COLLEGE BASKETBALL UPSET RATES SINCE 2012
(Do Upsets Prove Parity?)

Many years ago, a good friend and colleague, an Oklahoma graduate, asserted that the best team always wins. However, that assertion is simply not correct. The best team wins most of the time, but the best team does not win every game. It is true that in that particular meeting, the upset winner played a better game than the upset loser, but the upset outcome does not mean the upset winner is a better team than the upset loser. When the best team loses, the outcome is an upset. Upsets occur in all sports at all levels, and fans tend to react to upsets by concluding that the upsets mean more teams are of equal value, thus more PARITY!!!

In college basketball, a measure of a team's strength relative to other teams' strengths is the teams' adjusted net efficiency, ANE, measured in points per possession. To be sure, ANE is a simple concept, despite the fancy terminology. ANE is the average margin of victory (or defeat if negative) first normalized for tempo and then adjusted based on venue and that team's cumulative opponent strengths. Clearly, the raw net efficiency, RNE, is the team's average margin divided by the team's average tempo, possessions per game to yield the raw efficiency in points per possession. The ANE is determined by adjusting the RNE for the assorted game venue and opponents' cumulative strengths.

With the ANE method, the strength difference between any two teams is quantifiable as the arithmetic difference between two teams' respective ANE values plus the home court advantage

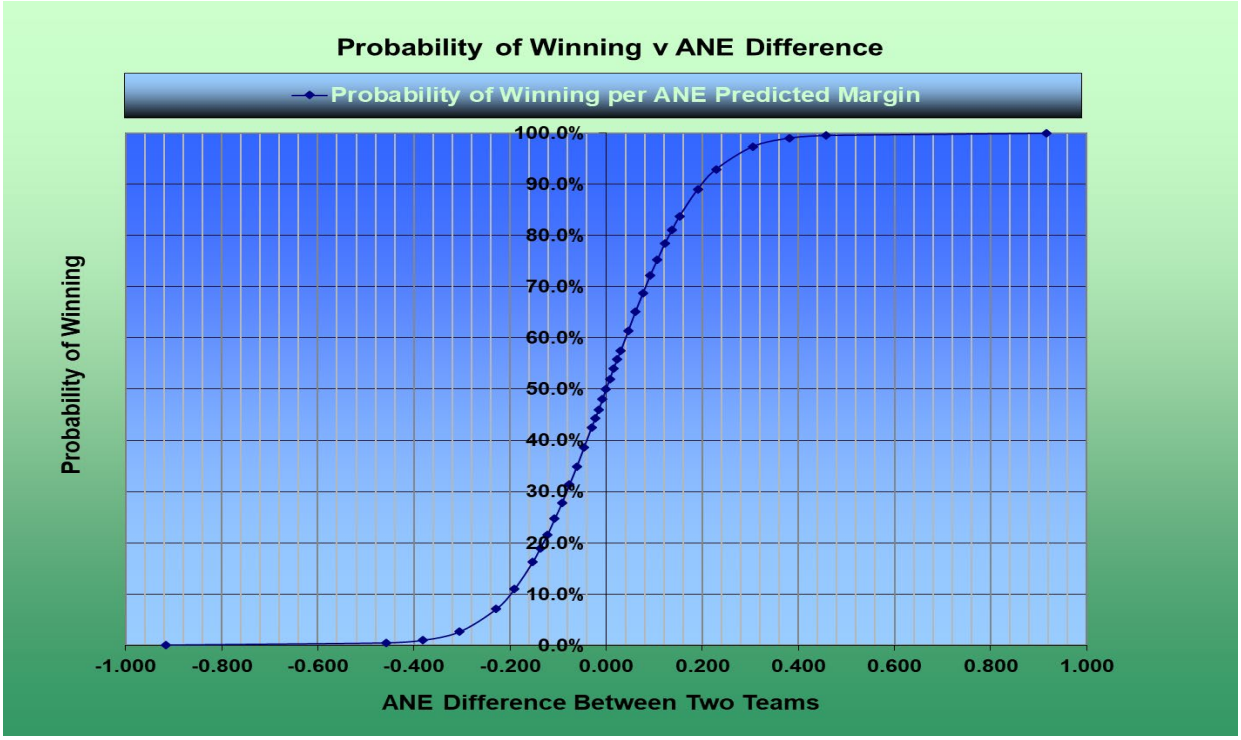

Figure 1 ANE DIFFERENCE and WIN/LOSS PROBABILITY

if applicable. FIGURE 1 provides the relationship between the ANE game difference for an upcoming game and probability that the stronger team will win a game between the two teams at the venue considered in the analysis.

