Senior Project

Department of Economics

The Impact of Legalizing Sports Gambling on Mental Health

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I. Abstract

This paper investigates the impact of legalizing sports gambling on mental health outcomes in the United States, focusing on key indicators such as poor mental health days, suicide rates, excessive alcohol consumption, and smoking. Utilizing county-level data from the County Health Rankings Database spanning 2008 to 2021 (with suicide data from 2017 onward), the study examines changes in these variables following the 2018 Supreme Court decision in Murphy v. NCAA, which allowed states to individually regulate sports betting. The analysis employs demographic controls and fixed effects to account for variations across counties and years, addressing challenges such as data reporting lags and fluctuations in county coverage. The literature review highlights the complex relationship between gambling and mental health, acknowledging both the risks of addiction and the potential for positive social experiences. The study aims to inform policymakers by providing empirical evidence on whether the legalization of sports gambling correlates with changes in mental health and related behaviors, ultimately guiding future regulation to balance entertainment value with public health considerations.

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III. Introduction

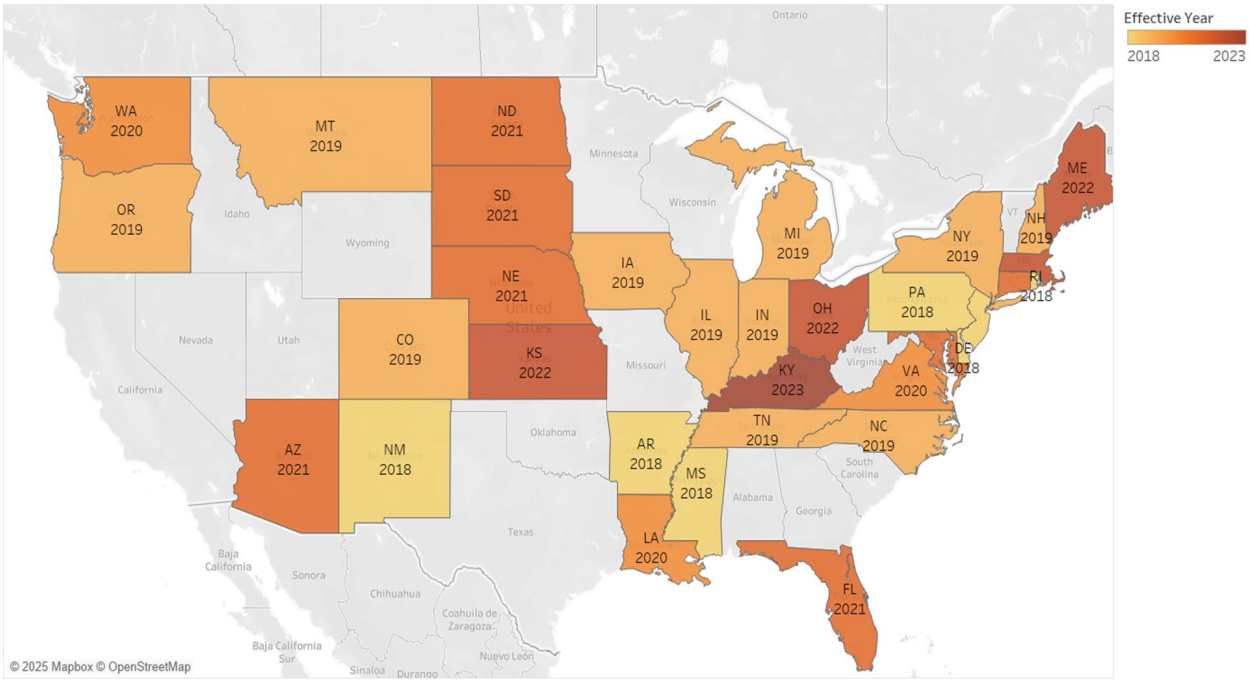
In recent years, mental health has taken a big step into the limelight. The idea of good health has blown up and become more desirable, especially in the arena of mental health. Mental health is something that everyone experiences every day. Having a healthy mind can make you happier at home and more successful in your professional life. One of the groups of people that have the largest negative mental health is the gamblers; and this group is growing, approximately 82% of U.S. adults reported engaging in some form of gambling (13). In a society that is bogged down by politics, addiction, economic and social hardship, perhaps making gambling more readily available could make things worse. A study published in 2018 states that psychological distress and declining well-being have increased significantly among Americans with low socioeconomic status (SES) between the mid-1990s and early 2010s (14).

While declining mental health is on the rise, many people have fun gambling, going to the casino, playing games and feeling the rush when or if they win some money. Gambling is designed to be a game, and games are meant to be fun. Not to mention the fun environment that casinos bring to the table, the buffets, the drinks, the lights, and fun concerts and shows that are put on. The casino is widely considered a fun environment. Going out and having a nice dinner and seeing a comedy show at a casino can be an enticing way to spend a night.

This paper aims to evaluate the impact of legalizing sports betting on mental health. How does the legalization of sports betting impact mental health statistics, suicide rate, and drug and alcohol consumption in the regions that allow it? As a result of the Supreme Court case *Murphy v. NCAA (2018)* the Supreme Court struck down the Professional and Amateur Sports Protection Act (PASPA) of 1992 allowing states to individually regulate sports gambling. The repeal of the PASPA allowed the states to decide their own policies on sports betting. Some states have little

restriction, and some are far more regulated and only allow certain kinds of sports gambling or only allow it in certain settings. For example, in the state of Nevada, to bet on any sports, you must be in a licensed casino, while in Ohio, you can gamble on sports on the internet.

Figure 1: Map of States Where Sports Gambling is Legal and Effective Year



In figure 1 it depicts the number of states that have chosen to legalize sports gambling and the years that each state legalized it. One common trend is that most of the states that have legalized it so far did so in 2018 or 2019 right after the supreme court struck down PASPA.

By evaluating and determining the impact of sports gambling on mental health, policy makers can form legislation to defend against its negative effects. Poor mental health can create less productive individuals and in extreme cases can cause suicide. If the public was more aware of the negative effects of sports gambling, then they would be better equipped to support policies to regulate or restrict sports gambling to counter these negative externalities that it creates. On

the other side of this coin, the public deserves to see the positive effects of gambling on mental health as well. The public should be able to hear about responsible ways to gamble that do not lead to poor mental health and should be able to enjoy the fun game that gambling was designed to be.

IV. Literature Review

In recent years, gambling has become a hot topic, with debates ranging from its impact on mental health to its economic and legal consequences (Matheson 2021). Some argue that gambling, when done responsibly, is just another form of entertainment, while others worry about its addictive nature and the problems it creates for individuals and society (Hodgins et al. 2011). Researchers have taken a deep dive into these issues, studying everything from gambling disorders to the role of technology in shaping the future of betting and mental health treatment (Liu et al. 2021).

A major area of research has been gambling addiction and its effects on mental health. Hodgins et al. (2011) provide a detailed analysis of gambling disorders, exploring their causes and treatment options. They highlight how addiction stems from a mix of genetic, psychological, and environmental factors. For some people, gambling is just a fun pastime, but for others, it can turn into a serious problem, fueled by stress or easy access to betting opportunities. The study suggests that the best ways to tackle gambling addiction include therapy and medication, showing that a combination of treatments can help those struggling with compulsive gambling. Similarly, Kuss and Griffiths (2012) discuss internet gaming addiction and its similarities to gambling (casino) addiction. They point out that both behaviors affect the brain in similar ways, making it hard for some people to stop once they start. Their research calls for more studies to better define what separates casual gaming from a true addiction, especially as online gambling becomes more popular and easily accessible.

