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Ruhan Zhang April 15, 2015

How did U.S. Prohibition affect human capital?

An analysis of long-term effects of prenatal alcohol exposure

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Abstract

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Using data from IPUMS 1960-80 U.S. Census, this paper evaluates how human capital changes under a nationwide alcohol consumption reduction. Before the United States Constitution first introduced the national ban of alcoholic beverages, every state had established different levels of local option laws and even state laws of similar kinds. The introduction of the Eighteenth Amendment and the repeal of it in the Twenty-first Amendment provide a natural experimental framework for examining how maternal prenatal alcohol exposure can possibly generate huge long-term differences among children. Census data reveal that cohorts in utero when the law was strongly enforced show significantly reduced rates of physical disability, increased educational attainment, and higher possibility of marriage.

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Table of Contents

I. Introduction

Fetal Alcohol Spectrum Disorders, permanent health defects caused by mothers' prenatal alcohol consumption, are surprisingly very prevalent among newborn children and are estimated to affect at least 1% of all births in the United States (May and Gossage 2001). Since nearly half of pregnancies are unexpected in the U.S., it is crucial to warn childbearing age women, especially those having plans of pregnancy, to practice abstinence from alcohol (Finer and Zolna 2011). However, the current female alcohol drinking status is dangerously high. The National Institute on Alcohol Abuse and Alcoholism used 30 days as the general time interval for the analysis and defined any alcohol use to be having at least one drink of any alcoholic beverage and binge drinking as four or more drinks on an occasion. Using this guideline, the CDC analyzes 2006-2010 Behavioral Risk Factor Surveillance System (BRFSS) data and estimates percentages and adjusted odds ratios of women aged between 18 to 44 years having any alcohol use and binge drinking behaviors (See Table1)(CDC 2012). The CDC estimates the prevalence of pregnant women having alcohol use is 7.6% and having binge drinking is 1.4%, whereas the prevalence of non-pregnant women having alcohol use is 51.5% and having binge drinking is 15.0%. It is widely assumed that people with higher education level would have become more aware of the detrimental effects of alcohol consumption on themselves as well as on their babies in utero. Nevertheless, counter-intuitively, the study shows that women with college degrees have in fact highest possibility of cultivating alcohol consumption habits, among both pregnant and non-pregnant groups.

Based on the National Survey on Drug Use and Health (NSDUH) and Substance Abuse and Mental Health Services Administration (SAMHSA), *Healthy People 2020,* also reached a similar conclusion for pregnant women aged between 15-44 years (See Figure1)(US Department of Health and Human Services 2012). Though the Health Departments publicized the serious health effects to young children after exposing to maternal alcohol consumption, some pregnant women are still

consuming alcohol and the rate of pregnant women abstaining from alcohol fluctuates in the past decade. The rate reached its lowest point at 87.9% in 2004, but since then, it displays a clear increasing trend. Though *Healthy People 2020* sets the target rate at 98.3 for 2020, it seems to be a big challenge for both the Health Departments and social media.

Recognizing pregnant women's everlasting interests in alcohol consumption, it is more important to understand the adverse effects associated with maternal alcohol consumption, particularly, maternal alcohol exposure-related disabilities, such as Fetal Alcohol Syndrome, than ever. Rather than taking conventional approaches of examining the current decade's data, I use the 1920s Prohibition, a national law prohibiting alcohol consumption and selling, as a vehicle to analyze long-term effects of prenatal alcohol consumption. When U.S Prohibition was implemented, pregnant women's accessibility to alcoholic products was largely decreased. As a result, children who were in utero during that certain period might have less birth defects and thus less long-term adverse effects.

While prior research concentrated on studying short-term health outcomes, such as facial abnormities and attention deficits, this paper concerns more about the long-term effects that are tightly related with Fetal Alcohol Syndrome, such as disabilities, education and marriage. Given that those clinical longitudinal studies mostly used small samples, divergent and sometimes even opposite results might occur. However, in this paper, I use a comprehensive dataset to carry out the entire analysis, thus potentially strengthen the credibility of my results.