When the ANE difference between two teams is small, approaching the lower bound ANE difference of 0.000, each team has a 50% probability of winning that game. Similarly, as the ANE difference rises, the probability that the stronger team will win rises until it becomes asymptotic to but never quite reaching 100%. All games fall within these boundary conditions.

Since the 2011-12 season, I have collected upset rate data for every D1 college basketball game. TABLE 1 shows this data by season.

UPSET DATA BY SEASON SINCE 2011-12

Seaon	Games Played	Number of Upsets	Theor. # of Upsets	Actual Upset Rate %	Theor. Upset Rate %
2020	3423	853	875	24.9%	25.6%
2019	5603	1476	1523	26.3%	27.2%
2018	5541	1438	1480	26.0%	26.7%
2017	5540	1461	1482	26.4%	26.8%
2016	5535	1460	1439	26.4%	26.0%
2015	5526	1463	1416	26.5%	25.6%
2014	5519	1448	1418	26.2%	25.7%
2013	5479	1428	1362	26.1%	24.9%
2012	5405	1312	1330	24.3%	24.6%
Average	5518.5	1435.75	1431.25	26.0%	25.9%

Table 1 UPSET RATES FOR ALL D1 BASKETBALL GAMES 2012 - 2020

Some interesting trends appear in this data. First, the number of games per season is rising primarily because of additional teams moving into the D1 classification. In 2012, there were 345 D1 college basketball teams and there have been 353 D1 teams since the 2019 season. This data demonstrates a global upset rate for D1 college basketball of 26.0% over a span of these 9 seasons, and this rate for an individual season has ranged between 24.6% (2012) and 27.2% (2019).

The global upset rate does not tell the entire story about upsets. Prior to each game, the ANE difference between the respective opponents and the venue of the game yield a win probability for

the favored teams prior to each game. Clearly, upsets do not occur in 26.0% of games that have a 55% or 95% probability that the stronger team will win because as noted previously, as the win probability rises, the upset rate falls. This begs the question. How well do these individual game win probabilities track with the outcomes of the games over the course of many games?

To address this question, I have placed each game into one of these five probability ranges based on the pre-game ANE differences for each game. Theoretically, the actual upset rate for each such probability range is the average win probability for the games in that category. Therefore, for the 90-99.9% probability range, the theoretical probability of an upset would be 5% because the favored team should win 95% of these games. Similarly, for the 80% to 90% probability range, the theoretical upset rate should be 15%, and so forth for the five probability ranges used in this analysis. Table 2 provides all of the results for all games since 2012 for each probability range.

SUMMARY OF UPSETS VS THEORETICAL RATES

PROBABILITY OF WINNING FROM	TO	GAMES	UPSETS	UPSET RATE, %	THEOR RATE, %
100.0%	90.0%	950.4	42.9	4.5%	5.0%
90.0%	80.0%	1085.6	170.6	15.7%	15.0%
80.0%	70.0%	1160.9	298.0	25.7%	25.0%
70.0%	60.0%	1185.0	420.0	35.5%	35.0%
60.0%	50.0%	1136.6	504.3	44.4%	45.0%
ALL	GAMES	5518.5	1435.8	26.0%	25.9%

Table 2 UPSET RATES BY PROBABILITY RANGE

The data in TABLE 2 presents the average quantities for the 2012 through 2019 seasons, with an average 5,518.5 games with an average 1,435.8 upsets. The actual upset rates are within a range of -0.6% to +0.7% of the theoretical upset rates for the five probability ranges. The consistency of the outcomes, as illustrated here, demonstrates the reliability of the ANE measure of teams' strength and the reliability of the relationship between the ANE difference and the probability that the stronger team will win a game.

