

Bryant University

HONORS THESIS



Daily Fantasy Sports: Chance or Skill?

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Submitted in partial fulfillment of the requirements for graduation with honors in the Bryant University Honors Program

APRIL 2017

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ABSTRACT

Online daily fantasy sports is a billion dollar industry that has caused controversy for the last few years with states debating its legal status. As of today, under the current United States federal laws and regulations, betting money on daily fantasy sports online is considered legal. However, several states have decided to ban these games within their borders believing they are based on chance and should be considered gambling which they have ruled to be illegal online. Each state has the right to make their own rules of what they consider gambling even if the federal government has allowed it. The purpose of this study is to determine the predominant factor of daily fantasy sports. Looking at the daily fantasy football games, I was able to determine whether chance or skill was the dominant factor in these games. Using a simulation to gather chance teams and using experts' chosen teams as my skilled teams, I was able to compare the results to determine which teams won a majority of the time. Using these results, I am able to determine if daily fantasy sports should be considered a form of gambling and if the ruling by the Federal Government and individual states on daily fantasy sports should be changed.

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INTRODUCTION

This project was completed to determine if online daily fantasy sports were games of skill or chance to then determine whether they should be considered gambling and illegal to win cash prizes. Gambling is defined as “the activity or practice of playing at a game of chance for money or other stakes” (dictionary.com) or “the act or practice of risking the loss of something important by taking a chance or acting recklessly” (dictionary.com). This means that games that are based on skill are not considered gambling; which would mean they do not fall under state gambling laws. This is why the question of skill versus chance is so important. If online fantasy sports were to be considered games of chance and therefore gambling, they would not be allowed online.

“The Department of Justice (DOJ) has taken the position that all forms of Internet gambling are illegal” (Nelson). This comes from the Interstate Wire Act of 1961, also known as the Federal Wire Act, where it states it’s illegal to engage in the use of wire transfers involved in any sporting event or contest. The problem with this act is how do you define what a sporting event or contest consists of? Does this law cover other forms of gambling outside of sports betting? This law had a narrow focus strictly covering sport bets, which makes it difficult to enforce other forms of online gambling. In 2006, the United States passed the Unlawful Internet Gambling Enforcement Act which “makes it illegal for banks and financial institutions to process transactions with Internet gambling sites” (Nelson). This covers more than just sporting events as it covers all internet gambling sites. However, it does not ban online gambling just the financial transactions that go along with the sites. Interestingly, within this law it excludes fantasy sports. When Congress passed this law, they believed that online fantasy sports were games of skill and should not be considered gambling and therefore exempt from the binds of this law. With that being said, they made three conditions the game needs to consist of to be considered a fantasy sport. These include: knowing the prizes, which are not based on the amount of people involved, before the game begins; the prizes are based off the skill and knowledge of the participant; and the wins are not based off a point-spread or a single performance in a single event.

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The federal government has ruled that online daily fantasy sports are games of skill which makes them legally allowed to offer cash rewards in exchange for an entry fee. Even though the federal government has ruled that these games are not gambling, each state has the right to their own opinion. The Interstate Horseracing Act states that “Congress finds that the States should have the primary responsibility for determining what forms of gambling may legally take place within their borders” (house.gov). So even though the federal government has allowed these games, some states are still claiming they are forms of gambling based on the chance involved in the game. Each state has its own rules and definition of gambling. While twelve states have laws allowing these games some states have currently banned wagering money online.

Some states including Massachusetts and Rhode Island allow online fantasy sports for money. Rhode Island’s governor agrees with the federal government that online fantasy sports are games predominantly based off skill which do not make them gambling. Massachusetts however, does believe online fantasy sports are gambling but instead of banning them for the state, Massachusetts put regulations in place for these games. On the other hand, Delaware and Alabama have banned playing for money through online fantasy sports within their borders. The Delaware’s DOJ stated that “an online fantasy sports contestant selects fantasy players and teams, but has no role in how these players actually perform once the real-life games or events occur. This is why chance – and not skill – is the dominant factor in online fantasy sports contests and why these contests are illegal in Delaware” (Reyes). Alabama’s Attorney General also agrees and has banned online daily fantasy sports in their state. He stated “the daily fantasy sports operations violate state law because a player stakes something of value on a contest of chance in order to win a prize. While there is a measure of skill involved in creating a fantasy sports roster, in the end contestants have no control over the performance of the players on their rosters. This activity is illegal under Alabama law” (Grass).

As you can see, each state has their own gambling laws and opinions on daily fantasy sports. However, most arguments come back to the question of daily fantasy sports’ dominant factor

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of skill or chance. Being able to determine what the dominant factor of online fantasy sports is will allow lawmakers to easily determine whether these games should be considered gambling and thus illegal online under their laws.

LITERATURE REVIEW

Introduction

Online fantasy sports companies such as FanDuel and DraftKings have been in the news for the past few years fighting to stay legal. The United States law declares playing online fantasy sports for money to be legal but each state has the right to determine which games are legal in their borders according to the Interstate Horseracing Act. Many states have already banned, or are considering banning, online fantasy sports. Most recently, the Delaware Department of Justice gave notice on July 7, 2016, that online fantasy sports will not be allowed in their state. The debate for the legal status of online fantasy sports is ongoing but all arguments are based on opinions and no argument has data to back up their beliefs. The argument to determine if online fantasy sports should be allowed is whether the game is based more on chance or skill. If the game is based on skill it is not considered gambling and is allowed online. My project gives data to help determine if fantasy sports should be legal online by determining its dominant factor.