Beyond personal struggles with gambling, there are also major economic and legal factors to consider. Matheson (2021) looks at the financial side of sports betting, discussing how legalized

gambling can bring in increased revenues for governments and sports organizations. However, he also acknowledges that it comes with risks, like increased addiction rates and potential corruption in sports. Similarly, Holden and Edelman (2020) analyze changes in gambling laws, particularly after the Supreme Court's *Murphy v. NCAA (2018)* ruling. This decision gave states the power to regulate sports betting as they see fit, leading to a patchwork of policies across the country. Some states have fully embraced legalized betting, while others have imposed strict regulations. Holden and Edelman (2020) examine the challenges of creating laws that balance consumer protection with the financial benefits of gambling. Looking at an earlier perspective, Smith (1990) explored how legalizing sports betting affects society, particularly in normalizing gambling behaviors. His work remains relevant today as more places legalize gambling, bringing both opportunities and concerns about the long-term effects on communities.

Technology has played a huge role in the changing gambling landscape. Liu et al. (2021) discuss how digital innovations, like mobile apps and online betting platforms, have made gambling more accessible than ever before. While this has led to industry growth, it has also raised concerns about problem gambling. The study highlights various responsible gambling tools, such as self-exclusion features and AI-driven monitoring systems, which help people keep their gambling habits in check. Similarly, Pons et al. (2022) focus on extended reality (XR) technologies and their use in mental health treatment. They explore how virtual reality can help people manage anxiety or undergo cognitive-behavioral therapy in a more immersive environment. While these innovations show promise, the Pons et al. (2022) also warn of ethical concerns, such as privacy risks and the need for clinical validation before widespread adoption. The combination of technology and mental health treatment continues to evolve, offering both potential benefits and challenges.

The discussion on mental health issues was expanded upon before sports gambling was legalized and there have been large advancements in treatment. Sharma et al. (2017) examine mental health promotion and new strategies to improve well-being. They discuss approaches like mindfulness programs, community support, and policy changes aimed at reducing mental health disparities. Their research stresses the need for a multi-level approach that includes individuals, communities, and lawmakers. Meanwhile, Dickey et al. (2002) investigate the link between medical conditions, mental illness, and substance use disorders. Their study finds that people with co-occurring disorders often struggle to get the care they need, as traditional healthcare systems are not set up to address the complexity of their conditions. This is especially relevant for gambling addiction, as many problem gamblers also deal with other mental health issues, such as depression or substance abuse (Dickey et al. 2002). Their findings support the idea that treatment should be holistic, addressing multiple aspects of a person's health rather than focusing on gambling addiction alone.

The existing research paints a complex picture of gambling and its effects. On the one hand, gambling can be a fun and exciting pastime for many people. On the other hand, it carries risks, from addiction to financial and legal concerns. The impact of gambling isn't just a personal issue, it's one that affects economies, public health, and society. Technology continues to shape how gambling works, making it easier to access while also offering new tools to promote responsible betting. By examining the different aspects of gambling, policymakers and researchers can work toward solutions that allow people to enjoy gambling responsibly while minimizing its negative effects. Moving forward, continued research and thoughtful regulation will be key in ensuring that gambling remains a source of entertainment rather than a widespread problem.

V. Data

These variables that I am using are from the County Health Rankings Database and this database provides rich information on respondents' health including poor mental health days, excessive alcohol consumption, smoking, and suicides. These will be the four outcome variables that I am focusing on the effects of, the first being Mental Health. This variable is represented in the database as the average number of poor mental health days by county, the second being adult smoking. In this database this variable is represented by the percentage of the population that reported they smoke, the next being the variable for alcohol consumption. This variable is represented in the database by the name excessive drinking and is represented as a percentage (the same as smoking). The final one is suicide, and this one is simply the number of suicides for each county reported annually. One thing to note is that the variable for suicide is limited in years that it was reported, it was only reported from 2017 forward. On top of these outcome variables, I am using a few related control variables, mainly covering demographics such as education and unemployment. These variables are collected and maintained by this organization every year and they have these variables from 2008 to 2021 (Aside from suicides which are from 2017-2021).

For this research project, I am using variables related to mental health to find a correlation between legalizing sports gambling and mental health. I was able to find one database that housed all the variables I need for this model. The County Health Rankings database has very strong data to use in my model. They have variables for mental health, excessive alcohol consumption, smoking, and suicide, the first being the mental health variable. This variable is represented as an average by county of poor mental health days over a week. To simplify, the

curators of the database surveyed people in each county, and they picked a number between one and thirty of how many days they experienced poor mental health over the last month. Then those responses were averaged for every county. This variable is the most important in my research because it is the most direct indicator of mental health of all the variables I am using, and it answers my research question.

The rest of these variables are behaviors and are represented in the data as either percentages or total counts. These behaviors are related to mental health in a significant way. Studies have shown that poor mental health can often lead to these behaviors. These behaviors include excessive alcohol consumption, smoking, and suicide. In this analysis, I would expect to see all these variables increase or decrease together over time depending on the effects based on the treatment group and treatment period. There are several different columns for different subsections for each variable, for example, they include numerator and denominator values for each variable. These values do not have any meaning to me or hold any necessary value to my analysis, so I am eliminating them for my analysis.

The only issue I am running into with this data is the way that I must compare the data across years. The number of counties has fluctuated over the years across states, so this can cause some slight errors if not accounted for properly. The other problem is how it is dated. The data reported in 2024 is the data collected in 2021, and the previous years are the same. The data within each report is a few years behind, so in SAS I will be using the reported year when running my model. My plan is to use the reported years because when I download the data from the database, it lists the reported year instead. When I look at the data for my model, instead of

2018 and on being the treatment period, the treatment period will begin in 2021 as that is the year that the 2018 data was reported.

Figure 2: Data Summary Statistics

Variable	N	Mean	Std Dev	Minimum	Maximum
Mental Health	45889	4.02	0.98	0.4	10.1
Smoking	44444	0.19	0.05	0	0.51
Alcohol	43910	0.16	0.043	0	0.56
Highschool	41994	0.84	0.093	0	1
College	41408	0.56	0.17	0.0083	1
Unemployment	47879	0.096	0.13	0.0057	0.93
Suicide	12328	18.8	7.79	4.26	155.37

In Figure 2 I have the summary statistics for each of the main variables across all the years reported. One interesting statistic I noticed was the mean of unemployment. The mean is pretty high and the reason for this is because on one end of my data is the Great Recession and on the other end of the data is the COVID-19 pandemic. I plan to control for this in my model by using year and county fixed effects and by proving that all of my variables have parallel trends. Another main item to note is that the number of observations for suicides is much lower than the rest of the variables. This is because as I mentioned earlier, data only existed from 2017-2021 for suicides in my database.

VI. Theories

Gambling can be expected to be a net-loss activity, meaning that the loss of income and negative feeling related to it is the connection to poor mental health. Another major connection is the family of a gambler puts pressure on him/her when income losses happen due to gambling. This pressure and/or related guilt that a person feels from not being able to support the family, hurting their loved ones in the process is a second contributing factor to poor mental health. If a person is suffering from gambling addiction the person may experience the feeling of being trapped and cannot stop gambling. The negative feeling of being trapped is another possible cause of poor mental health.

On the other hand, gambling can be fun for people. A positive effect could be expected because of the rush of throwing the dice and the excitement that comes with unpredictability. Others gamble with their friends. People like to meet and play poker with friends as a social event. Even at casinos, gambling with others can be a good time to meet others and play different games together, forming friendships.

Given these two sets of circumstances, I am testing which one dominates by testing if there is a significant effect on all the variables from the legalization of sports gambling. My expectation is that the first set of circumstances dominates in which gambling cause negative effects on mental health. I am hypothesizing that a negative change in mental health (the variable representing mental health as discussed previously is the average number of poor mental health days, likely a positive number) will be caused by the legalization of gambling and by proxy will cause the rest of my variables (tobacco use, alcohol consumption, suicides) to also see an increase and report positive values.