FIGURE 2 shows the annual upset rates for each probability range by year, including the 2020 results to date and the global upset rate by season. Thus far, the 2019-20 basketball season has been tracking closely with annual averages for the 8 previous full seasons.

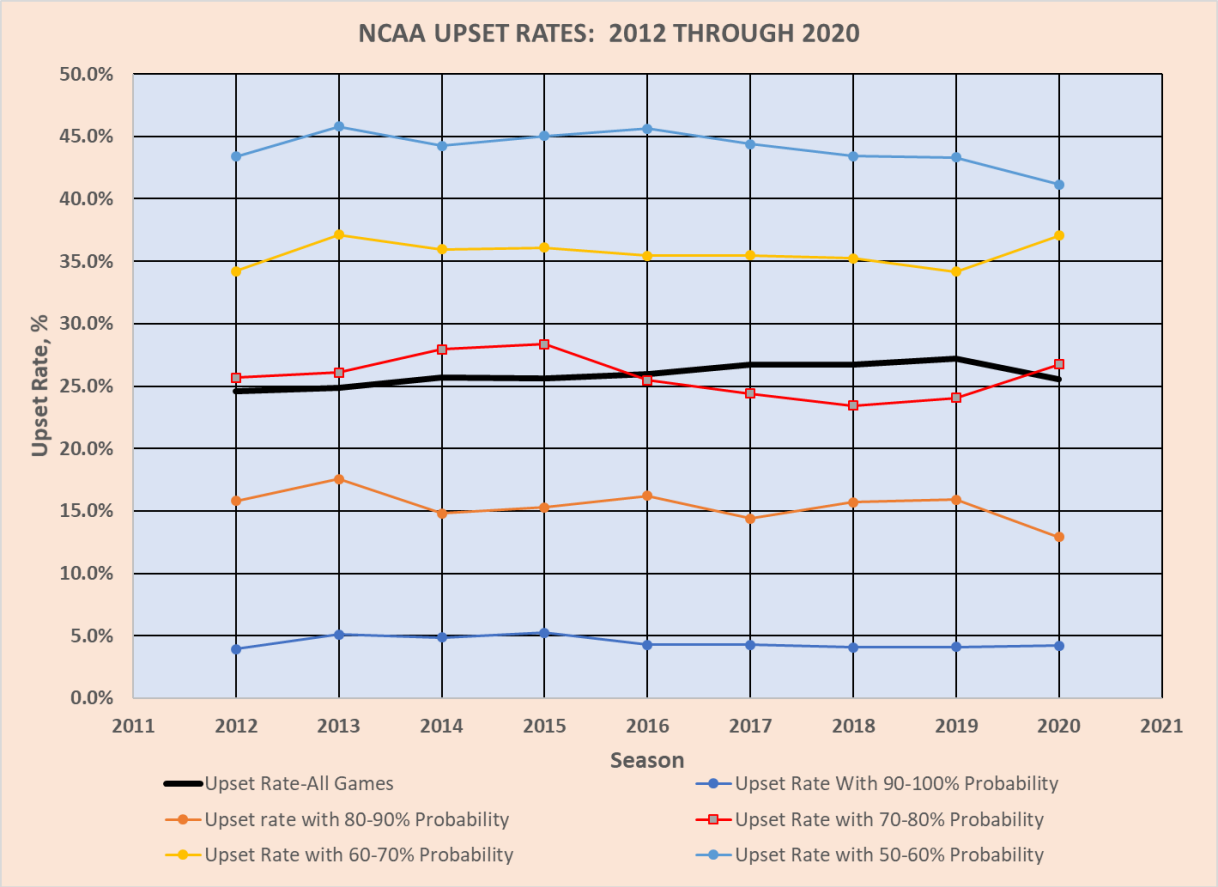

Figure 2 UPSET RATES BY YEAR AND PROBABILITY RANGE

Upsets are part of competitive endeavors, including college basketball, and upsets provide a convenient handle for fans of all teams to maintain hope for a better future for their favorite team despite the reality of their team's actual on court performance. The ANE value for a team provides an objective measure for each team's strength based on a team's average strength of performance over the course of the season.