The United States Congress passed the Unlawful Internet Gambling Enforcement Act of 2006 which prohibits institutions from accepting transactions that included a bet or wager. The United States Congress defines a bet or wager as “risking by any person of something of value upon the outcome of a contest of others, a sporting event, of a game predominantly subject to chance” (Congress.gov). Through this act, Congress excluded fantasy sports from being banned online based on their skill level needed to play. However, there are three conditions that need to be met to be considered a ‘fantasy sport.’ First, the participants need to know the prizes before the game starts and these prizes cannot be based on the number of players involved. Second, all the winnings are based off the knowledge and skill of the player. Lastly, none of the wins are based on a point-spread or on one single performance in a single

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event. Since you need to make your team by picking individual players in fantasy sports and you are not just picking one team, fantasy sports have an aspect of skill that the government does not consider gambling and so they are not banned online. However, there have been no studies done on online fantasy sports to determine what the actual predominant factor of these games are. This project studied which factor, skill or chance, is more predominant in these games. This study is needed to determine, if based on the current online gambling law, whether fantasy sports should be legal or illegal online.

For my project, I used simulations and comparisons to determine the predominant factor. Simulations were used to create my chance teams and sports analysts' lineups were used as my skilled teams. From there, I compared the teams to see which of them won most often to help determine if fantasy sports are based on skill or chance. I also studied the laws and regulations surrounding online fantasy sports. Once I examined the results from my project, I was able to compare them to the laws to determine if online fantasy sports should be legal or illegal.

My math background and personal experience in playing fantasy sports helped me throughout this project. My sources include information on the laws and regulations, information on fantasy sports and old fantasy sports data.

Background/History

Fantasy sports began back in the 1960's when Wilfred 'Bill' Winkenbach created the first reported fantasy football league called the Great Oakland Professional Pigskin Prognosticators League (GOPPPL) consisting of eight teams. From here, the game slowly began to expand. The rise of the internet made keeping statistics easier, getting information on players more available and joining the game more convenient. By 2014, daily fantasy sports began to take spotlight. The two major competing services are DraftKings and FanDuel. Since the formation of these two sites, their legal status has been debated. Both companies broke onto the scene and within years became million dollar companies. The federal government

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has ruled these games legal online on the basis of The Unlawful Internet Gambling Enforcement Act of 2006. This act has a statement in which it claims fantasy sports are games of skill and not chance and therefore are not gambling. Since you need to use superior knowledge to draft your own teams and the prizes are not determined by the number of players or the amount paid, then it can be legal online. In 2007, this industry won a court battle in the New Jersey District Court, where the court agreed that fantasy sports were games of skill because of the sport knowledge needed to actively manage your team and make strategic decisions. Despite the success in the federal government's agreement that fantasy sports should be legal online, these sites have had many setbacks when it comes to the individual states. Each state has the right to decide which games they considered gambling even if the federal government has approved them. Many states have declared online fantasy sports illegal within their borders; the most recent being Delaware on July 7th, 2016. The debate on their legal status continues and more states may decide to ban these sites.

It's important to understand what fantasy sports are to fully understand the debate taking place in many states. Fantasy sports are simulation games where you and other participants get to act as owners to draft and manage your own sports team. These teams compete against each other throughout the season. Each player on your team gets points based on statistics the player actually achieved in the real life game. The participant with the most combined points after the week has finished is the winner of that game.

The debate surrounding these games is whether they should be considered gambling and should be illegal to play with money online. How games are considered gambling is based on their predominant factor, whether it is chance or skill. If the main factor of the game is chance then the game is legally considered gambling. However, if the main factor of the game is skill then the game is not considered gambling and can be played for money online.

The key laws surrounding this debate is the Unlawful Internet Gambling Enforcement Act of 2006 and the Interstate Horseracing Act both passed by Congress. These two acts are the premise for this current debate. The Unlawful Internet Gambling Enforcement Act of 2006

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does not allow transactions from online gambling. Despite what most people believe, this act does not make online gambling illegal but prohibits the financial process that supports online gambling. However, the act excludes fantasy sports from this ruling. In the law it states that this law does not include participation in any fantasy or simulation sports game as long as the game meets the following conditions: all prizes and awards are made known in advance and their value is not based off the number of participants or the amount of any fees paid; all winnings reflect the skill and knowledge of the player and are determined predominantly by the total statistical results from the performance of an athlete in a real-world sporting event and not based on any single team or one single athlete.

Despite the United States government allowing online fantasy sports, states still have the right to declare these games gambling and make them illegal within their state. This is allowed because of the Interstate Horseracing Act. This act “finds that the States should have the primary responsibility for determining what forms of gambling may take place within their borders” (house.gov). This act is the reason that online fantasy sports are allowed to be banned in some states but legal in others. Without this act, online fantasy sports would be legal in all fifty states.

The regulation on internet gambling has shifted throughout the years. When internet gambling began to rise, the Department of Justice relied on the Interstate Wire Act of 1961 to regulate the newest form of gambling because it did not have any other regulation in place. This act declares any persons involved in betting or wagering on any sporting event or contest will be fined and/or imprisoned. There was an issue with this act. What exactly did the Department of Justice considered a ‘sporting event or contest’? Originally, the debate was about online poker and now has shifted to online fantasy sports. Are these games considered a sporting event or contest and fall under this act? Eventually, the Department of Justice needed a new strategy for regulating online gambling and shifted regulation as they passed the Unlawful Internet Gambling Enforcement Act of 2006. This is the act currently in place to regulate online gambling such as online fantasy sports.

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The major splits in this field is those who believe fantasy sports are based on skill and believe it should be legal online and those who believe that fantasy sports are based on chance and should be illegal online. As I have stated before, even though the federal government has claimed fantasy sports legal, the states have the right to choose for themselves. The states are split among the legal status of online fantasy sports. Twelve states are currently allowing betting on online fantasy sports, including Massachusetts and Rhode Island. In November 2015, the Massachusetts Attorney General acknowledge that fantasy sports are gambling but instead of banning them, put regulations in place including the participant has to be over 21 years old, sites have to offer beginner only games, and no fantasy sports can be based off high school or college sports. On the other hand, Rhode Island is allowing fantasy sports because in 2016, their governor stated that the dominant factor was skill and fantasy sports should not be considered games of chance. As you can see, even within the states that allow fantasy sports the dominant factor of the game is still not agreed upon.