VII. Methodology

In my research I am using a two-way fixed effects difference-in-difference model to estimate the effect that sports gambling legalization has on mental health, alcohol consumption, tobacco use, and suicides. The models I am building are going to compare all of these at a county level over multiple years. The data I am compiling begins in 2017 and ends in 2021 and includes all fifty states and the counties within.

This model is my parallel trends test. This model is designed to ensure that my data has similar trends before the treatment period. This model is only run for years before the treatment period (2018), and it will show that my variables are exhibiting predictable trend behavior before the policy change to show that any changes to the data are solely because of the policy change.

Equation 1: Parallel Trend Test

$$Y_{ct} = Treatment + Year + Year^2 + Year^3 + Treatment * Year + Treatment * Year^2 + Treatment * Year^3$$

As shown in Figure 4, the parallel trends test for mental health as my outcome variable shows that this has a parallel trend before my treatment period and my other outcome variables reported the same. My outcome variables show no unpredictable changes before the treatment period so anything that happens to these variables in my model is solely because of the policy change in 2018.

Figure 3: Parallel Trend Test

Parallel Trend Test			
Parameter	Mental Health	Smoking	Alcohol
Intercept	4.26*** (0.035)	0.17*** (0.0021)	0.16*** (0.0021)
Treatment	0.043 (0.044)	0.0088*** (0.0026)	0.0077*** (0.0024)
RT	0.12*** (0.026)	0.0018 (0.0017)	-0.0034** (0.0016)
RT*RT	0.00091 (0.0055)	0.0014*** (0.00035)	-0.0011*** (0.00033)
RT*RT*RT	-0.00042 (0.00032)	0.00008*** (0.000021)	-0.00005** (0.000019)
Treatment*RT	0.057* (0.033)	0.0027 (0.0021)	0.0033* (0.0018)
Treatment*RT*RT	0.0074 (0.0069)	0.00045 (0.00043)	0.00063 (0.00039)
Treatment*RT*RT*RT	0.00041 (0.00040)	0.00002 (0.000025)	0.00003 (0.00002)

The values of interest in this model are those reported for the interaction terms. The values are showing mostly insignificance, which is exactly what I need to show that there exists parallel trend. The only two that show some significance would be the in the row for the first interaction term for Mental Health and Alcohol. Luckily it is only for the first set of interaction terms, and it is significant in the 90% confidence level. One other thing to note is the absence of the Suicide variable. A parallel trends test would not show us anything for this variable because it only has data for one year before the treatment.

Equation 2: Linear Two-Way Fixed-Effects Difference-in-Differences Model

$$Y_{ct} = B_0 + B_1 Gambling_{ct} + X_{ct} + County_c + Year_t + error_{ct}$$

The $Gambling_{ct}$ variable is representative of when the individual lays within the treatment group and within the treatment period. The treatment period is when gambling is legalized, from 2018 to present. The variable is comprised of two underlying variables, *treatment* and *active*. *Treatment* is an indicator variable that equals 1 if the individual lays within the treatment group and is zero otherwise. *Active* is an indicator variable equal to 1 if the individual is currently in the treatment period and zero otherwise. This variable acts as a DID and it breaks down to *treatment* × *active*. Essentially it only equals one if the individual is currently in the treatment period and is in the treatment group. The last part of my model is the variable X_{ct}. This variable is the placeholder for my control variables. The control variables included in this model are unemployment, high school graduation, and college. This model will ensure that I can find any correlation between sports gambling and all these outcome variables.

Equation 3: Log Linear Two-Way Fixed-Effects Difference-in-Differences Model

$$Ln(Y_{ct}) = B_0 + B_1 Ln(Gambling_{ct}) + X_{ct} + County_c + Year_t + error_{ct}$$

To investigate all possibilities and to find a model of best fit, I am building a Log linear model as well. This model is very similar to the original linear model, except that in this model, I am taking the natural log of the outcome variable and my DID. In this model, all results are reported in percentage changes rather than changes in the unit of the variable being tested.

VIII. Results

With all the outcome variables and control variables measuring up properly, I can construct a model to measure the effects of legalizing sports gambling. To obtain these results, I am constructing four models, one with each outcome variable measuring the effect on each.

Figure 5: Linear Two-Way Fixed-Effects Difference-in-Differences Results

	Linear				Linear Per Capita			
Variables	**Mental Health**	**Smoking**	**Alcohol**	**Suicide**	**Mental Health**	**Smoking**	**Alcohol**	**Suicide**
DID	-0.02 (0.015)	-0.004*** (0.0008)	-0.001* (0.0006)	-0.11 (0.10)	-0.00003*** (0.00001)	-0.004*** (0.00076)	-0.001* (0.0006)	-0.00001 (0.00001)
Highschool	-0.16** (0.073)	-0.033*** (0.0043)	-0.0053 (0.0032)	0.63 (0.88)	-0.00018*** (0.000052)	-0.033*** (0.0043)	-0.009*** (0.0032)	-0.00003 (0.00008)
College	-0.17 (0.12)	-0.018*** (0.0067)	0.0039 (0.0056)	-1.30 (1.98)	-0.000054 (0.000091)	-0.022*** (0.0077)	0.024*** (0.0067)	-0.00017 (0.00027)
Unemployment	1.09** (0.54)	0.057** (0.028)	-0.14*** (0.021)	-3.14 (3.70)	0.0011*** (0.00018)	0.065** (0.027)	-0.12*** (0.020)	-0.00060 (0.00044)
Number of Obs	34291	32831	32472	12050	31439	30431	29918	12050
County and Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.78	0.78	0.78	0.94	0.86	0.79	0.78	0.99

Figure 5 is the results table for my first set of models, these being linear models, the second one being per capita. One note here is that the per capita model only changed the results for the variables that are not already represented as a percentage of the population. In both models, it is estimated that holding significance aside, the effects of this policy change are negative, meaning that poor mental health days have decreased, and the amount of the related poor behaviors has also decreased. For the first model we see a statistically significant decrease in smoking and in alcohol consumption of 0.4% and 0.1% respectively. In the second model, we see the same change for the previously mentioned variables with one change. In the per capita model, we see

that there is a statistically significant change of -0.00003 poor mental health days per capita at the 1% significance level. Both models show that there is no effect on the number of suicides.

Figure 6: Log Linear Two-Way Fixed-Effects Difference-in-Differences Results

	Log Linear				Log Linear Per Capita			
Variables	**Mental Health**	**Smoking**	**Alcohol**	**Suicide**	**Mental Health**	**Smoking**	**Alcohol**	**Suicide**
DID	-0.0066 (0.0044)	-0.025*** (0.0038)	-0.0036 (0.0058)	-0.0061 (0.005)	0.000023 (0.0044)	-0.025*** (0.0038)	-0.0036 (0.0058)	-0.0026 (0.0052)
Highschool	-0.082*** (0.021)	-0.15*** (0.022)	-0.058* (0.03)	0.017 (0.041)	-0.12*** (0.023)	-0.15*** (0.022)	-0.09*** (0.026)	-0.024 (0.043)
College	0.0082 (0.039)	-0.09** (0.038)	-0.052 (0.049)	-0.045 (0.083)	-0.060 (0.047)	-0.09** (0.038)	0.21*** (0.059)	-0.072 (0.086)
Unemployment	0.97*** (0.14)	0.29** (0.13)	-1.76*** (0.21)	-0.15 (0.15)	0.81*** (0.15)	0.29** (0.13)	-1.65*** (0.2)	-0.29* (0.16)
Number of Obs	34291	32831	32472	12050	31439	30431	29918	12050
County and Year Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.75	0.78	0.71	0.94	0.99	0.79	0.72	0.99

In figure 6 I have my Log Linear models with the second being pre capita. In these models we see more of the same. We see several negative values holding significance aside. In this model the only statistically significant values are those of smoking (smoking already being a percentage of the population making a per capita value unnecessary). In this model we see that on average, and all else constant, the number of smokers has decreased by 2.5 percentage points. While the rest of the values are not statistically significant, it can still illustrate a story about how this policy change has affected my variables of interest. They are mainly negative of all four of my models.