However, fans tend to adopt a subjective view about the relative strength of teams, and in so doing, fans:

- Elevate the value of their preferred teams' strongest performances and discount the importance of their preferred teams' weakest performances, and
- Discount the value of their disfavored teams' strongest performances and elevate the importance of their disfavored teams' weakest performances.

However, the upset rates derived from almost 50,000 D1 college basketball games since the 2011-12 season presented above demonstrate the viability of the ANE method, based on teams' average strength. Upsets not only occur but occur at predictable rates. Quite contrary to those who want to dispel the viability of the ANE method, upsets do not provide any evidence of the fallibility of the method.

Upsets occur at predictable rates based on the ANE defined team strengths. This is the case because no team plays at its average strength in every game. Actually, a team's performance strength in randomly selected games is not uniform. Not only do teams **NOT** play at their respective average strength every game, teams rarely do so. The data show that all teams seldom play "at its average." Rather, teams will play almost half of their games at a level that exceeds their average strength and will play almost half of their games at a level that falls short of their average strength.

Variable performance is a human trait. Basketball is a human team activity; therefore, basketball will have variable performance.

- Sometimes, both teams in a game play at levels that exceed their respective average strengths.
- Sometimes, both teams in a game play at levels that fall short of their respective average strengths.
- Sometimes, one team will play well and the other not so well, and those rolls can fall to either team from time to time.

FIGURE 3 illustrates how the range of variable performance in a game impacts the likelihood of an upset outcome between those teams. In this matrix, the stronger team's offense and defense are the measures, but the stronger team's offense is related to the weaker team's defense, and the stronger team's defense is related to the weaker team's offense.

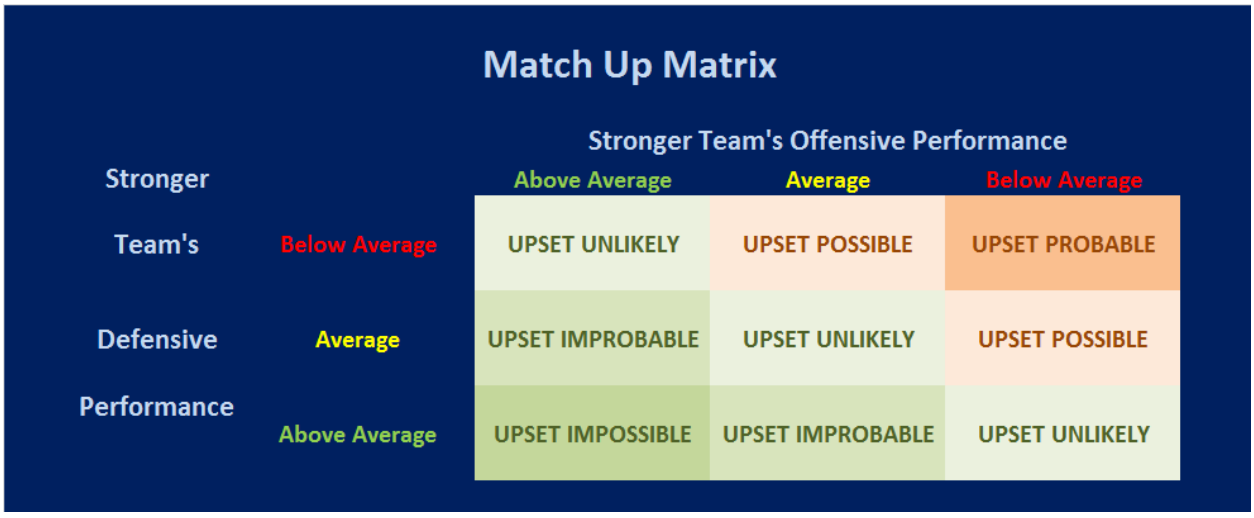

Figure 3 MATCH UP MATRIX

When an upset occurs, there is an upset winner and an upset loser. Therefore, for all of college basketball, the upset rate (26%) must be evenly divided between upset wins (13%) and upset losses (13%). The upset rates for college basketball have been remarkably uniform year to year, as the data demonstrate. However, upset rates team to team vary. The strongest teams rarely play stronger opponents and play most of their games against weaker opponents. Similarly, the weakest teams rarely play weaker opponents and play most of their games against stronger

opponents. The teams at either end of the strength continuum have upset rates that are lower than the national average.