However, fantasy sports are still banned in many states with decisions as recent as Alabama in April 2016, Idaho in May 2016, and Delaware in July 2016. These states believe that online fantasy sports are considered gambling which makes them illegal under their state laws. Arizona, Iowa, Louisiana, Montana, and Washington have all historically banned fantasy sports. Even with many states firmly on one side of the debate, there still are many states with a legislation proposed. These states are debating the legal status of online fantasy sports. For example, Connecticut is deciding if they want to ban fantasy sports or put regulations in place like Massachusetts. Other states, like California and Michigan, are trying to determine if this game is considered gambling because in their law gambling requires a 'bet or wager.' It is unclear to them whether online fantasy sports has this component. Finally, in states like Maine and New Hampshire there seems to be no legislative bill pending for online fantasy sports.

Many states have taken FanDuel and DraftKings to court over the years because they believe they are illegally operating within their states given their gambling laws. The only negotiation

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being made by some states is allowing these sites to operate in their state as long as they do not offer cash prizes.

Online fantasy sport companies and participants as well as state courts are debating on the legal status of online fantasy sports. Some are even comparing this debate to the debate a few years ago on the legal status of online poker. Since online fantasy sports have seemed to have taken the spot light in the last few years the debate has changed from poker to fantasy sports. Even though the games are very different, the debate is the same. Should making money on these games be legal or illegal online? To determine their legal status, you first have to determine if the games are based on skill or chance. The reason for this debate is because the Unlawful Internet Gambling Enforcement Act of 2006 states it does not allow transactions from online gambling which are games predominantly based on chance. If the games are based on skill, they do not fall under this act and will not be regulated as such.

Throughout the literature, you can find an abundance of debates and studies on whether poker should be considered gambling and what the predominant factor of this game is. There are many studies and simulations run to back up these debates. However, even though the debate for online fantasy sports is the same as online poker, there are no studies or simulations run on online fantasy sports. Online fantasy sports has the same debate but no one has come up with a study to show data on the main factor involved. The literature surrounding this game is just the debates and unlike poker it does not have the data to support either side. The online fantasy sports companies and participants believe the games are based on skill and want them to stay legal because they are making money off these games. On the other hand, many states believe online fantasy sports are games of chance, not skill, which means they are considered gambling. If these games are considered gambling, then they fall under the states online gambling laws and are prohibited within certain states.

The Unlawful Internet Gambling Enforcement Act focuses on games of chance. That is why the debate for the dominant factor in online fantasy sports is important. If the games are more chance than skill they will fall under the regulation of this act or the laws that many states'

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governments have enacted. As stated earlier, many states are banning online fantasy sports within their borders. Some of these states believe that online fantasy sports consist of a predominant factor of chance which makes these games gambling. Since these games are considered gambling they are illegal based on the online gambling laws the states' government has in place.

The online fantasy sports companies refute the claims that their games are games of chance. They believe their games are ones of skill and should be considered legal online. The knowledge of the sport, teams, and players, as well as the skill to pick the best players and manage the team, effects the outcome of the games. Since the participants have to draft their own team, player by player, and not bet strictly on one real life team, then the games are more than chance. These websites believe their games are games of skill and should not fall under the category of gambling and should be legal online in all states.

Another way states are deciding if online fantasy sports should be considered gambling, besides focusing on the predominant factor of the games, is to focus on the money being put into the site. Some states determine if a game is considered gambling if it consists of bets and wagers. However, does online fantasy sports have bets and wagers? That is the question many states are struggling with. California, for example, has a legislation proposed but it is not passed yet because it is unclear if fantasy sports falls under their gambling definitions requiring bets and wagers. On the other hand, some states have clearly made up their mind. Texas declared that fantasy sports are not allowed in their state. Their Attorney General wrote that since online fantasy sports are partially based on chance then "an individual's payment of a fee to participate in such activities is a bet" (ESPN). Oklahoma has also clarified that any cash-based contest will be qualified as a bet under their state law. These states believe that the money put into these fantasy sports sites should be considered a bet.

The CEO of the sports gambling company William Hill US, agrees with these states that there are bets and wagers involved in these online fantasy sports websites. He states, "Of course it's

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gambling. Of course it's sports betting. ... You're risking money on something of an uncertain outcome, and to me that sounds like gambling" (Schrotenboer).

FanDuel, the leading online fantasy sport website, disagrees with this opinion. While many people claim that fantasy sports are considered sports betting, FanDuel does not agree with that. FanDuel believes they should be considered an entertainment product. Even though you have to pay to participate on their website they claim there are no bets or wagers within their product so they should not fall under gambling. FanDuel stated: "In exchange for an entry fee, FanDuel allows sports fans the chance to win cash prizes every day based on the performance of players in professional or college sports" (Schrotenboer). FanDuel claims the money involved in their site is not betting which means they should not be considered gambling.

Depending on how many interpret the entry fee involved in online fantasy sports can change how they look at online fantasy sports. Seeing the fee as a fee for entertainment like the cost of tickets to a football game, may cause one to shift their beliefs to believe that online fantasy sports does not include bets and wagers and should not be considered gambling. If a person sees the entry fee as a bet they make that their team will win, may cause them to shift to the side that believes online fantasy sports should be considered gambling. Most of this debate depends on how you interpret the definitions in the laws surrounding these games.

Results/Methods

After reading through the literature on online fantasy sports, the studies are all qualitative because they are all debates and people's opinions. There are no studies to determine if online fantasy sports are games of skill or chance. That is why my project is important. With so much debate on the topic and no actual study to give numbers and data to back up either side, my project can be useful in the debate.

Despite there being no quantitative studies on online fantasy sports, I was able to find multiple studies on online poker that are similar to the study I was able to create in my

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project. The readings for online poker were both qualitative studies with debates with people's opinions and quantitative with simulations run to determine the dominant factor in the game. One study ran through over 456 million poker hands to determine if poker was a game of skill or chance (van Loon, van den Assem, van Dolder). This is the same debate that is currently happening with online fantasy sports.