Across all four of the models that I created, I can draw several conclusions. Across all four of my models, the number of suicides did not experience a statistically significant change

due to the policy change. All the values reported were negative, but none of these values are statistically different from zero. In terms of the other variables, linearly, smoking has on average decreased by 0.4% and logarithmically decreased by 2.5 percentage points on average. Only one model provided a statistically significant value for Mental Health. The per capita linear model and this model reported a decrease of 0.0003 poor mental health days per capita on average. Finally, alcohol decreased by 0.1% in my linear model on average.

IX. Conclusions

Considering these results one main conclusion is that sports gambling exhibits no negative effects on mental health, smoking, excessive alcohol consumption, or suicide. In fact, my model implies that legalizing sports gambling has led to better mental health on average and a decrease in smoking and alcohol consumption. There was no significant effect on the number of suicides.

The final conclusions to be drawn about sports gambling are simple. There are two reasons as to why the positives of gambling dominate the negatives in sports gambling. The first being that sports gambling must be inherently different from other forms. It could be that it has a less addictive nature, or perhaps the losses create fewer depressing feelings than traditional gambling. Sports gambling does not have a lottery type of outcome to it like other forms of gambling. It requires sports knowledge and strategy. These factors make it possible to be good at sports gambling because the outcome requires some type of skill or knowledge rather than being one hundred percent luck based.

The other reason would be the type of environment that sports gambling creates. The typical casino environment is a unique environment. Smoking and alcohol consumption are encouraged in casinos and those are both outcome variables I studied. Sports gambling in most states is available over the internet from the comfort of your home and this environment is much healthier than that of a casino. Sports gambling being able to happen in the home is socially healthy because it promotes watching sports, which often happens with friends, or by attending games. This promotes social interaction, and humans enjoy being social. This would explain the dominance of the positives regarding mental health.

Regarding policy makers, I would have to say that sports gambling does not exhibit the negative behaviors that I studied in my research. The states that do not allow sports gambling are missing out on boosted mental health and the tax revenues that come along with sports gambling. With the evidence I have found in my research, I would advise policy makers to legalize sports gambling and enforce less restrictions. There are a few other negatives that could have increased since the legalization of sports gambling that would cause concern for legalization. For example, I did not study the effects on personal debt, or credit scores, I also did not look at state tax revenue either. These are all things that could be studied further to gain a better understanding of the full impacts of sports gambling. In terms of my research, states are missing out on increased mental health, decreased smoking and alcohol consumption and tax revenues by not legalizing sports gambling.

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XI. Appendix

```
%let rundir = /home/u63746930/MySAS Senior Project ;

libname WK "&rundir";

run;


proc import datafile="&rundir/MasterFile.xlsx"

                out=WK.v2010 dbms=xlsx replace;

        sheet="2010";

        getnames=yes;

run;


proc import datafile="&rundir/MasterFile.xlsx"

                out=WK.v2011 dbms=xlsx replace;

        sheet="2011";

        getnames=yes;

run;


proc import datafile="&rundir/MasterFile.xlsx"
```

```
                out=WK.v2012 dbms=xlsx replace;
        sheet="2012";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2013 dbms=xlsx replace;
        sheet="2013";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2014 dbms=xlsx replace;
        sheet="2014";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
```

```
                out=WK.v2015 dbms=xlsx replace;
        sheet="2015";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2016 dbms=xlsx replace;
        sheet="2016";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2017 dbms=xlsx replace;
        sheet="2017";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
```

```
                out=WK.v2018 dbms=xlsx replace;
        sheet="2018";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2019 dbms=xlsx replace;
        sheet="2019";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2020 dbms=xlsx replace;
        sheet="2020";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
```

```
                out=WK.v2021 dbms=xlsx replace;
        sheet="2021";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2022 dbms=xlsx replace;
        sheet="2022";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.v2023 dbms=xlsx replace;
        sheet="2023";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
```

```
                out=WK.v2024 dbms=xlsx replace;
        sheet="2024";
        getnames=yes;
run;

proc import datafile="&rundir/MasterFile.xlsx"
                out=WK.effectiveyear dbms=xlsx replace;
        sheet="EffectiveYear";
        getnames=yes;
run;

%let rundir = /home/u63746930/MySAS Senior Project ;
libname WK "&rundir";
run;

Data effectiveyear;
        Set WK.effectiveyear;
Run;
```

```
Data merged;
        set WK.v2010(keep=fipscode state county year v042_rawvalue v021_rawvalue
                v009_rawvalue v049_rawvalue v022_rawvalue v023_rawvalue
        rename=(v021_rawvalue=v168_rawvalue v022_rawvalue=v069_rawvalue))

                WK.v2011(keep=fipscode state county year v042_rawvalue
v021_rawvalue
                v009_rawvalue v049_rawvalue v069_rawvalue v023_rawvalue
v051_rawvalue
        rename=(v021_rawvalue=v168_rawvalue))

                WK.v2012(keep=fipscode state county year
                v042_rawvalue v021_rawvalue v009_rawvalue v049_rawvalue
v069_rawvalue
                v023_rawvalue v051_rawvalue
rename=(v021_rawvalue=v168_rawvalue))

                WK.v2013(keep=fipscode state
```

county year v042_rawvalue v021_rawvalue v009_rawvalue
v049_rawvalue

v023_rawvalue v051_rawvalue
rename=(v021_rawvalue=v168_rawvalue))

WK.v2014(keep=fipscode state

county year v042_rawvalue v021_rawvalue v009_rawvalue
v049_rawvalue

v069_rawvalue v023_rawvalue v051_rawvalue
rename=(v021_rawvalue=v168_rawvalue))

WK.v2015(keep=fipscode state county year v042_rawvalue
v021_rawvalue

v009_rawvalue v049_rawvalue v069_rawvalue v023_rawvalue
v051_rawvalue

rename=(v021_rawvalue=v168_rawvalue))

WK.v2016(keep=fipscode state county year

v042_rawvalue v021_rawvalue v009_rawvalue v049_rawvalue
v023_rawvalue

v051_rawvalue

rename=(v021_rawvalue=v168_rawvalue))

WK.v2017(keep=fipscode state county year

v042_rawvalue v021_rawvalue v009_rawvalue v049_rawvalue

v069_rawvalue

v023_rawvalue v051_rawvalue

rename=(v021_rawvalue=v168_rawvalue))

WK.v2018(keep=fipscode state

county year v042_rawvalue v021_rawvalue v009_rawvalue

v049_rawvalue

v069_rawvalue v023_rawvalue v051_rawvalue

rename=(v021_rawvalue=v168_rawvalue))

WK.v2019(keep=fipscode state county year v042_rawvalue

v009_rawvalue

v049_rawvalue v069_rawvalue v023_rawvalue v051_rawvalue)

WK.v2020(keep=fipscode state county

year v042_rawvalue v021_rawvalue v009_rawvalue v049_rawvalue v069_rawvalue

v023_rawvalue v161_rawvalue v051_rawvalue rename=(v021_rawvalue=v168_rawvalue))

WK.v2021(keep=fipscode state county year v042_rawvalue v009_rawvalue

v168_rawvalue v051_rawvalue v049_rawvalue v069_rawvalue v023_rawvalue v161_rawvalue)