- For the strongest teams, the percentage of upset wins declines while the percentage of upset losses remains about the same rate (13%) as for all of college basketball.
- For the weakest teams, the percentage of upset losses declines while the percentage of upset wins remains about the same rate (13%) as for all of college basketball.
- For most teams, the rate of upset wins and upset losses will be near the national average for each..

During the Calipari Era, Kentucky has resided in the upper echelon of college basketball a few seasons, and when not in the uppermost reaches of the sport, Kentucky has dropped outside the top 15 teams for other seasons. Kentucky's overall upset rate during the Calipari Era has been 17.0%, ranging from a low of 2.6% in 2015 to a high of 27.3% in 2013 as shown in Table 3.:

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Comparison of Predicted and Actual Wins and Losses
2010-2020

Season	Predicted UK Wins	Predicted UK Loss	Actual Wins	Actual Losses	Predicted UK Win But Lost Upset Loss	Predicted UK Loss But Won Upset Win	Percentage Right on Winner
2020	14	5	15	4	3	4	63.2%
2019	33	4	30	7	6	3	75.7%
2018	26	11	26	11	4	4	78.4%
2017	36	2	32	6	4	0	89.5%
2016	30	6	27	9	6	3	75.0%
2015	39	0	38	1	1	0	97.4%
2014	30	10	29	11	5	4	77.5%
2013	26	7	21	12	7	2	72.7%
2012	39	1	38	2	2	1	92.5%
2011	33	5	29	9	6	3	76.3%
2010	34	4	35	3	1	2	92.1%
10	32.6	5	30.5	7.1	4.2	2.2	83.0%
					11.2%	5.9%	

Table 3 KENTUCKY UPSET RATES BY SEASON-CALIPARI ERA

As Kentucky's winning percentage falls, its' upset rate rises. This trend is consistent with the impact that high strength has on upset rates, as described above. FIGURE 4 shows the relationship between Kentucky's winning percentage and upset rate for Calipari's 10 seasons at Kentucky.