I believe the most effective method is the quantitative method that has data to back up their side. Coming from my math background, having data and numbers behind your opinion increases your argument. Talking about whether online fantasy sports are games of chance will not affect anything until there is proof of the dominant factor. That proof can be shown through simulation and a quantitative method. The arguments have not been very strong coming from the qualitative studies for online fantasy sports. When you look at the studies done on online poker the studies that are most talked about and used most as examples are the quantitative ones with studies of hands to have data to back up their chosen factor.

Online fantasy sports have no studies with data to determine if they are games of skill or chance. The studies on this topic have all been debates and with these debates the online fantasy sports companies still have had many successes. The United States federal court believes that online fantasy sports are games of skill and should not be regulated like other online gambling games. This has helped them in court cases including the one I talked about earlier in New Jersey in 2007 where the District Court ruled that online fantasy sports are games of skill and not chance.

Looking at online poker, it has had a few successes in the past including two statistical studies that found poker to be more skill than chance. The simulation study that ran over 456 million poker hands found that "skill dominates chance when performance is measured over 1500 or more hands of play" (van Loon, van den Assem, van Dolder). The simulation study is alike to the online fantasy sports study I ran. I used simulation to determine what the major factor in fantasy sports is and the study had a similar outcome as the poker study. This may cause

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states that had previously banned online fantasy sports to change their mind now that this study shows they are games of skill and not chance.

Despite the success that online fantasy sports had with the federal government ruling on their side, they still had a lot of limitations when it comes to states. Many states have ruled differently than the federal government and claimed fantasy sports are games of chance and should be considered gambling and thus illegal online in their state. Since there is no data to back up their side the online fantasy sports companies have nothing to show the states to try and prove that they are games of skill. While online poker has studies with numbers and data, online fantasy sports just has their word. This is not working out for them too well as many states have banned them and some have even sued them. Neither FanDuel nor DraftKings are yet to be profitable. Due to the marketing budget and the legal fees the companies have not made money. These companies are spending millions of dollars in legal fees to stay legal and in most states they are losing the battle because their word is not good enough. "DraftKings' attorney's fees once ran as high as \$1 million per week [and] FanDuel's auditors have raised 'significant doubts' about the company's future if more states do not declare daily fantasy sports legal" (Van Natta). If these companies do not find a way to prove that they should be legal, they may not exist for much longer.

Another limitation is the concern that if a study was to be made on fantasy sports that it would show they were games of chance like some of the poker studies. This would hurt the companies even more than they are already hurting. On the other hand, another concern is if the study did show that online fantasy sports were games of skill like the simulation study for poker, that just like poker, it would not have much effect on their legal status. For online poker, despite the studies that have shown that poker is a game of skill and thus not gambling, online poker is still illegal. One lawyer stated that these "studies still may not persuade juries, as this is a 'moral, political and social issue', as well as a mathematical one" (Biever). This may also be the case for online fantasy sports.

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Since there are no studies on online fantasy sports, there are no results to replicate since my project results are the first in its field. Instead, I looked at the online poker studies because I compared my project to those studies to help me along the way. Each study I found on online poker was different than the last, but they still were all trying to answer the same question. Is online poker a game of skill or chance? The results were accurate but depending on the study the results were different. First you have to take into account that each person's definition of predominant is different. Two people could get the exact same results but interpret them different depending on how they classified how much was a dominant factor. In two statistical studies, the researchers found that the game of poker was more skill than chance. On the other hand, in a quasi-experimental study, the researcher found that poker should be considered a game of chance (Meyer). I believe each of these results were accurate. It just depends on what type of study you run and how you interpret the results of that study.

Conclusion

The literature has helped inform my ideas because I was able to find other people's opinions on the topic. Reading other people's opinions from people who work at FanDuel, to lawyers to Attorney Generals has helped broaden my ideas and see all sides of the debate.

Throughout my research, I found no studies to determine what the major factor in online fantasy sports is; whether it is skill or chance. There are many debates on the legal status of these games but none of the debates have data to back up their ideas. Each side has stated their opinion, but neither side has any real evidence to support themselves. That is why I used a simulation as my methodology. I created a study that had data to back up my results. Having the numbers to show, I was able to determine whether chance or skill is the dominant factor in these games and determine what its legal status should be.

While there are no studies on online fantasy sports, I found an abundance of studies on whether online poker is more skill or chance. These online poker studies are trying to solve the same question that online fantasy sports has: Are these games based on skill or chance? Some of these online poker studies are using simulation to get their results. The creators of the

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studies then use these results to decide on the dominant factor and determine if this game should be legal online based on their results. I created a similar study on online fantasy sports. I was able to learn from these studies to help improve my own project. I compared my study to theirs and learned from their mistakes so I did not make the same ones in my project. I also looked to these studies if I had trouble and compared what they did. Once I got my results, I compared with their results to make sure I was interpreting my findings correctly. Since the online poker studies are trying to answer the same question I was but with a different game, they were extremely useful in my project. Having studies to compare to helped me improve my study and was a good comparison to know I am doing everything correctly. I used these studies throughout my entire project.

The most significant discovery I made while compiling the literature is how current this topic of the legal status of fantasy sports is. As I was doing my research, Delaware banned fantasy sports within their borders. Also, I did not realize how many states had pending laws to ban online fantasy sports. I discovered, if states continue to ban these sites that even before they are banned everywhere they may not be able to afford all the legal fees they have inquired and may go out of business. After all my research, I discovered how important the question of chance or skill really is to these companies.