WK.v2022(keep=fipscode state county year v042_rawvalue v009_rawvalue

v168_rawvalue v051_rawvalue v049_rawvalue v069_rawvalue v023_rawvalue v161_rawvalue)

WK.v2023(keep=fipscode state county year v042_rawvalue v009_rawvalue

v168_rawvalue v051_rawvalue v049_rawvalue v069_rawvalue v023_rawvalue v161_rawvalue)

```
                WK.v2024(keep=fipscode state county year v042_rawvalue
v009_rawvalue
                v168_rawvalue v051_rawvalue v049_rawvalue v069_rawvalue
v023_rawvalue v161_rawvalue);


          rename v168_rawvalue=Highschool v042_rawvalue=MentalHealth
v051_rawvalue=Population
                v009_rawvalue=Smoking v049_rawvalue=Alcohol
v069_rawvalue=College
                v023_rawvalue=Unemployment v161_rawvalue=Suicide;
Run;


ods output Summary=Sumfinal;
Proc means data=merged;
 var MentalHealth Smoking Alcohol Highschool College Unemployment Suicide;
run;
quit;


Proc sort data=merged;
```

```
    by state;
Run;

Proc sort data= effectiveyear;
    by state;
Run;

Data Merged2;
    merge merged effectiveyear;
    by state;
Run;

Data Merged3;
    set merged2;
    Year = year-3;
Run;

Data DID;
```

```
    set Merged3;
    If EffectiveYear= "." then DID=0;
        Else If Year>=EffectiveYear then DID=1;
        Else DID=0;
    If EffectiveYear="." then Treatment=0;
    else Treatment=1;
Run;

Proc TTest data=DID plots=none;
    where year<2018;
    var Highschool College Unemployment;
    class treatment;
Run;

Data RT;
    set DID;
    RT = year-2018;
Run;
```

```
/*Parallel Trend*/

Proc SurveyReg data=RT;

    class County State Year;

    where RT<0;

    model MentalHealth = Treatment RT RT*RT RT*RT*RT Treatment*RT
Treatment*RT*RT Treatment*RT*RT*RT

    /Solution adjrsq;

Run;



Proc SurveyReg data=RT;

    class County State Year;

    where RT<0;

    model Smoking = Treatment RT RT*RT RT*RT*RT Treatment*RT Treatment*RT*RT
Treatment*RT*RT*RT

    /Solution adjrsq;

Run;



Proc SurveyReg data=RT;

    class County State Year;
```

```
    where RT<0;
    model Alcohol = Treatment RT RT*RT RT*RT*RT Treatment*RT Treatment*RT*RT
Treatment*RT*RT*RT
    /Solution adjrsq;
Run;


/*Original Model*/
ods output ParameterEstimates=PEforModel1 DataSummary=ObsModel1
                    FitStatistics=AdjRsqModel1 Effects=OverallSigModel1;
Proc SurveyReg Data=RT plots=none;
    Class state Year/ref=first;
    Cluster state;
    Model MentalHealth = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;


ods output ParameterEstimates=PEforModel2 DataSummary=ObsModel2
                    FitStatistics=AdjRsqModel2 Effects=OverallSigModel2;
```

```
Proc SurveyReg Data=RT plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model Smoking = DID Highschool College Unemployment State Year/Solution AdjRsq;
Run;
quit;

ods output ParameterEstimates=PEforModel3 DataSummary=ObsModel3
                    FitStatistics=AdjRsqModel3 Effects=OverallSigModel3;
Proc SurveyReg Data=RT plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model Alcohol = DID Highschool College Unemployment State Year/Solution AdjRsq;
Run;
quit;

ods output ParameterEstimates=PEforModel4 DataSummary=ObsModel4
                    FitStatistics=AdjRsqModel4 Effects=OverallSigModel4;
```

```
Proc SurveyReg Data=RT plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model Suicide = DID Highschool College Unemployment State Year/Solution AdjRsq;
Run;
quit;


proc sort data=RT;
    by fipscode year;
Run;


Data test;
    set RT;
    where MentalHealth ne . and fipscode ne "" and fipscode ne "15005" and
fipscode="51515";
    count=1;
    lagfipscode=lag(fipscode);
    if fipscode= lagfipscode then count=2;
    *keep fipscode county year count lagfipscode;
```

```
Run;


proc sort data=test;
    by fipscode descending year;
Run;


Data test2;
    set test;
    where MentalHealth ne . and fipscode ne "" and fipscode ne "15005" and
(fipscode="51515" or fipscode="51510");
    lagfipscode=lag(fipscode);
    if fipscode= lagfipscode then count=2;
    keep fipscode county year count lagfipscode;
Run;
/*Log and Per Capita Creation*/


Data RT2;
    set RT;
    LogMentalHealth = log(MentalHealth);
```

```
    LogSmoking = log(Smoking);
    LogAlcohol = log(Alcohol);
    LogSuicide = log(Suicide);
    PCMentalHealth = MentalHealth/Population;
    PCSmoking = Smoking/Population;
    PCAlcohol = Alcohol/Population;
    PCSuicide = Suicide/Population;
    LogPCMentalHealth = log(PCMentalHealth);
    LogPCSmoking = log(PCSmoking);
    LogPCAlcohol = log(PCAlcohol);
    LogPCSuicide = log(PCSuicide);
Run;


/*Proc Panel Model*/
Data RT_Clean;
        Set RT2;
        Where (substr(fipscode,3,5) ne "000") and fipscode ne "";
```

```
Run;


Data RT_MentalHealth;
        set RT_Clean;
        where year ne . and fipscode ne "" and MentalHealth ne . and
                DID ne . and Highschool ne . and College ne . and Unemployment ne . ;
        lagfipscode=lag(fipscode);
        Count =1;
        If fipscode=lagfipscode then Count=2;
Run;


proc sort data=RT_MentalHealth;
        by fipscode decending year;
Run;


Data RT_MentalHealth2;
        Set RT_MentalHealth;
        lagfipscode=lag(fipscode);
```

```
        If fipscode=lagfipscode then Count=2;
Run;

Data RT_MentalHealth3;
        Set RT_MentalHealth2;
        where Count=2;
Run;

proc sort Data=RT_MentalHealth3;
        by fipscode year;
Run;

ODS Output ParameterEstimates=PE_MentalHealth FitStatistics=Rsq_MentalHealth
FixedEffectsTest=DFs_MentalHealth;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        Model MentalHealth=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
```

```
Quit;


ODS Output ParameterEstimates=PE_Smoking FitStatistics=Rsq_Smoking
FixedEffectsTest=DFs_Smoking;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        Model Smoking=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;


ODS Output ParameterEstimates=PE_Alcohol FitStatistics=Rsq_Alcohol
FixedEffectsTest=DFs_Alcohol;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        Model Alcohol=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;
```

```
ODS Output ParameterEstimates=PE_Suicide FitStatistics=Rsq_Suicide
FixedEffectsTest=DFs_Suicide;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        where Suicide ne .;
        Model Suicide=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;

/*Log Linear Proc Survey Reg*/
ods output ParameterEstimates=PEforLogModel1 DataSummary=ObsLogModel1
