1_{t-1} is a dummy variable that equals 1 for the year 1988 (the year after which the players went on a 1-game strike) and 0 otherwise. Strike7_{t-1} is a dummy variable that equals 1 for the year 1983 (the year after which the players went on a 7-game strike) and 0 otherwise. UPI_{t-1} is the one-year lag of the total relevant urban personal income per capita in thousands of dollars. Points_{t-1} is the one-year lag of the season's average combined points per game. CB_{t-1} is the one-year lag of the individual competitive balance measure in question (MARGIN, RATIO, CBR, or HHI). $\text{PopUrban}_{t-1,i}$ is the one-year lag of team i's relevant urban population in thousands of persons. $\text{PIUrban}_{t-1,i}$ is the one-year lag of the personal income per capita in thousands of dollars for the relevant urban area of team i. $\text{WP}_{t-1,i}$ is the one-year lag of team i's winning percentage. One-year lags are used since most NFL fans purchase tickets for the NFL season before the season starts. Fans would theoretically use last year's variables as a basis for their purchase decision. The twenty-two teams for the individual team Sellout Rate models are the teams that existed in 1965 in order to have a consistent sample without the influence from expansion.

Fan interest is also analyzed through five models explaining TV Share, four models using the competitive balance measures individually as independent variables and one model using all four of the competitive balance measures together

as independent variables. These models are modified from Humphreys (2002) and are presented in Equations 5 and 6.

$$\text{TV Share}_t = \beta_0 + \beta_1 * \text{Pop}_t + \beta_2 * \text{Strike1}_t + \beta_3 * \text{Strike7}_t + \beta_4 * \text{PI}_t + \beta_5 * \text{Points}_t + \beta_6 * \text{CB}_t + \varepsilon_t \quad (5)$$

$$\text{TV Share}_t = \beta_0 + \beta_1 * \text{Pop}_t + \beta_2 * \text{Strike1}_t + \beta_3 * \text{Strike7}_t + \beta_4 * \text{PI}_t + \beta_5 * \text{Points}_t + \beta_6 * \text{MARGIN}_t + \beta_7 * \text{RATIO}_t + \beta_8 * \text{CBR}_t + \beta_9 * \text{HHI}_t + \varepsilon_t \quad (6)$$

TV Share_t is the TV Share for time t. Pop_t is the national population, in millions of persons, for time t. PI_t is the personal income per capita for the United States, in thousands of US dollars, for time t. Points_t is the season's average combined points per game for time t. CB_t is the competitive balance measure in question (MARGIN, RATIO, CBR, or HHI) for time t. Since watching a program on television is a semi-instantaneous decision, these two models do not incorporate lagged variable values like those equations considering fan attendance (Sellout Rate).

RESULTS AND ANALYSIS

Table 3 presents the results of the generalized model incorporating the four possible competitive balance models presented in Equation 1. Parity Schedule is significantly related to both MARGIN and RATIO. For the years that parity scheduling was in place (1978-2001), all else being equal, MARGIN and RATIO are lower than for the other years where scheduling was not based on previous year performance. The significant and negative estimated coefficient on Parity Schedule in the MARGIN regression indicates that the deliberate sorting of team schedules by team strength lowered the margin of victory and enhanced competitive balance. Surprisingly, the significant and negative estimated coefficient on Parity Schedule in the RATIO regression indicates that the deliberate sorting of team schedules by team strength lowered RATIO and decreased competitive balance. None of the other independent variables are significant in the MARGIN or RATIO regressions. In the CBR regression, the positive and significant estimated coefficient on the Teams variable indicates that a larger number of teams is associated with a higher Competitive Balance Ratio as expected. In the HHI regression, the estimated coefficient on Merged is negative and significant. This result tells us that for the years in which the merger was in effect (1970-2002) where the AFL and the NFL

combined into one league, the HHI is lower than in the other years - indicating that the concentration of championships is lower and hence that competitive balance is higher. The F value on three of the four models is significant, with the model for RATIO being the exception. It should be noted that the variable Free Agency was not significant in any of the models, weakening the conclusions from the time series results above which indicated that competitive balance was increased through the introduction of free agency. Consequently, the generalized models provide mixed evidence regarding the relationship between competitive balance and related league decisions.