METHODOLOGY

Introduction

The methods of study for this project consisted of a review of the current laws and regulations surrounding online daily fantasy sports, fantasy sports experts' football lineups and a simulation to create randomly chosen chance teams. The purpose behind this capstone was to determine if online daily fantasy sports should be considered a game of predominantly chance or skill. Working off these results, the project then determined if these games should be considered gambling and thus illegal to make money off of online based on the current federal and state gambling laws. The null hypothesis for this capstone was that online daily fantasy sports were games predominantly determined by chance and should be considered gambling

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and thus illegal online. To disprove this hypothesis, a simulation was created to randomly choose teams for each week in 2016 based off a \$50,000 budget and the DraftKings lineup. These lineups were then compared to the weekly lineups of expert's choices to see who won most often in a head to head contest. These results determined if daily fantasy sports should be considered a game predominantly based on skill or chance.

Fantasy Sports

Fantasy sports is an online game where participants can select a sport and act as the manager of their team. The participant selects real life players through a draft to fill their lineups to compete head to head with other participants in the league. Within this draft, once a player is selected no other participant can select this player. Throughout the game, participants can drop these players to pick up new ones or trade players with other participants. The real life athletes play their respected sport and each of their statistics are worth points in the game. These points are then added up to a total score for the participant. The traditional fantasy sports are how these games began and consist of a season long competition with a single winner at the end. This means the participants had a season long commitment and had to wait till the end of the entire season, which usually consisted of playoffs, to know the outcome of the game. Fantasy sports have evolved to now include a daily fantasy sports option.

Daily fantasy sports are similar to traditional fantasy sports in the set up. The participant will still pick their real life athletes to fill their line ups. However, daily fantasy sports does not have a draft to choose players. Participants are allowed to have the same athletes on their team as another participant in the game. Instead of the draft, participants choose players that stay under their budget or cap. There is no trading players and each week you can choose a completely new line up. Also, as the name implies, these competitions compete daily (or in the case of football, weekly). This means that everyday there is a winner and participants can win money more often and a lot faster than traditional fantasy sports.

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DraftKings

DraftKings is one of the two most popular online daily fantasy sports websites where people can wager money online in hopes that their chosen team scores the most points. DraftKings offers a variety of different sports and this project was focused on football. Each participant has a \$50,000 budget or cap, in which to buy players to fill their lineup. Each real life player is worth a certain amount based on their performance and playing time. For a football lineup on the DraftKings site, a participant has to buy one quarterback, two running backs, three wide receivers, one tight end, one defense and one flex player that can consist of a running back, wide receiver, or a tight end, while staying under the cap. The real life athletes compete in their game each week and their performance will dictate their fantasy score. For example, each touchdown your quarterback throws or runs in will give you points while every interception they throw will lose you points. Each players' stats are correlated to a given point value on the site and then added up to give each participant a final score. These final scores are compared with the rest of the participants and the highest score is the winner. DraftKings offers free games as well as cash games. Were you to pay money to enter the competition you could take home a cash prize if you were to win.

Expert Picks

To determine if fantasy sports was a game of chance or skill, skilled teams were compared with chance teams to determine which factor won most often. For the skilled teams, expert analysts were chosen that used the DraftKings lineup and salaries for each player. Using their picks from each week, their final scores were able to be calculated by totaling each player's points from that week. For this project, six experts were chosen to represent the skilled teams. These six experts were: the NESN staff, Heath Cummings, Michael Beller, Adam Sutton, Thomas Emerick and a combination of Tim Keeney and Jonathan Adams.

The New England Sports Network (NESN) is a major source of sporting news for the New England region launched in 1984. It is consistently rated as a top regional sports network in

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the country and known for its New England Sports knowledge. Heath Cummings is a Senior Fantasy Writer for *CBS Sports* covering all types of Daily Fantasy Sports. He is the lead analyst on *Daily Fantasy Live* and has also worked as a staff writer for *Footballguys* and hosted *The Fantasy Football Show* on ESPN 1510 in Kansas City. *CBS Sports* provides sports fans with “in-depth analysis, breaking news, and scores and statistics across high school, college, and pro sports” (cbssports). Michael Beller is a writer for *Sports Illustrated*. The first issue of *Sports Illustrated* was published in 1954 and has continued to provide sporting news to millions of sports fans. This name is well known around sports and has a strong reputation of providing breaking news and sports analysis. Adam Sutton is a correspondent at *FantasyPros*. This site “aggregate and rate expert advice from around the web to make it easy for you to make the best decisions. [Their] innovative tools provide the easiest way to get the latest and most accurate fantasy advice” (fantasypros). Thomas Emerick is a fantasy football and NFL contributor at *SportingNews*. His work has also been published through *USA today*, *Bleacher Report*, *Pro Football Focus* and *The Sports Daily*. *SportingNews* is a website for sports fans to find information on fantasy sports. Tim Keeney and Jonathan Adams are both sports contributors for *Heavy*, specializing in daily fantasy sports. *Heavy* is a New York based digital media company established in 1999. They provide coverage on sporting events including details and advice about fantasy sports.

Simulation

The simulation was created to represent the chance factor. Using VBA code in Excel, a program was written to run the simulation. The salary and rank of each player was entered into the excel file along with the points each player scored that week. The simulation would randomly select a player in each position from the top fifteen ranked players. Top players were ranked by highest salary in each position. For the next wide receiver and running back needed, the simulation would choose a player ranked sixteenth through thirtieth. To choose the last running back and wide receiver, the simulation would choose a player ranked thirty-first through forty-fifth. In the simulation, the flex player was always chosen as a running back. The simulation would use a v-lookup to determine each players’ salaries. These salaries

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were added and if the total was over the \$50,000 cap it would know to discard that lineup. If the lineup was under the \$50,000 cap the simulation would replace the lowest ranked wide receiver with the best ranked wide receiver it could get while still staying under the \$50,000 cap. Once the lineups were set, another v-lookup was used to gather each player's points to get the total points for that chance team. This program could be run multiple times and would compare these lineups to the skilled lineups to see the percentages of times the chance team would beat each expert. To change the week, the new player's salaries, rank, and scores as well as the expert's picks from that week were entered. The code was able to stay the same and the simulation was run for the next week.

