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The Fighting Irish Playing Chicken? How Notre Dame-Michigan Would Have Matched Up Had the Annual Series Not Ended

**Motivation**

The history of college football cannot be written properly without the Notre Dame Fighting Irish and the Michigan Wolverines. These two programs had each played football at the highest level for over 100 years, and from 1978-2014, the two programs engaged in one of the most important early-in-the-season rivalries in the sport. However, with Notre Dame’s move to the Atlantic Coast Conference (ACC) causing them to have to difficulties with fitting many of their annual matchups on the schedule (Michigan, Michigan State, Purdue, Pittsburgh), the annual matchup with the Wolverines had to come to an end aside from a home-and-home in 2018 and 2019. Being a Florida Gators fan and alumnus, I have a strong feeling of wonder towards their dormant rivalry with the University of Miami, where I often wonder how the matchups between the two schools would have fared had they never stopped playing on an annual basis. Although I have only become a Notre Dame fan recently, that feeling of wonder has now transitioned over to the dormant Michigan rivalry; this got me thinking on how the teams would have matched up if they kept playing annually after 2014.

There have been several works done on predicting the results of college football games. In a paper published by Carson K. Leung and Kyle W. Joseph from the University of Manitoba in 2014, they created a model predicting outcomes based on similar teams using statistics like team winning percentage, ratings percentage index, and Elo ratings. The model that they ultimately created was wildly successful, where their model picked 32 out of 35 bowl games correctly for the 2011 postseason and picked 34 out of 35 bowl games correctly for the 2012 postseason; this was far more successful than the other models that were used for comparison (Leung, 718). In 2009, Dennis Qin took a different approach, instead trying to predict the final rankings for teams and had a fairly good accuracy, predicting teams to finish closely to their actual rankings (Qin, 4). A collection of researchers led by Andrew D. Blaikie also used alternative methods to predict the outcome of both college and professional football games, mainly using artificial neural networks. While the NFL predictions were able to improve under certain conditions, the college football model was unable to be fixed in a major way, causing it to have more overall error (Blaikie, 7). The authors make a point to explain as to why this is the case, highlighting aspects like conference strength causing purely statistical analyses to overestimate or underestimate the evenness of teams (Blaikie, 6). There are several more works that deal with this topic, both for college football and other sports; however, there are no works that I could find that used statistical analysis to try and analyze the matchups and outcomes between two specific teams, outside of fan made articles and posts using basic statistics to try and predict those matchups.

**Problem Framing**

The problem I will focus on is creating a concrete prediction between hypothetical Notre Dame and Michigan games in the years 2015-2017, 2020-seasons (they played each other in 2018 and 2019) and showcasing how the teams match up in those years. My data source will be from the “CFBFastR” package, where it lists play-by-play data for all Division I-A college football games played going back decades; I will use data for Notre Dame and Michigan for the 2015-17 and 2020-2022 seasons to solve this problem. This data contains descriptions for all plays, from basic attributes like run/pass and how many yards they gain, to advanced statistics like winning percentage after each play is conducted. I will then evaluate matchups based on how the EPA for run plays and pass plays compare for both teams. Fortunately for me, the data set was already clean, I just need to filter out for specific team results and years. Some easily determined matchups before any analysis is done are that Notre Dame in 2016 and Michigan in 2020 were not very good teams, as each finished with a losing record; to contrast, Michigan in 2016 finished 10-3 and at one point was the second ranked team in the country, while Notre Dame in 2020 made the College Football Playoff and was also ranked second in the country at one point. There is a lot to learn from this data set, as while I am analyzing specifically just Notre Dame and Michigan, this can be applied to any other hypothetical matchups and can teach how effective each team is in the run and/or pass in the selected years. There is potential for bias to be shown in the data and the analysis, primarily regarding strength of schedule; this can cause one of the teams to be overestimated in how good they may be. Another source of bias, particularly in the 2020 season due to COVID, is that Notre Dame and Michigan played a different amount of games (13 to 6), which would maybe skew results heavily towards Notre Dame.

**Data Overview**

The data I will use comes from the CFBFastR package, where it contains hundreds of thousands of plays per season, with 50 columns for each play, with the vast majority of them being quantitative. The categorical variables primarily describe the type of play run, what half it was, the play description, and the description of penalties. The quantitative variables cover basic stats like how many yards the play gained or lost, the score each team had at the time of the play, and the play number, to advanced stats like percentage chance of winning at the time of the play. The data can address a variety of combinations, like offense and defense EPA, and home and away EPA; this could allow me to use performance at home and on the road as another layer of analysis.