Table 3: Regression Results for Measures of Competitive Balance

	Dependent Variable			
	MARGIN	*RATIO*	*CBR*	*HHI*
Intercept	18.5633*** (5.60)	5.9765** (2.50)	0.2822 (1.35)	5,647.48** (2.11)
FreeAgency	0.0224 (0.06)	0.1702 (0.60)	0.0081 (0.33)	-59.70 (-0.19)
ParitySchedule	-0.7576** (-2.09)	-0.4642* (-1.78)	0.0349 (1.53)	486.37 (1.66)
Merged	-0.9301 (-1.63)	-0.5541 (-1.35)	-0.0429 (-1.20)	-1,839.23*** (-4.00)
Teams	-0.1885 (-1.47)	0.0172 (0.19)	0.0181** (2.25)	-46.87 (-0.45)
F Value	7.45***	2.01	5.48***	4.88***
R^2	0.49	0.20	0.4143	0.3865
Adjusted R^2	0.42	0.10	0.33	0.30
N	37	37	37	37

Note: t statistics in parentheses. F Value tests combined significance of all independent variables. N is the number of observations.
*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

Table 4 presents the results of the five models that measure fan interest with the variable Sellout Rate. In all five of the models, the estimated coefficient on per

capita personal income (UPI) is positive and significant indicating that increases in this income measure increase fan interest as measured by the Sellout Rate - perhaps due to game tickets being a discretionary expense. In three of the models, the estimated coefficient on population (UPop) is positive and significant indicating that increases in population would increase fan interest as measured by the Sellout Rate. CBR and HHI are significant independent variables both in the regressions when each is the only measure of competitive balance included and in the regression when all four measures of competitive balance are included. These are unexpected results. The finding of a negative and significant relationship between CBR and the Sellout Rate says that an increase in the competitive balance ratio is associated with lower fan interest as measured by the Sellout Rate. The positive and significant relationship between HHI and the Sellout Rate says that an increase in concentration of championships is associated with higher fan interest as measured by the Sellout Rate. Perhaps, fans do like dynasties. The other two measures of competitive balance (MARGIN and RATIO) are not significant in any of the other regressions with the Sellout Rate as the dependent variable. With one exception, none of the other independent variables (Strike1, Strike7, and Points) are significant in any of the five models. Based on the F-Test, the four competitive balance variables (MARGIN, RATIO, CBR, and HHI) have a combined significance on Sellout Rate.

Table 4: Regression Results for Models of NFL Sellout Rate

	Dependent variable in all models is Sellout Rate				
Intercept	-0.3824 (-0.66)	-0.3166 (-0.55)	-0.2147 (-0.40)	-0.0863 (-0.16)	-0.0327 (-0.06)
UPOP (1-year lag)	0.0340* (2.00)	0.0321* (1.96)	0.0316** (2.07)	0.0249 (1.61)	0.0271 (1.68)
Strike1 (1-year lag)	-0.0343 (-0.68)	-0.0377 (-0.73)	-0.0366 (-0.78)	-0.0091 (-0.19)	-0.0211 (-0.43)
Strike7 (1-year lag)	-0.0262 (-0.50)	-0.0259 (-0.49)	0.0119 (0.24)	-0.0179 (-0.37)	0.0015 (0.03)
UPI (1-year lag)	0.0003** (2.42)	0.00038*** (3.36)	0.0005*** (4.21)	0.0004*** (4.06)	0.0005*** (3.41)
Points (1-year lag)	0.0065 (1.41)	0.0055 (1.34)	0.0104** (2.34)	0.0020 (0.50)	0.0071 (1.35)
MARGIN (1-year lag)	-0.0057 (-0.57)				-0.0010 (-0.08)

Table 4: Regression Results for Models of NFL Sellout Rate					
	Dependent variable in all models is Sellout Rate				
RATIO (1-year lag)		-0.0077 (-0.55)			-0.0050 (-0.29)
CBR (1-year lag)			-0.4542** (-2.22)		-0.3707* (-1.78)
HHI (1-year lag)				0.0001** (2.19)	0.0001* (1.82)
F Value	2.63**	2.62**	3.80***	3.76***	2.96**
R^2	0.3522	0.3515	0.4400	0.4376	0.5062
Adjusted R^2	0.2181	0.2174	0.3241	0.3213	0.3353
N	37	37	37	37	37
F Test					12.44**

Note: t statistics in parentheses. F Value tests combined significance of all independent variables. F Test is the F Value testing the combined significance of 1-year lags of MARGIN, RATIO, CBR, and HHI for the SellOutRate ALL model. N is the number of observations.
*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