Analysis

Multiple statistical tests were run on the results of the simulations and the experts' chosen lineups. The standard deviation and the mean were used to compare the results of the experts and the simulations. A one-sided binomial test was run on each individual expert and then the total of the six experts compared against the simulation. Also, a statistical t-test, assuming unequal variance, was run as well as an ANOVA test on the experts and the experts and simulation average. The results of these statistical tests, discussed later in this paper, led to rejecting the null hypothesis and stating that online fantasy sports are games of predominantly skill.

Conclusion

This project's main goal was to determine if online daily fantasy sports were games of predominantly skill or chance and determine if they should be legal to make money online. Using simulations based on DraftKings requirements to generate chance teams and six experts' chosen lineups as the skill teams, statistical tests were able to be performed on the results to determine which side won most often. Then using these results, this project can decide if online daily fantasy sports should be legal to win money online based on the federal governments and the states' laws for online gambling.

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FINDINGS

Simulations

Weekly simulations were run to create simple sets of NFL players that match the criteria defined by DraftKings. A Visual Basic program was created to run 10,000 attempts at gathering a “luck-based” set of players for each given week. Between 1,500 and 4000 of the simulations were successful at spending under the cap of \$50,000 on top players. Top players were defined as those with the highest salary at each position.

Statistical Tests

After the results from the simulations and the experts for all 17 weeks were recorded, as seen in appendix A, statistical tests were run to determine the results of this project. The standard deviation of the mean points in each weekly simulation is within 1.0 points. For example, in the first three weeks the simulation resulted in the following statistics:

	Avg.		
	Points	SD(points)	SD(mean)
Week 1	116.79	20.47	0.51
Week 2	106.59	20.48	0.51
Week 3	112.53	24.67	0.62

Therefore the chance group, represented by the simulation, has a mean that is stable for any given week. This means there is not much question as to whether the expert or the simulation was better each week – the expert points were rarely very close to the simulation average points. Note that the standard deviation of the points between weeks was much higher (6.1) and so there is certainly a difference in the points for both the experts and the simulation from week to week.

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The simulations for each week had results that were roughly normally distributed. Appendix B shows the graphs for the first three weeks as well as where each expert's score falls in relation to the distribution of the simulation that week. The graphs for week 1 and 2 show that all experts' scores were above the average and in those weeks no expert lost to the simulation a majority of the time. In week 3, Adam and Heath's scores were to the left of the mean in the graph and these were the only two experts to lose to the simulation in week 3 over 50% of the time. This pattern is similar to the rest of the weeks where experts scoring under the simulation average lost over 50% of the time.

Based on the 17 weeks of simulations, the experts were able to beat the simulation 78% of the time. Due to the fact that the simulator has a low standard deviation, the overall result will easily reject the null hypothesis that the simulator is just as effective as a fantasy football expert using a binomial distribution test. The p-value of the one-sided binomial test is well below 1% as seen in appendix C. Each expert easily beat the simulation overall in 2016. The worst expert, Tim, was still significantly better than the simulator. A statistical t-test was performed assuming unequal variance, resulting in a p-value of 0.0005, thus rejecting the null hypothesis that the simulator could perform as well as Tim as seen in appendix D.

Next, an ANOVA test on the experts and simulation average was run as seen in Appendix E. The null hypothesis for this test was no difference between any of the rows or columns. The rows were the weeks with weeks 7 and 17 omitted because of the missing values and 14 degrees of freedom. The columns consist of the 6 experts and the simulation average with degrees of freedom of 6. This test resulted in a non-significant p-value for the rows and a significant p-values for the columns. This means there is no difference between the weeks but there was a difference between at least two of the columns. To determine if this difference was between the experts or between the simulation and the experts another ANOVA test was run.

The second ANOVA test ran only included the experts and not the simulation average but had the same null hypothesis of no difference. The rows were the same with 14 degrees of

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freedom. The columns only included the experts so the degrees of freedom was now 5. The results from this test was still a non-significant p-value for the rows. The p-value was closer to being significant but still showed no difference between the weeks. However, the p-value for the columns was no longer significant, which means that there is no difference between the experts. This shows that the difference between the columns in the last ANOVA test was the simulation versus the experts. This means that the simulation and the experts are not equal and the results of this test is seen in Appendix F.

Also, the simulation calculated the percentages of times it beat each expert for that given week. Appendix F summarizes results based on the percentage of times the simulation outperformed the experts. This happened on a number of occasions, which are highlighted in blue. But no expert was beaten more than 4 weeks, and the point differential was not great in these cases.

It is also interesting to note that the 2015 season performance by the experts was very consistent with the 2016 season in overall point average although the experts scores varied with each other.

Finally, the simulation could be modified in some cases as to improve performance without changing the inherent “luck-based” strategy of the program. For example, in week 3, if the program took random players from the top 12 instead of the top 15, then the simulator could gain almost a 10 point improvement in the simulation. However, there is no consistent way to attempt to improve weeks in general. In most cases, trying to get better players resulted in too many simulations over the \$50,000 cap.

Conclusion

In the end, the statistical tests run on the results show that online daily fantasy sports are games predominantly based off skill. The federal government’s ruling that online fantasy sports are legal online is correct based off their online gambling laws. For states like

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Delaware, Alabama and Rhode Island, these games would not fall under their online gambling laws because these games are not games predominantly based off chance and thus not considered gambling. That would make these games legal to play online with money. However, for the state laws that claim any amount of chance in a game will make the game illegal online will still declare these games illegal since it is clear there is some chance involved even though it is not the predominant factor. Also, for the states that determine whether games are gambling based on bets and wagers will not be affected by this project.