II. Historical Background

The debate of legalization of alcohol consumption could be traced back to 1607 when Europeans first introduced liquor to Native Indians who had never experienced alcohol before. Therefore, health issues, such as fainting, became a large concern among the Native Indian community. As early as 1619, The Colony of Virginia enacted a law that was explicitly against drunkenness and required that drunkards to be publicly reproved by ministers. Throughout the following decades, local governments enacted different kinds of laws changeably. The temperance movement reached a peak in the 1910s. Towards the end of 1913, the two biggest anti-liquor groups in the nation, Woman's Christian Temperance Union (WCTU) and Anti-Saloon League, decided to further facilitate national accordance on the alcohol ban; thus they marched to the Capitol and introduced the Constitutional Amendment to Congress for the very first time. (Blumenthal 2011) With the substantial support from government officials, the Eighteenth Amendment was certified on January 16th, 1919. In accordance with the law, the government contributed significant efforts to enforce the law, however, the arrival of the law adversely incented the black markets. Al Capone, one of the most infamous gang leaders in Chicago, took advantage of loopholes in the amendment that allowed scientific, religious, medical, and industrial alcohol use. After he was arrested, government officials estimated that his brewing, bootlegging and gambling businesses brought him nearly $100 million a year (or more than $1 billion a year in today's dollars).

With the boom of black markets, the Prohibition Law also led to higher homicide rates. Miron (1999) discovers that the homicide rate rises steadily from the begging of 1910s to 1933 and declines after the repeal of the Prohibition Law. Under the historical contexts of black markets, he speculates that since in black markets participants prone to use violence to resolve commercial disputes, thus leading to unexpected crime rates increase.

The increasing crime rates completely smashed conventional wisdom that alcohol consumption is the origin of violence. The quick rebound in alcohol consumption also made once-advocators for alcohol ban question whether they proposed the right solution. Pauline Morton Sabin, a once radical promoter for temperance, changed her mind and stated in public that she was now convinced that the law had been proved a total failure. When realizing the ineffectiveness of the law and witnessing market shrinkages, the government took a step back and repealed the Eighteenth Amendment in the Twenty-first Amendment on December 5th, 1933.

In general, there are a wide variety of clinical longitudinal studies evaluating Fetal Alcohol Syndrome and many researches analyzing the effectiveness of the 1920s Prohibition Law in terms of why alcohol consumption is not the major source of many social issues, including unemployment and violence. However, no one has ever related Prohibition Law with Fetal Alcohol Syndrome and provided empirical results, thus leaving many undiscovered fields for this paper to further explore.

III. Literature Review

As early as 19th century, people did not have scientific explanations in terms of how maternal alcohol consumption could affect children outcomes. However, it was widely believed by physicians and scientists that maternal alcohol consumption would have a significantly negative impact on the fetus (Warren and Hewitt 2009). Thus, from the mid 1850s until the Prohibition era, many physicians were in fact temperance advocators who supported total abstinence from alcohol use (Varma and Sharma 1981).

In 1973, two United States researchers Kenneth L. Jones and David W. Smith first identified Fetal Alcohol Syndrome (FAS) as a pattern of altered growth and morphogenesis associated with maternal alcoholism (Jones and Smith 1973). Fetal Alcohol Syndrome, accompanied with Fetal Alcohol Effects (FAE), which was later expended into Alcohol-Related Neurodevelopmental Disorder (ARND) and Alcohol-Related Birth Defects (ARBD), is a subgroup under a larger umbrella syndrome Fetal Alcohol Spectrum Disorders (FASDs)(Streissguth et al. 2004). This major finding stimulated large scientific interests in further studying to what extents and aspects would prenatal alcohol exposure affect children. This finding also caught government advisory departments' attention. In 1981, The Surgeon General first advised women who were pregnant, or considering pregnancy not to drink alcoholic beverages and to be aware of the alcoholic content of foods and drugs because of a series of defects that alcohol consumption could cause in newborn children (US Department of Health and Human Services 1981). In 2005, The Surgeon General again released an immediate note to warn women to abstain from alcohol consumption and made clarifications that any amount of alcohol at any pregnancy stage would not be considered safe (US Department of Health and Human Services 2005).