Table 5 presents the regression results of the TV Share models which only include the years 1972-1998 as explained earlier in the paper. Several issues raise a cautionary flag regarding the interpretation of these results. First, Nielsen Media changed its TV share measurement method in 1999, thereby making it difficult to measure fan interest based on TV Share across the entire sample period. Including 1999 and beyond without including an appropriate adjustment would introduce noise. Second, TV Share captures only MNF games, which may not be the most meaningful measure of fan interest in watching all NFL games. The variability of the competitive balance measures specific to MNF games may be different from that for all NFL games in a season. Finally, other explanatory variables may not be captured in the model. For instance, casual fans may prefer a specific group of sports commentators. If the commentators for a particular game are not part of that group, the individual may decide not to watch the game. Also, there have been scheduling changes for MNF games. In the current scheduling format, all NFL

teams play either a Sunday night or a Monday night game. In the past, only the strongest teams were shown on Monday night football. Consequently, the game match ups were probably of similar strength teams and the games may have been crucial to determine who would compete in the playoffs, as well as their seeding in the playoffs (obtaining first-round byes, securing home-field advantage, etc.). However, it is difficult to account for these issues in the models, especially when considering maintaining an appropriate number of degrees of freedom. Nevertheless, we consider TV Share since it is a consistent and reasonable proxy of a sub-dimension of fan interest. Again, Table 5 provides the regression results for TV Share models. Surprisingly, none of the independent variables have a statistically significant relationship with TV Share; however, all of these variables combined have a significant impact on TV Share. Based on the F-Test, the four competitive balance variables (MARGIN, RATIO, CBR, and HHI) have a combined significance on TV Share.

Table 5: Regression Analysis of Determinants of TV Share

	Dependent variable in all models is TV Share				
Intercept	0.18228 (0.24)	0.39876 (0.55)	0.16287 (0.26)	0.35767 (0.54)	0.58464 (0.76)
Population	0.00037645 (0.1)	-0.00060152 (-0.17)	0.00053718 (0.17)	-0.00062025 (-0.19)	-0.00162 (-0.43)
Strike1	-0.00208 (-0.13)	-0.00557 (-0.34)	-0.00368 (-0.24)	0.00275 (0.17)	-0.00369 (-0.23)
Strike7	0.00701 (0.42)	0.00446 (0.28)	0.01523 (0.95)	0.00973 (0.63)	0.01275 (0.76)
PI	-0.00367 (-0.38)	-0.00111 (-0.12)	-0.00367 (-0.45)	-0.0011 (-0.13)	0.00189 (0.19)
Points	-0.0005074 (-0.35)	-0.00058281 (-0.42)	0.00072865 (0.45)	-0.00067986 (-0.5)	-0.0000891 (-0.05)
MARGIN	-0.00109 (-0.26)				0.00426 (0.79)
RATIO		-0.00538 (-0.98)			-0.00925 (-1.27)
CBR			-0.10557 (-1.44)		-0.07214 (-0.94)

Table 5: Regression Analysis of Determinants of TV Share					
	Dependent variable in all models is TV Share				
HHI				0.00000654 (1.33)	0.00000712 (1.36)
F Value	6.19***	6.63***	7.17***	7.02***	5.01***
R^2	0.6615	0.6767	0.6937	0.6892	0.7381
Adjusted R^2	0.5546	0.5746	0.597	0.5911	0.5909
N	27	27	27	27	27
F Test					21.607**

Note: t statistics in parentheses. F Value tests combined significance of all independent variables. F Test is the F Value testing the combined significance of MARGIN, RATIO, CBR, and HHI for the TV Share ALL model. N is the number of observations.
*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

The regression results of the individual team Sellout Rate models are summarized in Table 6. (Detailed regressions results for each of the 22 teams in the sample will be furnished by the authors upon request). The one-year lagged PopUrban variable has a significant positive relationship with Sellout Rate for the Bills, Browns/Ravens, Chiefs, Eagles, Giants, Jets, and Lions. All else being equal, an increase in population is associated with an increase in Sellout Rate for these seven teams. PopUrban has a significant negative relationship with Sellout Rate for the Bears, Broncos, Oilers/Titans, Raiders, and Steelers, indicating that an increase in population is associated with a decrease in Sellout Rate. That an increase in population would increase the Sellout Rate for certain cities and decrease the Sellout Rate for other cities is a surprising result and might prove to be a topic for future research.