Even though this project shows that online daily fantasy sports are games predominantly based off skill, it may not have any influence on changing states' rulings if online poker is any indication. Online poker has been controversial for years with the same debate online fantasy sports is now having: are these games skill or chance and should they be legal online. Many studies have been done on online poker similar to this project but they have not had much luck in convincing the states to rule in their favor. In one study, "Sean McCulloch, a computer scientist at Ohio Wesleyan University in Delaware, says the results may fail to sway a judge or jury. 'If you want to use a mathematical argument as the basis for legislation or court decisions, it has to be easy to explain, easy to follow and intuitive'" (Biever). Even if the results are easy to understand it is not the only obstacle these games have to overcome. "Preston Oade of law firm Holme Roberts and Owen in Denver, Colorado, who worked on a separate poker case in Colorado, cautions that the studies still may not persuade juries, as this is a 'moral, political and social issue', as well as a mathematical one" (Biever). With that being said, some judges have ruled in favor of poker being a skill based game. Just like poker, online daily fantasy sports may be stuck in this argument for years and may never get a unanimous answer.

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APPENDICES

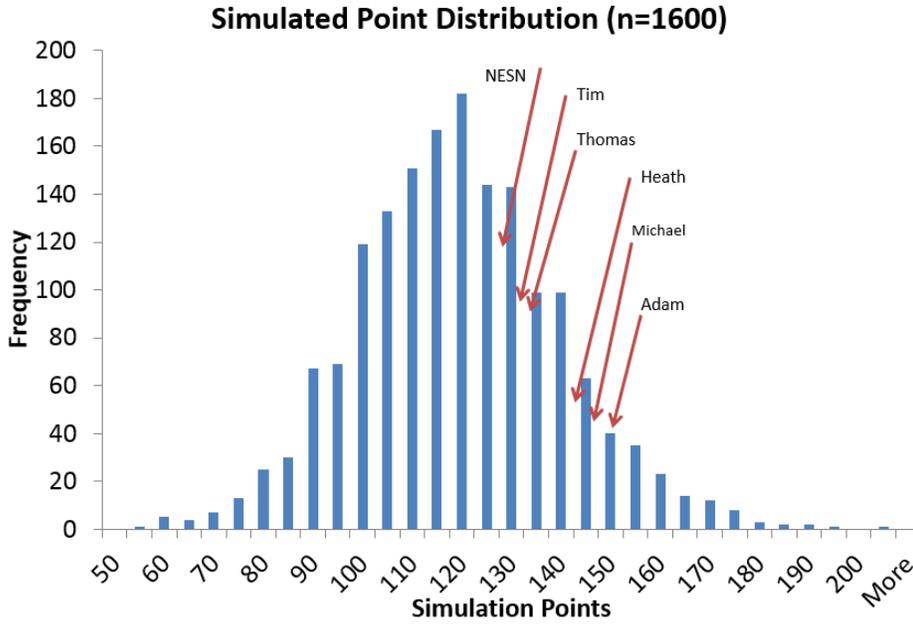
Appendix A: 2016 NFL fantasy points – experts versus simulation

	NESN	Heath	Michael	Adam	Thomas	Tim	Sim Avg.
Week 1	153.66	113.2	130.1	145.9	124.84	138.56	117.97
Week 2	162.96	182.02	134.92	143.54	113.9	123.42	106.7
Week 3	143.86	107.06	148.46	84.16	118.76	150.3	112.4
Week 4	141.82	130.84	110.14	151.8	125.68	117.02	108.3
Week 5	133.58	142.2	144.18	115.72	120.16	96.96	109.8
Week 6	102.98	119.6	132.4	178.84	76	118.76	100.1
Week 7	74.14	166.12	161.72	131.84	199.54	0	105.8
Week 8	91.8	97.52	95.9	126.04	121.4	107.3	109.7
Week 9	138.38	133.18	146.58	166.9	104.46	135.24	104
Week 10	127.94	145.3	147.2	169	118.14	108.84	112.3
Week 11	122.24	126.5	113.38	113.18	162.48	121.8	101.3
Week 12	108.24	109.74	105.6	97.56	104.14	127.8	105.5
Week 13	130.16	145.06	149.04	153.44	137.44	135.38	98.3
Week 14	111.46	141.42	175.96	111.46	126.8	152.14	92.5
Week 15	125.72	131.46	136.72	124.82	142.52	108.78	99.1
Week 16	88.32	114.46	136.78	154.1	137.36	138.32	107.1
Week 17	147.6	0	161.48	145.58	98.98	94.48	103.6

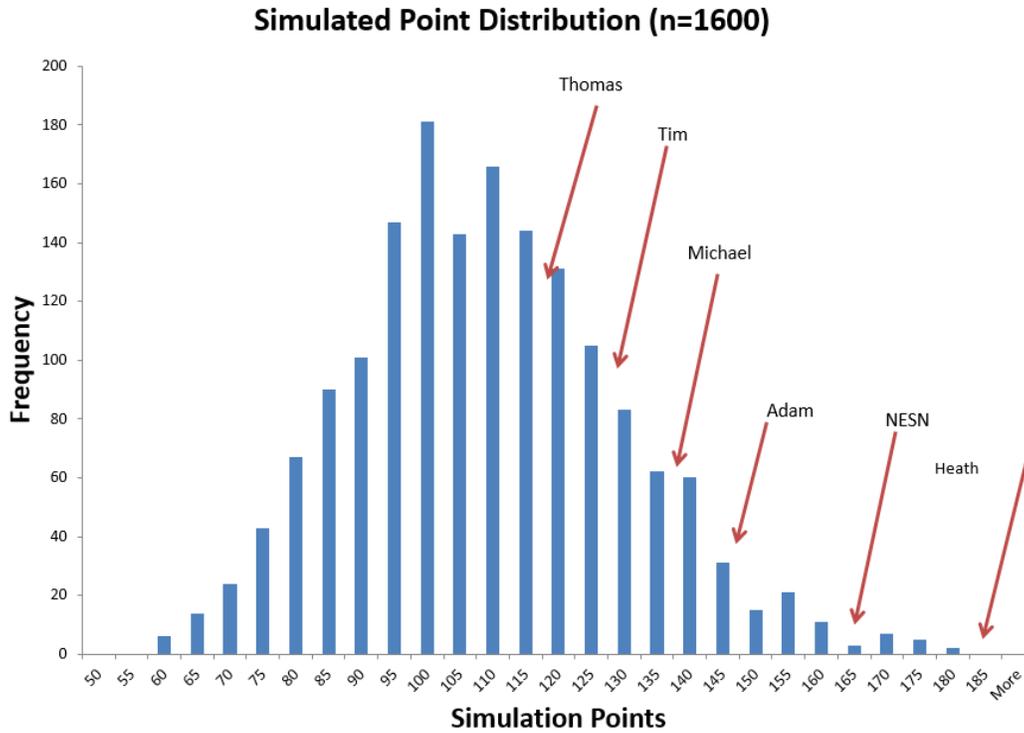
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Appendix B: Simulation distributions for weeks 1, 2, and 3