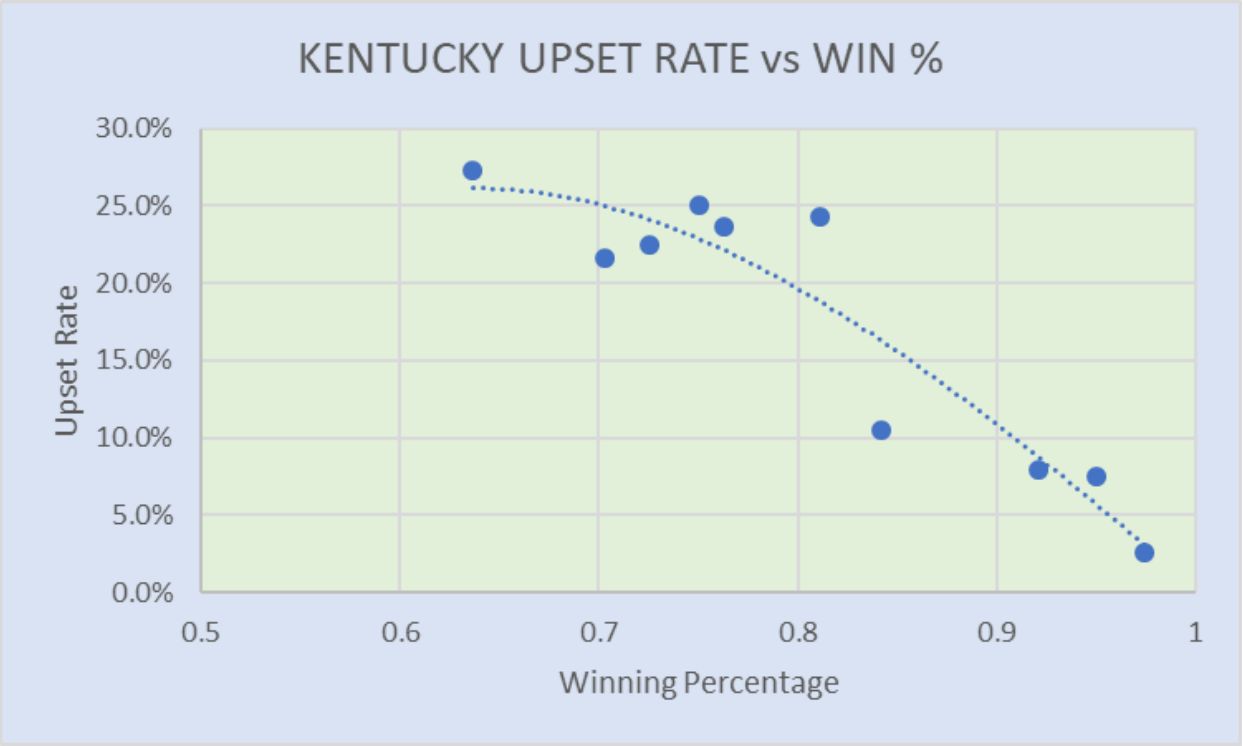

Figure 4 KENTUCKY WINNING % vs UPSET RATE BY SEASON-CALIPARI ERA

It is important to note how the trend line becomes asymptotic to about 26% as the winning percentage declines below about 80%. Furthermore, this information describes the exclusivity of a team's strength. In 2019, only 1 team ended the season with a wining percentage greater than 90%, and only 18 additional teams finished the season with a winning percentage between 80% and 90%. At the other end of the spectrum, only 1 team ended the 2019 season with a winning percentage less than 10%, and 12 additional teams finished the season with a winning percentage between 10% and 20%. That leaves 321 teams finishing the season with winning percentages between 20.1% and 79.9%, this is 91% of all D1 college basketball teams. In 2018, there were 12 teams that finished with winning percentages of 80% or greater and 15 teams at the 20% or less end, leaving 322 (92%) teams in the broad middle range.

The Kentucky data illustrates that teams in the top or bottom 10 to 20 are affected by these end conditions relative to upset rates. The Kentucky experience during the Calipari Era is completely consistent with this information relative to upset rates for upset wins and upset losses.

When subjective attempts to predict a team's success fail, fans must find some other explanation for continued upset, whether wins or losses. This is when fans instinctively turn to the parity argument, i.e. there is more parity in the game "this year" than ever before, or so the argument goes.

What is parity? Merriam-Webster defines parity as "the quality or state of being equal or equivalent."

Each season, fans and commentators drag out the parity argument. Some begin advancing the parity argument in November as soon as upsets contradict expected outcomes. Others wait until December when games trend toward greater competitiveness and upset rates begin to climb. Yet others wait until conference races catch fire. Regardless of the timing of the parity argument, it always emerges, and since it occurs every season, then there should be a discernable and measurable trend over the course of a few seasons manifested by an annual narrowing gap between the strength of the strongest and weakest teams.

However, no such trend exists, and there has been no change in the distribution of team strength, top to bottom over the last 11 years.

The distributions of the ANE of every team for each year since 2010 are almost identical. The number 1 ranked team in these 11 seasons has had an ANE between 0.303 ppp to 0.369 ppp with an average of 0.329 ppp. There have been 1 or 2 teams with an ANE at 0.300 ppp or higher every year except 2015 and 2019 when there were 5 and 6 such teams, respectively. This year there is only 1 team over 0.300 ppp, as there were in 2018, 2017, 2016, and 2011. There were two teams over 0.300 ppp in 2010, 2012, 2013, and 2014. Some other key markers might include the strength of the #4, #8, #16, #32, #64, #100, #150, #200, #250, #300, and the lowest ranked team, as shown in the table below. TABLE 4 shows the maximum, minimum, average, standard deviation, and the current 2020 values for each ranking level.