Throughout the last couple decades, researchers identified several different pronounced abnormal facial features associated with Fetal Alcohol Syndrome. Fetal Alcohol Syndrome Children have

more possibilities to have small head circumferences, small eye openings, low nasal bridges and etc. (See Figure 2) (Gordis 1991). Though discriminating facial features are normally regarded as hallmarks of Fetal Alcohol Syndrome, *10th Special Report to the U.S. Congress on Alcohol and Health* (2000) points out that they are not present among all children who have been exposed to alcohol before birth (US Department of Health and Human Services et al. 2000). In fact subtler and more hazardous consequences associated with FAS are truly within children's brain functionality. An expanding body of research using magnetic resonance imaging (MRI) discovers that people with FAS have relatively smaller brain size, reduced cerebellum volume and thinner corpus callosum (Archibald et al. 2001, Mattson et al. 1992). These abnormal brain variations could affect the overall intellectual performance, language-learning abilities, and memorizing abilities to different extents. Streissguth et al. (1990), after doing an experiment which closely observed the children whose mother had alcohol consumption in their pregnancy periods, also notices that children exposed to more than 1 ounce of absolute alcohol per day mid pregnancy had a mean IQ 6.7 points lower than children exposed to less than this amount.

So far, clinical longitudinal researches also have made incredible efforts in analyzing the correlations of adverse attention deficits and prenatal alcohol exposure. Nanson et al. (1990) discovers that FAS children tend to display similar attention deficits levels with Attention Deficit Disorder (ADD) children. Nanson further suggests that treatments that are beneficial to ADD children could be applicable to FAS to facilitate attention practices. On the other hand, Fried et al. (1980) argue that there is no clear relationship between maternal alcohol consumption and a lack of attention in children by using a sample predominantly involves low-alcohol-consumption mothers (Fried, Watkinson and Gray 1992).

Though different studies reach conflicting conclusions as to whether prenatal alcohol exposure would affect cognitive outcomes, O'Callaghan et al.(2007) discover that the seemingly

inconsistencies arise from both timing and quantity of alcohol consumption. Analyzing Master University of Queensland Study of pregnancy (MUSP) participants, O'Callaghan finds that no adverse attention, learning or cognitive outcomes are displayed for alcohol consumption of <1 glass/day in the early or late pregnancy period. Instead, increasing prevalence of overall learning difficulty is shown in late pregnancy exposure.

Besides primary disabilities, referring to brain damages, there is another type of disabilities called secondary disabilities that are not present at birth but occur as a direct result of primary disabilities. Streissguth et al. (1996) discovers that these secondary disabilities usually include mental health problems, trouble with the law and alcohol/drug problems and employment problems.

IV. Data and Empirical Model

In order to analyze how the Prohibition Law affected human capital, I combine two datasets into one unified dataset. Respectively, one data file is the Integrated Public Use Microdata Series (IPUMS), which consists of the individual-level information, and the other one is the Prohibition Law Years Specification, which provides a comprehensive record of the nationwide Prohibition Law movements.

3.1 The 1960-80 Integrated Public Use Microdata Series (IPUMS)

Though the Eighteenth Constitutional Amendment was ratified on January 16, 1919 and was taken into effect on January 17, 1920, most states had had statewide or countywide laws that set different protocols for alcohol sales. Therefore, IPUMS, which identifies the state of birth, is the most approachable dataset and allows the analysis controlled by states.

Since state laws were progressively executed and they were usually within a relatively short period of time, the identification of the quarter of birth would potentially aid the preciseness of the analysis. Among the IPUMS censuses dated later than 1900, only the 1960, 1970 and 1980 censuses provide records of the quarter of birth; therefore I combine 1% of the state sample from 1960, 1% of the state fm1 sample from 1970, and 5% of the state sample from 1980.

The year and quarter of birth variable *born* is constructed as

$$\text{Born} = \text{birth year} + (\text{birth quarter} - 1) * 0.25$$

Using this notation, the 1st quarter would be transformed to be .00, the 2nd quarter to be .25, the 3rd quarter to be .50, and the 4th quarter to be .75.

Since normally the female gestation lasts 9 months, which is approximately 3 quarters of a year,

variable *pregnant* is then constructed as

$$\text{Pregnant} = \text{Born} - 0.75$$

According to the above equation, a person who was born in August 1923, his or her variable *born* would be coded as 1923+ (3-1)*0.25=1923.50 since he or she was born in the 3rd quarter of the year. Thus, the corresponding variable *pregnant* would be 1923.50-0.75=1922.75.

3.2 Prohibition Law Years Specification

The Prohibition Strong Law Period and the Weak Law timing for each state are defined according to *The Anti-Saloon League Year Book* published in 1920 (See Table 2)(Anti-saloon League of America). Livingston (2015) also used this book along with other years of series published throughout the decade to identify the approximate Prohibition Law timelines. Though his table is primarily concerned with city-level, his work still provides a cross-table validation for constructing my table, which addresses largely state-level data.