The one-year lagged Strike1 variable has a significant negative relationship with Sellout Rate for the Chargers, Cowboys, and Lions, while it has a significant positive relationship with the Cardinals. The one-year lagged Strike7 variable has a significant positive relationship with Sellout Rate for the Broncos and Steelers while it is negative and significant with only the Raiders. For 15 of the 22 teams, the strikes of 1982 and 1987 did not have a significant relationship with Sellout

Rate. Based on these results, it appears that for the NFL as whole the two strikes really did not adversely impact the Sellout Rate.

Table 6: Regression Results of Models of Individual Team Sellout Rate

	Intercept	PopUrban	Strike 1	Strike 7	PIUrban	WP	F-Val	AdjR^2
49ers	+	-	-	+	+	+	20.65	0.732
	**				***		***	
Bears	+	-	+	-	+	+	10.73	0.575
	***	**					***	
Bills	+	+	+	-	+	+	3.63	0.268
		*			*	***	**	
Broncos	+	-	-	+	+	+	12.23	0.609
	***	**		*	***	***	***	
Browns/ Ravens	+	+	+	+	+	+	2.21	0.144
	***	**			**		**	
Cardinals	+	-	+	-	-	+	6.71	0.442
	***		**		***	**	***	
Chargers	+	+	-	-	+	+	11.00	0.581
			*				***	
Chiefs	-	+	-	-	+	+	10.96	0.580
	*	**			***		***	
Colts	+	+	+	-	+	+	3.92	0.288
					*	***	***	
Cowboys	+	-	-	+	+	+	3.74	0.276
	***		***			**	***	
Eagles	-	+	+	-	+	+	6.68	0.441
	**	***			***	***	***	
Giants	+	+	+	-	+	+	2.21	0.144
		**					*	
Jets	-	+	-	+	-	+	3.37	0.248
		***					**	
Lions	-	+	-	+	+	+	9.85	0.551
	**	***	**		***		***	

Table 6: Regression Results of Models of Individual Team Sellout Rate

	Intercept	PopUrban	Strike 1	Strike 7	PIUrban	WP	F-Val	AdjR^2
Oilers/ Titans	+	-	-	+	+	+	11.54	0.594
	***	**			***	***	***	
Packers	+	-	-	+	+	-	0.52	0.071
	***							
Patriots	+	+	+	-	+	+	1.34	0.046
						**		
Raiders	+	-	+	-	+	+	12.38	0.612
	***	***		**	***	***	***	
Rams	+	-	+	+	+	+	6.37	0.427
	***				***		***	
Redskins	+	+	-	-	+	+	1.89	0.110
	***					*		
Steelers	+	-	-	+	-	+	32.40	0.814
	***	***		**		*	***	
Vikings	+	+	-	-	+	+	1.73	0.092
	***					**		

+ = has a positive estimated coefficient
- = has a negative estimated coefficient
* = significant at 10% level
** = significant at 5% level
*** = significant at 1% level

The one-year lagged PIUrban variable has a significant positive relationship with Sellout Rate for half the teams in the sample - the 49ers, Bills, Broncos, Browns/Ravens, Chiefs, Colts, Eagles, Lions, Oilers/Titans, Raiders, and Rams. An increase in per capita income is associated with an increase in the Sellout Rate in these markets. The only market with a negative and significant relationship between per capita income and Sellout Rate is the Cardinals. The one-year lagged WP variable has a significant positive relationship with Sellout Rate for the Bills, Broncos, Cardinals, Colts, Cowboys, Eagles, Oilers/Titans, Patriots, Raiders, Redskins, Steelers, and Vikings. For these teams, an increase in winning percentage is associated with an increase in Sellout Rate. None of the teams have a significant negative relationship between WP and Sellout Rate. Despite a small number of team exceptions, it appears that the two strikes did not have a significant impact on

the Sellout Rate throughout the NFL. On the other hand, with a few exceptions, population (PopUrban) and per capita income (PIUrban) each have a significant positive relationship with Sellout Rate. Furthermore, for most teams winning percentage (WP) is positively associated with Sellout Rate.

To further examine the impact of competitive balance on fan interest measured by Sellout Rate, we decompose the sample of 22 NFL teams into those with a significant winning percentage (WP) relationship to Sellout Rate and those with no significant WP relationship. The first regressions include only the Bills, Broncos, Cardinals, Colts, Cowboys, Eagles, Oilers/Titans, Patriots, Raiders, Redskins, Steelers, and Vikings, which are the teams whose winning percentage is significant to their respective Sellout Rate. The regression results for these models are found in Table 7.