ANE DISTRIBUTION DATA FOR SELECTED RANKING POSITIONS
2010-2020

Rank	Max	Min	Average	Std Dev	2020
1	0.369	0.303	0.329	0.018	0.303
4	0.324	0.263	0.280	0.020	0.263
8	0.276	0.236	0.251	0.013	0.240
16	0.236	0.195	0.215	0.010	0.195
32	0.182	0.159	0.169	0.007	0.171
64	0.123	0.107	0.115	0.005	0.111
100	0.075	0.061	0.067	0.005	0.068
150	0.025	0.011	0.016	0.004	0.015
200	-0.028	-0.035	-0.031	0.002	-0.028
250	-0.068	-0.085	-0.075	0.004	-0.073
300	-0.113	-0.138	-0.126	0.008	-0.117
350	-0.294	-0.331	-0.313	0.026	-0.331

Table 4 ANE DISTRIBUTION CHARACTERISTICS FOR SELECTED RANKING 2010 THROUGH 2020

The standard deviation values indicate that the variability of ANE year to year is greatest at the very high and very low-ranking levels (1, 4, 8, 16, and 350) and very low for ranking levels in between (32, 64, 100, 150, 200, and 250).

FIGURE 5 shows the average for all years and all ranks (blue) and the ANE for 2020 (Gold).

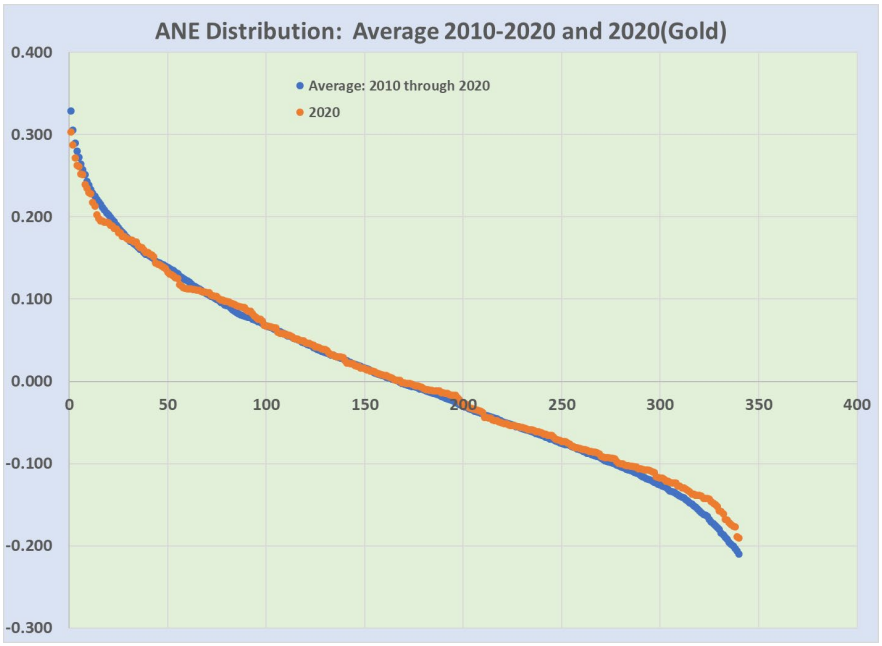

Figure 5 ANE DISTRIBUTION- AVERAGE FOR ALL TEAMS 2010-2020 AND 2020

FIGURE 6 shows the distribution of ANE for any given year.