Though every effort is made to retain the objectiveness of the study, it is difficult to make clear decisions about the timing of the Prohibition Law because unfortunately, true alcohol consumption data are not available. My strategy to address this issue is to divide all the years that are believed to be related with the Prohibition Law into four periods: no law periods, weak law periods, strong law periods and post-law periods for each state. However, the inherent discrepancies among the laws across all states can be inevitably large. Some enacted local option laws compelled all saloons to close at 8 o'clock and not to open until 7a.m., whereas some laws banned liquor shipments and transportation. Since it is impossible to establish a unified quantitative standard, or even a relatively qualitative standard, when I am determining which particular government actions and

laws can be regarded as signs of weak, strong, post or no law periods, some level of subjectivity is inevitably incorporated into the data section.

In addressing the issue of the subjectivity in transforming the data for the timing of The Prohibition Law, several general guidelines are developed to maintain the uniformity of coding data. The implementation of any sorts of statewide laws marks the start of the Strong Law. It is common that the state law enacted by the Legislature in one year went into effect in a different year. In these cases, the timeframe that the law actually went into effect would be considered the inception. The determination of the Weak Law period is comparatively more intricate, as even though some local option laws were implemented, generally people did not alter their alcohol-consumption behaviors accordingly. Therefore, the alternative way to understand the substance of the Weak Law becomes the proportion of abolished saloons or the proportion of dry counties across the state.

Setting the criteria for determining when the Strong Law Periods' ended and the Post Law periods began, I integrate the fact that alcohol consumption was sharply increased right after the promulgation of the Eighteenth Amendment. Miron et al. (1991), used alcoholism deaths, drunkenness arrests, cirrhosis deaths and alcoholic psychosis to estimate the national alcohol consumption (See Figure 3). These four estimations all reached their lowest points in 1920, when the Eighteenth Amendment was officially taken into effect, but they all at the same time experienced a sharp increase from 1921 to 1927. The Moderation League (1928) conducted a national survey in 1928 and collected intoxication arrests data from as many police departments as possible (See Figure 4). Given the fact that the intoxication arrests are quick impacts of alcohol consumption, this dataset is one of the most reliable indicators of the effectiveness of the Prohibition Law. This survey also provides similar patterns with Miron. The aggregated intoxication arrests level reached its lowest point at 235,612 in 1919 when aggregating the reports from all places from 1914 to 1927. For wet places where alcohol was widely sold, the number of the

aggregated intoxication arrests was the lowest in 1920 and in 1926 the number even surpassed the 1914 level. Dry places where the sale of alcohol was prohibited, though believed to have greater adherence to the law, experienced a steady but a relatively higher increase since hitting its lowest level in 1919.

The Strong Law period ranging between the issue and the repeal of the Eighteenth Amendment could no longer capture the true trend; thus, I divide this lump-sum period into two separate periods: the Strong Law period and the Post Law Period. Without the state-level, alcohol-consumption information, the data provided by the Moderation League can provide a more general trend. In Figure 3, before the national Prohibition Law, the highest point for the total number of intoxication arrests occurred in 1915 at 115,810. However, in 1925, the number of intoxication arrests was at 116,229, which surpassed the 1915 data. In this sense, the year 1925 can be considered the end of a relatively strong law enforcement period, thus making 1926.00 as the unified end of the Strong Law period for all states.

Strong Laws, Weak Laws and Post Laws are constructed in binary notations.

$$\begin{cases} Strong\ Law = 1, if\ the\ individual\ was\ in\ utero\ in\ any\ Strong\ Law\ periods \\ Weak\ Law = 1, if\ the\ individual\ was\ in\ utero\ in\ any\ Weak\ Law\ periods \\ Post\ Law = 1, if\ the\ individual\ was\ in\ utero\ after\ 1926.00 \end{cases}$$

3.3 Estimation Framework

I use the following analytical model framework to investigate how one's disability, education and marriage would change if one were in utero during the Strong Law period, Weak Law period or Post Law period, respectively.

$$y_i = \beta_0 + \beta_1 StrongLaw_i + \beta_2 WeakLaw_i + \beta_3 PostLaw_i + \beta_4 Pregnancy_i + \beta_5 Pregnancy_i^2 + \beta_6 Sex_i + \beta_7 black_i + \beta_7 american\_indian_i + \beta_7 asian_i + \varepsilon_i$$

where y_i takes values of education, disability and marriage.