                FitStatistics=AdjRsqLogModel1 Effects=OverallSigLogModel1;
Proc SurveyReg Data=RT2 plots=none;
    Class state Year/ref=first;
    Cluster state;
    Model LogMentalHealth = DID Highschool College Unemployment State Year/Solution
AdjRsq;
```

```
Run;

quit;


ods output ParameterEstimates=PEforLogModel2 DataSummary=ObsLogModel2
                    FitStatistics=AdjRsqLogModel2 Effects=OverallSigLogModel2;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model LogSmoking = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;


ods output ParameterEstimates=PEforLogModel3 DataSummary=ObsLogModel3
                    FitStatistics=AdjRsqLogModel3 Effects=OverallSigLogModel3;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
```

```
    Model LogAlcohol = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;


ods output ParameterEstimates=PEforLogModel4 DataSummary=ObsLogModel4
                    FitStatistics=AdjRsqLogModel4 Effects=OverallSigLogModel4;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model LogSuicide = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;


/*Per Capita Proc Survey Reg*/
ods output ParameterEstimates=PEforPCModel1 DataSummary=ObsPCModel1
                    FitStatistics=AdjRsqPCModel1 Effects=OverallSigPCModel1;
Proc SurveyReg Data=RT2 plots=none;
```

```
    Class state Year/ref=first;
    Cluster state;
    Model PCMentalHealth = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;

ods output ParameterEstimates=PEforPCModel2 DataSummary=ObsPCModel2
                    FitStatistics=AdjRsqPCModel2 Effects=OverallSigPCModel2;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model PCSmoking = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;

ods output ParameterEstimates=PEforPCModel3 DataSummary=ObsPCModel3
                    FitStatistics=AdjRsqPCModel3 Effects=OverallSigPCModel3;
```

```
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model PCAlcohol = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;

ods output ParameterEstimates=PEforPCModel4 DataSummary=ObsPCModel4
                    FitStatistics=AdjRsqPCModel4 Effects=OverallSigPCModel4;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model PCSuicide = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;

/* Log linear Per Capita Proc Survey Reg*/
```

```
ods output ParameterEstimates=PEforLogPCModel1 DataSummary=ObsLogPCModel1
                    FitStatistics=AdjRsqLogPCModel1 Effects=OverallSigLogPCModel1;
Proc SurveyReg Data=RT2 plots=none;
    Class state Year/ref=first;
    Cluster state;
    Model LogPCMentalHealth = DID Highschool College Unemployment State
Year/Solution AdjRsq;
Run;
quit;


ods output ParameterEstimates=PEforLogPCModel2 DataSummary=ObsLogPCModel2
                    FitStatistics=AdjRsqLogPCModel2 Effects=OverallSigLogPCModel2;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model LogPCSmoking = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;
```

```
ods output ParameterEstimates=PEforLogPCModel3 DataSummary=ObsLogPCModel3
                    FitStatistics=AdjRsqLogPCModel3 Effects=OverallSigLogPCModel3;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model LogPCAlcohol = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
quit;


ods output ParameterEstimates=PEforLogPCModel4 DataSummary=ObsLogPCModel4
                    FitStatistics=AdjRsqLogPCModel4 Effects=OverallSigLogPCModel4;
Proc SurveyReg Data=RT2 plots=none;
    Class State Year/ref=first;
    Cluster state;
    Model LogPCSuicide = DID Highschool College Unemployment State Year/Solution
AdjRsq;
Run;
```

```
quit;


/*Log Proc Panel*/

ODS Output ParameterEstimates=PE_LogMentalHealth FitStatistics=Rsq_LogMentalHealth
FixedEffectsTest=DFs_LogMentalHealth;

Proc Panel Data=RT_MentalHealth3 plots=none;

        ID fipscode year;

        Model LogMentalHealth=DID Highschool College Unemployment/FixTwo
HCCME=1 Cluster;

Run;

Quit;


ODS Output ParameterEstimates=PE_LogSmoking FitStatistics=Rsq_LogSmoking
FixedEffectsTest=DFs_LogSmoking;

Proc Panel Data=RT_MentalHealth3 plots=none;

        ID fipscode year;

        Model LogSmoking=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;

Run;
```

```
Quit;


ODS Output ParameterEstimates=PE_LogAlcohol FitStatistics=Rsq_LogAlcohol
FixedEffectsTest=DFs_LogAlcohol;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        Model LogAlcohol=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;


ODS Output ParameterEstimates=PE_LogSuicide FitStatistics=Rsq_LogSuicide
FixedEffectsTest=DFs_LogSuicide;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        where Suicide ne .;
        Model LogSuicide=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
```

```
Quit;


/*Per Capita Proc Panel*/

ODS Output ParameterEstimates=PE_PCMentalHealth FitStatistics=Rsq_PCMentalHealth
FixedEffectsTest=DFs_PCMentalHealth;

Proc Panel Data=RT_MentalHealth3 plots=none;

        ID fipscode year;

        where year ne 2007;

        Model PCMentalHealth=DID Highschool College Unemployment/FixTwo
HCCME=1 Cluster;

Run;

Quit;


ODS Output ParameterEstimates=PE_PCSmoking FitStatistics=Rsq_PCSmoking
FixedEffectsTest=DFs_PCSmoking;

Proc Panel Data=RT_MentalHealth3 plots=none;

        ID fipscode year;

        where year ne 2007;
```

```
        Model Smoking=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;


ODS Output ParameterEstimates=PE_PCAlcohol FitStatistics=Rsq_PCAlcohol
FixedEffectsTest=DFs_PCAlcohol;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        where year ne 2007;
        Model Alcohol=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;


ODS Output ParameterEstimates=PE_PCSuicide FitStatistics=Rsq_PCSuicide
FixedEffectsTest=DFs_PCSuicide;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
```

```
        where Suicide ne . and year ne 2007;

        Model PCSuicide=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;

Run;

Quit;


/*Log Per Capita Proc Panel*/

ODS Output ParameterEstimates=PE_LogPCMentalHealth
FitStatistics=Rsq_LogPCMentalHealth FixedEffectsTest=DFs_LogPCMentalHealth;

Proc Panel Data=RT_MentalHealth3 plots=none;

        ID fipscode year;

        where year ne 2007;

        Model LogPCMentalHealth=DID Highschool College Unemployment/FixTwo
HCCME=1 Cluster;

Run;

Quit;


ODS Output ParameterEstimates=PE_LogPCSmoking FitStatistics=Rsq_LogPCSmoking
FixedEffectsTest=DFs_LogPCSmoking;
```

```
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        where year ne 2007;