While there is no extensive cleaning I need to do for the data, I do need to filter out certain results. I primarily need to focus on the years post-2014 where Notre Dame and Michigan did not play each other in football, and I need to filter out the results by specifically those teams. I cannot filter out plays or entire games because that would compromise the entire data set. I initially did have reservations about analyzing the 2020 season due to the unique circumstances brought to the season by COVID-19, but I decided to analyze because numerous matchups in the postseason occurred with teams that had very different number of games played, and the results of the games did not necessarily favor teams that played more or less games (Ohio State dominating Clemson but getting squashed by Alabama in the College Football Playoff exemplifies this). Once the correct teams and years were gathered, the data was ready for analysis.

**Methods**

For each year, the play-by-play data had to be loaded, where a new column was created that converted plays labeled as “Pass Reception” and “Pass Incompletion” as “Pass” and “Rush” and “Rushing Touchdown” as “Rush.” This would allow for key metrics like EPA and WPA to be more easily evaluated and would allow for a team’s passing/rushing offense and defense to be properly evaluated. Each team then had different measurements of their EPA by play type and down evaluated through a series of density plots as way to showcase how effective each team was individually; this was done for both offense and defense. A similar process was done to calculate their statistics by field position; these plots were marked on a football field, where the average passing and rushing EPAs were calculated according to these types of plays being done in each of the different designated zones of the field (own 20, own 20-50, opponent 20-50, and opponent 20); a different plot was done for both offense and defense. This analysis was able to highlight the individual strengths of the different Notre Dame and Michigan teams throughout each year that was examined. For example, Notre Dame’s offense in 2015 was prolific through the passing attack, particularly in the red zone (opponent 20); every time the Irish threw the ball inside the red zone, they could expect an average of 0.521 points, which is a staggering number. On the other side, Michigan’s pass defense was elite in 2015, as every time their opponents passed in the red zone, the offenses they faced would expect an average of -0.199 points, meaning that they’d likely lose points whenever they tried to pass on the Michigan defense that year in the red zone, which is a remarkable sign of how strong that defense was.

After the individual strengths of the teams were assessed, the two teams were then matched up by WPA and EPA depending on field position (using the same four zones as the individual graphs); I decided to evaluate play value by field position because offensive and defensive strategy differs depending on where the ball is positioned on the field, which a deeper look would lead to potentially interesting analysis. Each combination of team chosen, offense/defense, pass/rush, and WPA/EPA were all tested, creating a total of 8 different bar graphs per year studied. Each chart would calculate the average change between WPA/EPA between the different combination (for example, Notre Dame passing offense vs Michigan passing defense in 2023); if an individual bar was positive, that would indicate an offensive advantage, while a negative value would indicate a defensive advantage. A similar process was done for EPA and WPA comparisons, but by which down it was. I thought this would be interesting to look at because like field position, football teams typically treat each down differently in terms of what they try to accomplish. Like the field position analysis, each combination of team chosen, offense/defense, pass/rush, and WPA/EPA were tested, and the analysis of each individual bar was the same, as a positive value would indicate an offensive advantage while a negative value would indicate a defensive advantage.

**Discussion**

A graph with different colored squares

Description automatically generated Due to college football changing quite frequently over the course of 2015-2023, including within the Notre Dame and Michigan football program themselves, there were several observations that I found to be incredibly interesting. The biggest observation was the consistency of each team’s passing attack being usually more useful in comparison to each team’s rushing attack. Notre Dame in 2015 and 2017 were the teams that would have had more balanced offensive attacks, but the other years that were examined showed the Irish having far more success throwing the ball in a hypothetical matchup against Michigan in those years. This discrepancy can maybe be attributed to Notre Dame having athletic quarterbacks like DeShone Kizer (2015) and Brandon Wimbush (2017), who would have added another dimension to the Irish ground attack with their running ability. While other quarterbacks like Ian Book (2018-2020) possess the ability to run a little bit, the QB run was not a part of their repertoire. Michigan experienced a similar situation regarding the overall success of their passing attack relative to their rushing attack, with their most balanced years coming in 2016 and 2017 but being predominantly successful in the passing attack for the rest of the years examined. The fact that the most balanced years for these teams occurred in years prior to the 2020s helps show how college football has only expanded its focus on building offenses through the pass more in comparison to the run, even within the last few years. Perhaps the biggest example of teams’ passing attacks being prioritized more than their rushing attacks comes from the two teams that had losing records in real life (2016 Notre Dame and 2020 Michigan). In the matchups they had against their opposing defenses, their rushing attacks would be repeatedly outclassed, however the passing attacks would still maintain an acceptable level of productivity in a hypothetical matchup in 2016 and 2020.