Disability data are only available in the 1970 and 1980 censuses. Any person who has any lasting physical or mental health conditions that both limit working and not limit working is regarded as a disabled person. Since I aim to evaluate long-term disabilities, disabilities due to temporary health conditions are not considered as disabilities in the analysis.

Education and marriage data are both available in all three censuses. Education indicates one's highest grade of school attended or completed. For marriage, as long as the individual once has marriage, he or she will be considered a married person.

Variables that are intended to control for demographic variations include sex (1 for male) and race/ethnicity (white, black, American Indian, and Asian). To derive the unbiased estimations on the impacts of the laws, *pregnancy* and $pregnancy^2$ are included to adjust for the general yearly trend that affects y_i.

3.4 Further Adjustments

Under this empirical framework, further adjustments are made to address the imbalanced census samples. Given the fact that the original IPUMS dataset incorporates 1% of the state sample from 1960, 1% of the state fm1 sample from 1970 and 5% of the state sample from 1980, the 1980 census would potentially have approximately five times the weight of the 1960 and 1970 censuses when examining the aggregate effects of the Strong Law, the Weak Law and the Post Law on y_i using all census years.

Therefore, I create a 1% state sample from 1980, which is 20% of the current 1980 census. I randomly assign numbers to each 1980 census observation and divide the entire census into five equal samples. I randomly choose Sample 1 for the further pooled sample analysis.

3.5 Important Remarks

Almond (2006) also used similar datasets to evaluate the long-term health effects of the 1918 Influenza. He discovers that people who were in utero during this period displayed reduced educational attainment and experienced increased rates of physical disability. Given the fact that 1918 Influenza pandemic did affect human health capital, it would be beneficial to incorporate this external shock into my analysis. Almond points out that the pandemic seemed to vary arbitrarily within the states as well. Thus, in order to thoroughly eliminate this shock from my study, the exact state-level 1918 Influenza data should be used. As this kind of dataset is not widely available, I choose to leave the shock off my analysis. However, reassuringly, this pandemic lasted for at most one year. A one-year shock probably does not impact the final results of my study, as I evaluate the impacts of alcohol-consumption on human capital for extending periods of time intervals.

V. Discussions

In this section, I present the empirical results of the study. The results are organized into three separate sections: Disability, Education and Marriage.

A. Disability

Since the state-level Fetal Alcohol Syndrome rates are not attainable from public sources, the general disabilities from the IPUMS are used as proxies. The OLS regression provides puzzling results that it show that disability is positively related with the Strong Law period, suggesting that when the Prohibition Law was strongly enforced, disability on average in fact increased (See Table 3). However, when using the state Fixed Effects estimation, the variable disability becomes negatively associated with the Strong Law period and the relationship is also statistically significant. The fact that the sign shifts from positive to negative suggests that disability is correlated with the state fixed effects, which in turn attests to the initial assumption that the state-level analysis is remarkably preferable to the national-level one.

Table 4 provides the impact of different periods of the Prohibition Law on disability in different census. Discrepancies in coefficients for both the Strong Law and the Weak Laws can be easily noticed: the 1970 census reveals a significantly negative relationship, whereas the 1980 census exhibits a significantly positive relationship. The difference in the signs of these two censuses is the result of the inherent characteristics of different censuses data. The number of people who were in utero between 1900 and 1933 is 725,681 in the 1960 census, 682,261 in 1970 census, and 617,916 in the 1980 census Sample 1. There are progressive number shrinkages because some people passed away between censuses. This cohort comprises of some old people in their 70s and 80s. Also, it is very likely that people who had certain disabilities would die at an earlier age. Therefore, people who were left in later census years are expected to be generally healthier and less disabled.

Since the 1980 census has more selection bias in cohort composition, it might not be fully reliable any more for my further analysis. Thus, the 1970 census is mainly used as a reference census.