Table 7: Regression Analysis of Determinants of Average Sellout Rate for Teams Whose Winning Percentage is Significant

	Dependent variable in all models is Sellout Rate				
Intercept	1.22402*** (9.84)	1.18444*** (8.91)	1.21561*** (11.02)	1.1762*** (10.41)	1.20045*** (9.15)
UPop (1-year lag)	-0.01244*** (-2.9)	-0.01238*** (-2.82)	-0.00885* (-1.91)	-0.01189*** (-2.75)	-0.0081 (-1.65)
Strike1 (1-year lag)	0.02919 (0.79)	0.03145 (0.84)	0.02115 (0.59)	0.03699 (1.0)	0.02832 (0.75)
Strike7 (1-year lag)	-0.04641 (-1.23)	-0.03814 (-1.02)	-0.02298 (-0.64)	-0.03727 (-1.03)	-0.02801 (-0.71)
UPI (1-year lag)	.00047753*** (4.35)	.00052651*** (5.89)	.00064989*** (5.82)	.00053881*** (6.03)	.00057034*** (3.85)
Points (1-year lag)	-0.00568** (-2.11)	-0.00641** (-2.53)	-0.00259 (-0.79)	-0.00687** (-2.69)	-0.0019 (-0.5)
MARGIN (1-year lag)	-0.00525 (-0.75)				-0.00831 (-0.9)
RATIO (1-year lag)		0.00004956 (0.0)			0.01007 (0.77)
CBR (1-year lag)			-0.30333* (-1.71)		-0.28329 (-1.5)
HHI (1-year lag)				0.00000697 (0.88)	0.00000486 (0.6)

Table 7: Regression Analysis of Determinants of Average Sellout Rate for Teams Whose Winning Percentage is Significant

	Dependent variable in all models is Sellout Rate				
F Value	7.35***	7.12***	8.31***	7.43***	5.36***
R^2	0.5951	0.5875	0.6242	0.5979	0.6412
Adjusted R^2	0.5142	0.505	0.549	0.5174	0.5217
N	37	37	37	37	37
F Test					19.658**

Note: t statistics in parentheses. F Value tests combined significance of all independent variables. F Test is the F Value testing the combined significance of 1-year lags of MARGIN, RATIO, CBR, and HHI for the SellOutRate ALL model. N is the number of observations.
*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

In four of the five models, Population (UPop) has a statistically significant negative relationship with Sellout Rate. The exception is the model that includes all four competitive balance measures. Neither the one-game strike (Strike1) nor the seven-game strike (Strike7) is significant in any of the models. In all five models, Per capita personal income (UPI) is statistically significant and positive. In three of the five models, the combined points per game (Points) variable has a statistically significant negative relationship with Sellout Rate. The only competitive balance measure that has a statistically significant impact by itself is CBR; however, F test results show that all four competitive balance measures have a combined significance with the Sellout Rate. For this sample of teams, it appears that an increase in population, and/or an increase in combined points per game are associated with decreases in Sellout Rate, while an increase in per capita personal income generally is related to an increase in Sellout Rate. Finally, an increase in competitive balance generally is related to a decrease in Sellout Rate.

The second regressions include only the 49ers, Bears, Browns/Ravens, Chargers, Chiefs, Giants, Jets, Lions, Packers, and Rams, which are the teams whose winning percentage is not significant to their respective Sellout Rate. The regression results for these models are found in Table 8. Just like our above results for the first sample of teams, per capita income (UPI) has a statistically significant

and positive relationship with Sellout Rate. Generally, for the rest of the non-competitive balance variables we find that most of them are not significant explanators of the Sellout Rate. Just as in our results in Table 4, here CBR and HHI are significant independent variables both in the regressions when each is the only measure of competitive balance included and in the regression when all four measures of competitive balance are included. Again, these are unexpected results. The finding of a negative and significant relationship between CBR and the Sellout Rate says that an increase in the competitive balance ratio is associated with lower fan interest as measured by the Sellout Rate. The positive and significant relationship between HHI and the Sellout Rate says that an increase in concentration of championships is associated with higher fan interest as measured by the Sellout Rate. Perhaps, fans do like dynasties. The other two measures of competitive balance (MARGIN and RATIO) are not significant in any of the other regressions with the Sellout Rate as the dependent variable. Again, F test results show that all four competitive balance measures have a combined significance with the Sellout Rate.