        Model LogSmoking=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;

ODS Output ParameterEstimates=PE_LogPCAlcohol FitStatistics=Rsq_LogPCAlcohol
FixedEffectsTest=DFs_LogPCAlcohol;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        where year ne 2007;
        Model LogAlcohol=DID Highschool College Unemployment/FixTwo HCCME=1
Cluster;
Run;
Quit;
```

```
ODS Output ParameterEstimates=PE_LogPCSuicide FitStatistics=Rsq_LogPCSuicide
FixedEffectsTest=DFs_LogPCSuicide;
Proc Panel Data=RT_MentalHealth3 plots=none;
        ID fipscode year;
        where Suicide ne . and year ne 2007;
        Model LogPCSuicide=DID Highschool College Unemployment/FixTwo
HCCME=1 Cluster;
Run;
Quit;


/*Cleaning*/
Data Table_Long1;
    length Parameter $30;
    length Model $7;
    set /*PEforModel1-PEforModel4 PEforLogModel1-PEforLogModel4 PEforPCModel1-
PEforPCModel4
    PEFORLogPCMODEL1-PEFORLogPCMODEL4*/
    PE_MentalHealth (Rename=(VarName=Parameter))
    PE_Smoking (Rename=(VarName=Parameter))
```

```
PE_Alcohol(Rename=(VarName=Parameter))

PE_Suicide(Rename=(VarName=Parameter))

PE_LogMentalHealth(Rename=(VarName=Parameter))

PE_LogSmoking(Rename=(VarName=Parameter))

PE_LogAlcohol(Rename=(VarName=Parameter))

PE_LogSuicide (Rename=(VarName=Parameter))

PE_PCMentalHealth (Rename=(VarName=Parameter))

PE_PCSmoking(Rename=(VarName=Parameter))

PE_PCAlcohol(Rename=(VarName=Parameter))

PE_PCSuicide(Rename=(VarName=Parameter))

PE_LogPCMentalHealth(Rename=(VarName=Parameter))

PE_LogPCSmoking(Rename=(VarName=Parameter))

PE_LogPCAlcohol(Rename=(VarName=Parameter))

PE_LogPCSuicide(Rename=(VarName=Parameter))

indsname=TheModel;

where Estimate ne 0 and substr(Parameter,1,5) ne "state" and substr(parameter,1,4) ne
"year";


if /*TheModel="WORK.PEFORMODEL1" then Model="Model1";
```

```
else if TheModel="WORK.PEFORMODEL2" then Model="Model2";

else if TheModel="WORK.PEFORMODEL3" then Model="Model3";

else if TheModel="WORK.PEFORMODEL4" then Model="Model4";

else if*/ TheModel="WORK.PE_MENTALHEALTH" then Model="Model5";

else if TheModel="WORK.PE_SMOKING" then Model="Model6";

else if TheModel="WORK.PE_ALCOHOL" then Model="Model7";

else if TheModel="WORK.PE_SUICIDE" then Model="Model8";

/*else if TheModel="WORK.PEFORLOGMODEL1" then Model="Model9";

else if TheModel="WORK.PEFORLOGMODEL2" then Model="Model10";

else if TheModel="WORK.PEFORLOGMODEL3" then Model="Model11";

else if TheModel="WORK.PEFORLOGMODEL4" then Model="Model12";*/

else if TheModel="WORK.PE_LOGMENTALHEALTH" then Model="Model13";

else if TheModel="WORK.PE_LOGSMOKING" then Model="Model14";

else if TheModel="WORK.PE_LOGALCOHOL" then Model="Model15";

else if TheModel="WORK.PE_LOGSUICIDE" then Model="Model16";

/*else if TheModel="WORK.PEFORPCMODEL1" then Model="Model17";

else if TheModel="WORK.PEFORPCMODEL2" then Model="Model18";

else if TheModel="WORK.PEFORPCMODEL3" then Model="Model19";
```

```
else if TheModel="WORK.PEFORPCMODEL4" then Model="Model20";*/

else if TheModel="WORK.PE_PCMENTALHEALTH" then Model="Model21";

else if TheModel="WORK.PE_PCSMOKING" then Model="Model22";

else if TheModel="WORK.PE_PCALCOHOL" then Model="Model23";

else if TheModel="WORK.PE_PCSUICIDE" then Model="Model24";

/*else if TheModel="WORK.PEFORLOGPCMODEL1" then Model="Model25";

else if TheModel="WORK.PEFORLOGPCMODEL2" then Model="Model26";

else if TheModel="WORK.PEFORLOGPCMODEL3" then Model="Model27";

else if TheModel="WORK.PEFORLOGPCMODEL4" then Model="Model28";*/

else if TheModel="WORK.PE_LOGPCMENTALHEALTH" then Model="Model29";

else if TheModel="WORK.PE_LOGPCSMOKING" then Model="Model30";

else if TheModel="WORK.PE_LOGPCALCOHOL" then Model="Model31";

else if TheModel="WORK.PE_LOGPCSUICIDE" then Model="Model32";



length Star $3;

if probt=. then star="";

        else if probt le 0.01 then star="***";

        else if probt le 0.05 then star="**";
```

```
            else if probt le 0.1 then star="*";
            else Star="";

        Results=Estimate;
        EditedResults=cats(put(Results,comma16.6),star);
        output;

        Results=StdErr;
        EditedResults=cats("(",put(Results,comma16.6),")");
        output;

        keep Model Parameter EditedResults;
Run;

Proc Sort Data=Table_Long1 out=Table_Long_Sorted1;
By Model Parameter;
run;
```

```
Data Model1Results(rename=(EditedResults=MentalHealth))

Model2Results(rename=(EditedResults=Smoking))

Model3Results(rename=(EditedResults=Alcohol))

Model4Results(rename=(EditedResults=Suicide))

Model5Results(rename=(EditedResults=LogMentalHealth))

Model6Results(rename=(EditedResults=LogSmoking))

Model7Results(rename=(EditedResults=LogAlcohol))

Model8Results(rename=(EditedResults=LogSuicide))

Model9Results(rename=(EditedResults=PCMentalHealth))

Model10Results(rename=(EditedResults=PCSmoking))

Model11Results(rename=(EditedResults=PCAlcohol))

Model12Results(rename=(EditedResults=PCSuicide))

Model13Results(rename=(EditedResults=LogPCMentalHealth))

Model14Results(rename=(EditedResults=LogPCSmoking))

Model15Results(rename=(EditedResults=LogPCAlcohol))

Model16Results(rename=(EditedResults=LogPCSuicide));

Set Table_Long_Sorted1;
```

```
If Model="Model5" then output Model1Results;
Else if Model="Model6" then output Model2Results;
else if Model="Model7" then output Model3Results;
Else if Model="Model8" then output Model4Results;
else if Model="Model13" then output Model5Results;
Else if Model="Model14" then output Model6Results;
Else if Model="Model15" then output Model7Results;
else if Model="Model16" then output Model8Results;
Else if Model="Model21" then output Model9Results;
Else if Model="Model22" then output Model10Results;
else if Model="Model23" then output Model11Results;
Else if Model="Model24" then output Model12Results;
Else if Model="Model29" then output Model13Results;
else if Model="Model30" then output Model14Results;
Else if Model="Model31" then output Model15Results;
Else if Model="Model32" then output Model16Results;
drop Model;
```

```
Run;


data Table_Wide1;

merge Model1Results Model2Results Model3Results Model4Results Model5Results
Model6Results Model7Results

Model8Results Model9Results Model10Results Model11Results Model12Results
Model13Results Model14Results

Model15Results Model16Results;

by Parameter;


length Order 5;

If Parameter = "DID" then order =1;

Else if Parameter = "Highschool" then order =2;

Else if Parameter="College" then Order=3;