A graph of different colored squares

Description automatically generated Perhaps the most evenly matched year would come in 2017, as it was the only year where there was not a clear advantage for either team when it came to either passing or running the ball. In the case of Notre Dame that year, whether the offense should prioritize the pass or run depended on the analysis done. When looking at field position analysis, Notre Dame’s passing attack came out slightly ahead, while the analysis by down showed preference towards the Irish ground attack. The difference in results would create an interesting situation if Notre Dame and Michigan had played in 2017, as you could have two different analysts disagreeing on whether the offense should be focused more on the run or pass depending on what analysis they used.

The most lopsided matchup occurred in 2016, as Michigan’s offense, regardless of analysis done or category, won in almost every matchup; to contrast, Notre Dame’s struggled to get consistent wins against the Michigan defense. This revelation was not surprising, as Notre Dame struggled mightily that season while Michigan almost won the Big Ten Conference as previously stated, but the level of dominance Michigan likely would have had in that matchup was larger than what I expected. The most surprising year in terms of dominance when record was accounted for was 2021, where despite Michigan and Notre Dame both going 11-1 in the regular season, Michigan’s offense showcased a universal advantage over Notre Dame’s defense in almost every category, while Notre Dame’s offense showcased a slight advantage on offense when it came to passing the ball and an overall disadvantage when it came to running the ball.

In terms of year-by-year predictions based on the analysis done, I believe that Michigan would have held an overall advantage, particularly in the last few years of analysis. I believe that Michigan would have had almost guaranteed wins in 2016, 2021, and 2022, while having an advantage in 2023. Notre Dame would have had one guaranteed win in 2020, and 2015 and 2017 would have been too close to determine based on the analysis I did. In terms of gameplans I think would have been wise to do for Notre Dame to beat Michigan in the years examined, a passing-reliant offense would have been preferred in 2016, 2020, 2021, 2022, and 2023, while a balanced/run focused offense would have been preferred for 2015 and 2017. For Michigan, I would recommend a passing-reliant offense in 2015, 2020, 2021, and 2023, while a balanced/run focused offense would have been preferred for 2016, 2017, and 2022. The fact that balanced and run-focused attacks are in the minority in terms of recommendations showcases not only the strength of each team’s passing offense during the years examined, but it serves a microcosm as to the shift in the sport to become far more pass-effective compared to previous decades where offenses homed in on the run. **Remaining visualizations will be in .Rmd and .Html file**.

**Conclusion**

Based on the findings of the data, Notre Dame and Michigan would have matched up competitively in most of the games they did not play each other since the annual series ended. Both programs would have likely relied on the passing attack more than the rushing attack based on the analysis done, which showcases the prowess of the Notre Dame and Michigan passing offenses during these years. However, despite the findings in my analysis, there is a lot more that can be done regarding the matchups of these teams. While special teams is by far the least commonly played phase of football, it can create high-impact moments that can wildly swing the outcome of a game, so a deeper level of analysis would have been incredibly useful and interesting to analyze. There are also aspects of college football that cannot be easily quantified, like homefield advantage and whoever the coach of the team is, that also play instrumental roles in the outcome of games; access to some sort of quantitative data would be extremely helpful in terms of analyzing these hypothetical matchups. While the data from the CFBFastR package is incredibly vast and useful, it does not consider everything that goes into the outcome of a college football game. Overall, based on the number of close matchups and the players/coaches that have come through both programs since the annual series ended in 2014, college football would be better off if the Notre Dame-Michigan rivalry never ended.

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networks." *Proceedings of the Midstates Conference for Undergraduate Research in Computer Science and Mathematics, Denison University, Granville, OH*. 2011.

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