Table 8: Regression Analysis of Determinants of Average Sellout Rate for Teams Whose Winning Percentage is Not Significant

	Dependent variable in all models is Sellout Rate				
Intercept	0.63644** (2.06)	0.63443* (2.0)	0.4033 (1.37)	0.59985** (2.09)	0.40804 (1.33)
UPop (1-year lag)	0.00222 (0.17)	0.00254 (0.2)	0.0209 (1.51)	0.00403 (0.34)	0.01925 (1.36)
Strike1 (1-year lag)	-0.06657 (-1.26)	-0.06683 (-1.26)	-0.08479* (-1.77)	-0.04708 (-0.95)	-0.06583 (-1.33)
Strike7 (1-year lag)	-0.01552 (-0.29)	-0.01683 (-0.32)	0.03118 (0.62)	-0.01169 (-0.24)	0.0291 (0.55)
UPI (1-year lag)	.00099121*** (3.65)	.00098082*** (3.74)	0.00165*** (4.62)	.00107*** (4.33)	.00163*** (4.44)
Points (1-year lag)	0.00147 (0.37)	0.0017 (0.46)	0.01007** (2.14)	0.00016937 (0.05)	0.00752 (1.4)
MARGIN (1-year lag)	0.00142 (0.14)				0.00052764 (0.04)
RATIO (1-year lag)		0.00090688 (0.07)			-0.00050223 (-0.03)

Table 8: Regression Analysis of Determinants of Average Sellout Rate for Teams Whose Winning Percentage is Not Significant

	Dependent variable in all models is Sellout Rate				
CBR (1-year lag)			-0.61783** (-2.51)		-0.52649** (-2.09)
HHI (1-year lag)				0.00002303** (2.2)	0.00001854* (1.75)
F Value	7.32***	7.31***	9.9***	9.29***	6.98***
R^2	0.5942	0.5939	0.6644	0.6502	0.6994
Adjusted R^2	0.513	0.5127	0.5973	0.5802	0.5992
N	37	37	37	37	37
F Test					25.593**

Note: t statistics in parentheses. F Value tests combined significance of all independent variables. F Test is the F Value testing the combined significance of 1-year lags of MARGIN, RATIO, CBR, and HHI for the SellOutRate ALL model. N is the number of observations.
*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

There are only three consistent results when comparing the regressions on the Sellout Rate for each of these two samples of teams. Across both sample's sets of regressions we find that per capita income has a significant and positive impact on Sellout Rate, that the estimated coefficient on CBR is significant and negative in the regression where it is the only competitive balance measure included, and that F test results show that all four competitive balance measures have a combined significance with the Sellout Rate. Future research might look to explain why the many differences in the regression results for these two samples of teams occur.

CONCLUSIONS

The intuitive argument is that free agency in the NFL would increase competitive balance and that increased competitive balance would increase fan interest. It would logically follow that free agency in the NFL would increase fan interest.

Our results, however, do not provide convincing evidence of a statistically significant relationship between free agency and competitive balance (as measured by MARGIN, RATIO, CBR, and HHI). Although free agency has no significant impact on competitive balance, structural changes as a whole do.

Our analysis of the relationship between competitive balance and fan interest show mixed results. Two of our competitive balance measures (MARGIN and RATIO) are never significant to our two fan interest measures (TV Share and Sellout Rate). While neither CBR nor HHI is significant to TV Share, both are significant to Sellout Rate, indicating that only across-seasons competitive balance is significant to fan interest in attending games. The significant negative relationship between CBR and Sellout Rate says that an increase in CBR decreases fan interest as measured by Sellout Rate. The significant positive relationship between HHI and Sellout Rate says that an increase in the concentration of championships increases fan interest as measured by Sellout Rate. These unexpected results may warrant future research.

Individual team model regressions show that winning percentage has a significant positive impact on fan interest for only 12 of 22 teams. These results support the contention that the uncertainty of outcome hypothesis generally does not hold for the NFL. Increased fan interest in attending games is a function of increased absolute performance, increased population, and increased personal income. Periodically, a team will dominate and develop into a dynasty, whereby their superior play diminishes the uncertainty of outcome in related games. Examples include the Packers (1961-1968), Vikings (1969-1973), Cowboys (1970-1978, 1992-1995), Dolphins (1971-1973), Steelers (1974-1979), 49ers (1984-1989), and Bills (1990-1993). Perhaps fans temporarily tolerate dominant teams and "certainty" of outcome, until the competitive balance reverts and a more uncertain outcome returns (until the next dynasty emerges).

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