else if parameter="Unemployment" then Order=4;

else order=5;

If mod(_n_,2)=1 then Variables=Parameter;

drop parameter;

run;
```

```
proc sort data=Table_Wide1;

by Order;

run;



Data RSQ1(rename=(cvalue1=MentalHealth))

     RSQ2(rename=(cvalue1=Smoking))

     RSQ3(rename=(cvalue1=Alcohol))

     RSQ4(rename=(cvalue1=Suicide))

     RSQ5(rename=(cvalue1=PCMentalHealth))

     RSQ6(rename=(cvalue1=PCSmoking))

     RSQ7(rename=(cvalue1=PCAlcohol))

     RSQ8(rename=(cvalue1=PCSuicide))

     RSQ9(rename=(cvalue1=LogMentalHealth))

     RSQ10(rename=(cvalue1=LogSmoking))

     RSQ11(rename=(cvalue1=LogAlcohol))

     RSQ12(rename=(cvalue1=LogSuicide))

     RSQ13(rename=(cvalue1=LogPCMentalHealth))
```

```
 RSQ14(rename=(cvalue1=LogPCSmoking))

 RSQ15(rename=(cvalue1=LogPCAlcohol))

 RSQ16(rename=(cvalue1=LogPCSuicide));

Set Rsq_MentalHealth Rsq_Smoking Rsq_Alcohol Rsq_Suicide

Rsq_PCMentalHealth Rsq_PCSmoking Rsq_PCAlcohol Rsq_PCSuicide

Rsq_LogMentalHealth Rsq_LogSmoking Rsq_LogAlcohol Rsq_LogSuicide

Rsq_LogPCMentalHealth Rsq_LogPCSmoking Rsq_LogPCAlcohol Rsq_LogPCSuicide

indsname=M;

where Label1="R-Square";



if M="WORK.RSQ_MENTALHEALTH" then output RSQ1;

else if M="WORK.RSQ_SMOKING" then output RSQ2;

else if M="WORK.RSQ_ALCOHOL" then output RSQ3;

else if M="WORK.RSQ_SUICIDE" then output RSQ4;

else if M="WORK.RSQ_PCMENTALHEALTH" then output RSQ5;

else if M="WORK.RSQ_PCSMOKING" then output RSQ6;

else if M="WORK.RSQ_PCALCOHOL" then output RSQ7;
```

```
    else if M="WORK.RSQ_PCSUICIDE" then output RSQ8;
    else if M="WORK.RSQ_LOGMENTALHEALTH" then output RSQ9;
    else if M="WORK.RSQ_LOGSMOKING" then output RSQ10;
    else if M="WORK.RSQ_LOGALCOHOL" then output RSQ11;
    else if M="WORK.RSQ_LOGSUICIDE" then output RSQ12;
    else if M="WORK.RSQ_LOGPCMENTALHEALTH" then output RSQ13;
    else if M="WORK.RSQ_LOGPCSMOKING" then output RSQ14;
    else if M="WORK.RSQ_LOGPCALCOHOL" then output RSQ15;
    else if M="WORK.RSQ_LOGPCSUICIDE" then output RSQ16;

    Keep Label1 cValue1 ;
Run;

Data RSQMergeNonLog (rename=(Label1=Variables));
    merge RSQ1-RSQ8;
Run;

Data RSQMergeLog (rename=(Label1=Variables));
```

```
    merge RSQ9-RSQ16;
Run;

Data OBS1 OBS2 OBS3 OBS4 OBS5 OBS6 OBS7 OBS8 OBS9 OBS10 OBS11 OBS12
OBS13 OBS14 OBS15 OBS16 ;
    set Dfs_MentalHealth Dfs_Smoking Dfs_Alcohol Dfs_Suicide
    Dfs_PCMentalHealth Dfs_PCSmoking Dfs_PCAlcohol Dfs_PCSuicide
    Dfs_LogMentalHealth Dfs_LogSmoking Dfs_LogAlcohol Dfs_LogSuicide
    Dfs_LogPCMentalHealth Dfs_LogPCSmoking Dfs_LogPCAlcohol Dfs_LogPCSuicide
indsname=M;
    Variables = "Number of Obs";
    Observ = NumDF + DenDF + 4 + 1;

    if M="WORK.DFS_MENTALHEALTH" then output OBS1;
    else if M="WORK.DFS_SMOKING" then output OBS2;
    else if M="WORK.DFS_ALCOHOL" then output OBS3;
    else if M="WORK.DFS_SUICIDE" then output OBS4;
    else if M="WORK.DFS_PCMENTALHEALTH" then output OBS5;
    else if M="WORK.DFS_PCSMOKING" then output OBS6;
```

```
    else if M="WORK.DFS_PCALCOHOL" then output OBS7;
    else if M="WORK.DFS_PCSUICIDE" then output OBS8;
    else if M="WORK.DFS_LOGMENTALHEALTH" then output OBS9;
    else if M="WORK.DFS_LOGSMOKING" then output OBS10;
    else if M="WORK.DFS_LOGALCOHOL" then output OBS11;
    else if M="WORK.DFS_LOGSUICIDE" then output OBS12;
    else if M="WORK.DFS_LOGPCMENTALHEALTH" then output OBS13;
    else if M="WORK.DFS_LOGPCSMOKING" then output OBS14;
    else if M="WORK.DFS_LOGPCALCOHOL" then output OBS15;
    else if M="WORK.DFS_LOGPCSUICIDE" then output OBS16;

    keep Variables Observ;
Run;

Data OBS1(rename=(Observ=MentalHealth))
     OBS2(rename=(Observ=Smoking))
     OBS3(rename=(Observ=Alcohol))
     OBS4(rename=(Observ=Suicide))
```

```
    OBS5(rename=(Observ=PCMentalHealth))
    OBS6(rename=(Observ=PCSmoking))
    OBS7(rename=(Observ=PCAlcohol))
    OBS8(rename=(Observ=PCSuicide))
    OBS9(rename=(Observ=LogMentalHealth))
    OBS10(rename=(Observ=LogSmoking))
    OBS11(rename=(Observ=LogAlcohol))
    OBS12(rename=(Observ=LogSuicide))
    OBS13(rename=(Observ=LogPCMentalHealth))
    OBS14(rename=(Observ=LogPCSmoking))
    OBS15(rename=(Observ=LogPCAlcohol))
    OBS16(rename=(Observ=LogPCSuicide));
Run;


Data OBSMergeNonLog;
    merge OBS1-OBS8;
Run;
```

```
/*Data OBSMergeNonLog2;
    input MentalHealth /*Smoking Alcohol Suicide  PCMentalHealth PCSmoking
PCAlcohol PCSuicide;
    MentalHealth = put(MentalHealth.12);
Run;*/



Data OBSMergeLog;
    merge OBS9-OBS16;
Run;



Data FixedEffectsNonLog;


length Variables MentalHealth Smoking Alcohol Suicide
```

```
PCMentalHealth PCSmoking PCAlcohol PCSuicide $30;


Variables = "County and Year Fixed Effects?";

MentalHealth = "Yes";

Smoking = "Yes";

Alcohol = "Yes";

Suicide = "Yes";

PCMentalHealth = "Yes";

PCSmoking = "Yes";

PCAlcohol = "Yes";

PCSuicide = "Yes";

output;

Run;


Data FixedEffectsLog;


Length Variables LogMentalHealth LogSmoking LogAlcohol LogSuicide

LogPCMentalHealth LogPCSmoking LogPCAlcohol LogPCSuicide $30;
```

```
Variables = "County and Year Fixed Effects?";

LogMentalHealth = "Yes";

LogSmoking = "Yes";

LogAlcohol = "Yes";

LogSuicide = "Yes";

LogPCMentalHealth = "Yes";

LogPCSmoking = "Yes";

LogPCAlcohol = "Yes";

LogPCSuicide = "Yes";

output;

Run;



Data Table_WideNonLog2;

    set Table_Wide1 FixedEffectsNonLog /*OBSMergeNonLog*/ RSQMergeNonLog;

    drop LogMentalHealth LogSmoking LogAlcohol LogSuicide

            LogPCMentalHealth LogPCSmoking LogPCAlcohol LogPCSuicide;

Run;
```

```
Data Table_WideLog2;
    set Table_Wide1 FixedEffectsLog /*OBSMergeLog*/ RSQMergeLog;
    drop MentalHealth Smoking Alcohol Suicide PCMentalHealth PCSmoking PCAlcohol
PCSuicide;
Run;

ods excel file="/home/u63746930/MySAS Senior Project/FinalResultsLogModels.xlsx";
proc print data=Table_WideLog2 noobs;
var Variables LogMentalHealth LogSmoking LogAlcohol LogSuicide
LogPCMentalHealth LogPCSmoking LogPCAlcohol LogPCSuicide;
format Variables $VariableName.;
footnote justify=left "Notes: *, **, and *** represent 10%, 5%, and 1% significance levels,
repectively.";
run;
ods excel close;

ods excel file="/home/u63746930/MySAS Senior Project/FinalResultsNonLogModels.xlsx";
proc print data=Table_WideNonLog2 noobs;
```

```
var Variables MentalHealth Smoking Alcohol Suicide

PCMentalHealth PCSmoking PCAlcohol PCSuicide ;

format Variables $VariableName.;

footnote justify=left "Notes: *, **, and *** represent 10%, 5%, and 1% significance levels,

repectively.";

run;

ods excel close;
```