Week 1:

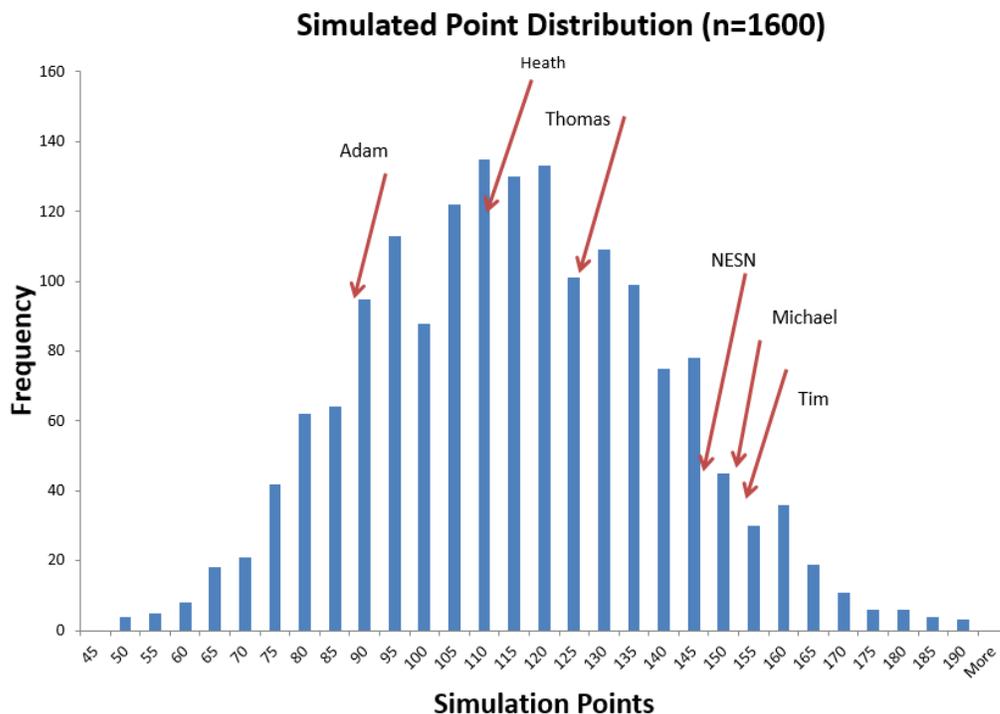


Week 2:



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Week 3:



Appendix C: Binomial distribution test on each expert

	NESN	Heath	Michael	Adam	Thomas	Tim	Total
# Weeks (n)	17	16	17	17	17	16	100
Expert Wins	14	14	16	15	14	12	85
Binomial p-value	0.006363	0.00209	0.000137	0.001175	0.006363	0.038406	2.41271E-13

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Appendix D: Two-sample t-test assuming unequal variance on Tim versus simulation

	<i>Tim</i>	<i>Sim Avg.</i>
Mean	123.4438	105.541875
Variance	306.0165	40.78352292
Observations	16	16
Hypothesized Mean Difference	0	
df	19	
t Stat	3.8452	
P(T<=t) one-tail	0.000546	
t Critical one-tail	1.729133	
P(T<=t) two-tail	0.001091	
t Critical two-tail	2.093024	

Appendix E: Two factor ANOVA test without replication on Experts and Simulation

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>
Rows	7920.48	14	565.7486	1.521673	0.121053
Columns	8889.637	6	1481.606	3.98502	0.001474
Error	31230.68	84	371.7939		
Total	48040.8	104			

Appendix F: Two factor ANOVA test without replication on only Experts

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>
Rows	9433.968	14	673.8549	1.62043	0.095009
Columns	2083.081	5	416.6163	1.001844	0.423205
Error	29109.47	70	415.8495		
Total	40626.52	89			

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Appendix G: Percentage of times the simulation outperformed the experts

	NESN	Heath	Michael	Adam	Thomas	Tim
Week 1	28%	11%	9%	6%	17%	20%
Week 2	1%	0%	10%	5%	35%	21%
Week 3	11%	57%	8%	87%	39%	7%
Week 4	6%	13%	43%	2%	18%	31%
Week 5	14%	8%	7%	39%	32%	71%
Week 6	42%	20%	9%	0%	85%	21%
Week 7	91%	1%	1%	14%	0%	N/A
Week 8	79%	71%	73%	22%	29%	53%
Week 9	7%	10%	4%	1%	47%	9%
Week 10	23%	8%	7%	1%	38%	54%
Week 11	14%	10%	26%	26%	0%	14%
Week 12	43%	40%	48%	63%	51%	16%
Week 13	5%	1%	1%	0%	2%	3%
Week 14	20%	2%	0%	20%	8%	1%
Week 15	11%	7%	5%	12%	3%	32%
Week 16	79%	35%	10%	3%	9%	9%
Week 17	4%	N/A	1%	5%	56%	63%

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