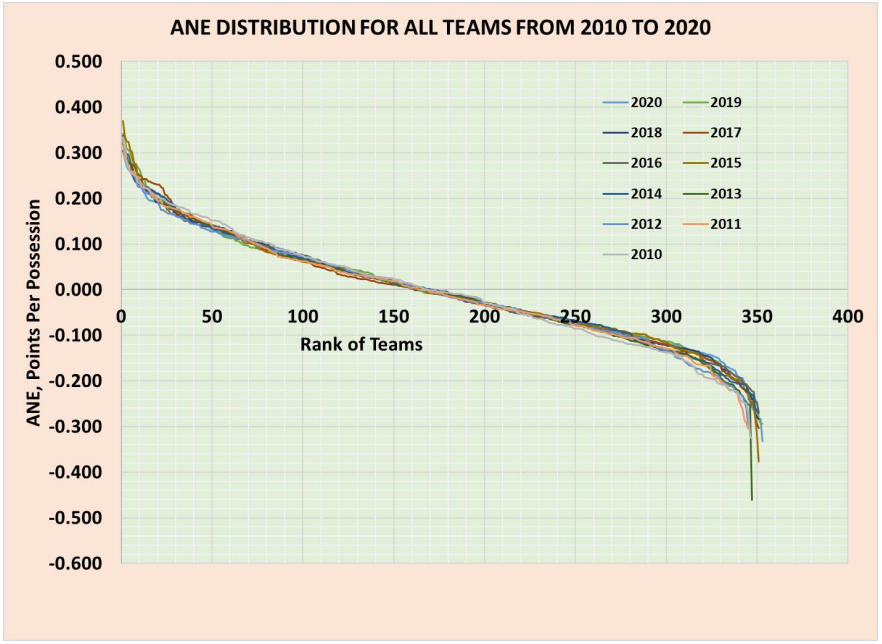

Figure 6 ANE DISTRIBUTION ALL TEAMS FOR 2010-2020

FIGURE 7 shows the distribution of ANE for 2014 and 2019 to illustrate two of the more divergent seasons of the past 11 seasons.

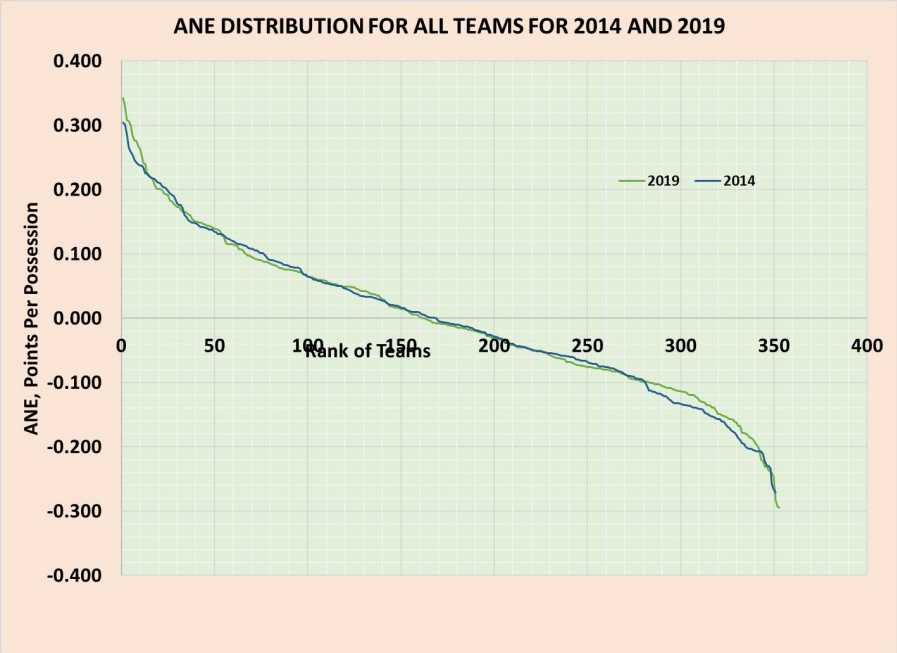

Figure 7 ANE DISTRIBUTION COMPARISON: 2014 AND 2019

The ANE distribution of teams in 2020 is the same as it has been for the previous 10 seasons. The distribution of ANE values is not changing, which is the central premise of parity argument.

Fans pin their hopes (and dreams) about their team's standing and likelihood of future success on some aspect of the upset. Fans of the top teams bemoan the simple occurrence of upsets as interfering with their team's ability to be even better than their record may seem. Fans of the bottom teams are eternally encouraged by the occurrence of upsets as indicative of how good their struggling team really can be. However, most fans follow teams that are not part of the upper crust or the bottom dregs. These fans cite the occurrence of upsets as why their teams need to be more consistent. However, inconsistent play is another of the fall back position that the data does not support.

This leads to fan statements like:

a) If my team plays like it can, it will win the championship.
b) My team will beat the other team badly because I saw the other team when it lost a game it should have won, and they are not as good as my team.

Fans are eternal optimists.