The negative relationship of the Weak Law period and disability strongly accords with the expected result that overall consumption of alcohol would gradually decrease in the Weak Laws period. Although the impacts of the Weak Law period are fairly small at only -0.008, it is possible that alcohol consumption in some states might increase in this particular period. Some pioneering states restricting alcohol consumption started their Weak Law period as early as 1898. In contrast to these pioneering states, some other states, such as Pennsylvania, enforced no Weak Law periods at all. People who were living in these states, would notice that the general trend of alcohol ban and the Anti-Saloon League movements in the other states, and then they would surmise that alcohol would be ultimately banned at the national level. Confronting this situation, people residing in these states would consume as much alcohol as possible before the official promulgation of the Prohibition Law. It is also very plausible that people from dry states across the border to buy the alcohol and store them for future use. Therefore, when aggregating the impacts of all the states together, the effect could be very tiny.

My study also reveals that the Post Law period poses 0.038 points higher rate of disabilities than the Weak Law period. This result confirms the findings of Miron et al. (1991) that alcohol consumption dramatically increased to a higher level in the Post Law period than in the previous Weak Law period. This finding suggests that when the alcohol ban was loosely enforced in the Post Law period, the possibility of being disabled could actually increase, not decrease, comparing to society with no enforcement of the Prohibition Law. The study's result further indicates that the nationwide prohibition, except for the Strong Law periods that only lasted for on average 6-7 years, contributed more negatively to society than economists previously realized.

B. Education

Some scientists discover that people with Fetal Alcohol Syndrome will experience some degrees of attention deficit, which in turn lead to intellectual impairs in their earlier age. However, not all people agree this argument. There is still a huge debate about whether or not prenatal alcohol consumption can affect a child's intellectual performance. Since issues relating to intellectual performances are partially correlated with education attainment, an increasing trend in education is expected in the Prohibition Law periods when mothers were suppose to be restricted to the access to alcohol consumption.

Table 3, aggregating 1960, 1870, 1980 censuses, presents evidence that the children's education were indeed significantly related with the maternal alcohol consumption when the fixed effects are included in the estimates. A consistent pattern across all census years is that the coefficients for the Weak Law are always bigger than the coefficient for the Strong Law, suggesting that the Weak Law has unexpected larger impact on raising education attainment more than the Strong Law period (See Table 5). Though the Strong Law had a big initial impact on alcohol consumption, the rapid increase in the alcohol consumption after the first few years' implementation cannot be ignored. Since increased bootlegging activities made it easier to get access to alcohol over time, it is possible that towards the end of the Strong Law period, the Strong Laws' effects in regressions are reversed. It will attenuate the absolute value of coefficient and made the strong law coefficient goes to zero. Though the Strong Law effect is indeed statistically significant, the illegal drinking and illegal alcohol selling activities lead to the shrinkage of the effect.

Economists mostly contend that education is closely associated with intellectual abilities; however, children who display some sorts of intellectual impairment may have more incentives to pursue higher education. Also, the education variable in this study only indicates the education degrees, rather than the achievements accomplished through education. Therefore, though a positive effect

in the variable education is clearly witnessed in different censuses, it is important to bear in mind that this result does not directly resolve the heated debate on whether maternal alcohol exposure will largely affect children's intellectual abilities.

C. Marriage

Although the Prohibition Law might not directly affect marriage, it is very interesting to examine how this important social indicator would change under a nationwide policy change, especially when human capital was greatly improved. In this analysis, I mainly evaluate whether people who were in utero during the Law period had larger chances of getting married, compared with other cohorts. Thus, people who ever got married will be considered a married person.

In Table 6, coefficients for most Law periods are positive, except for the Weak Law effect in 1960 census analysis. Nevertheless, the effect is considerably tiny, approximately at -0.004. Since small effects are technically difficult to be detected, thus, reversing signs are possible. In general, the national ban is associated with higher educational attainment and decrease disability of the general cohort, thus affecting the marriage rate. The effect on marriage is probably in a positive direction, but it is definitely tiny.

VI. Limitations

The 1920s Prohibition Law provides a great natural experiment setting for evaluating the relationships between maternal alcohol exposures and children disabilities, education attainment, and marriage status. Nevertheless, several presumptions will potentially limit the robustness of the estimations.

The first limitation arises from the nature of the dataset. IPUMS, including a variety of individual demographics, fails to identify the fathers' education level and the mothers' education level. Therefore, when I am trying to estimate the effects of the Law on the individual's education, many crucial variables are omitted and left into the error term; therefore the coefficients estimation would not be entirely unbiased and inconsistent.

Additionally, the entire study is carried out based on the assumption that the Prohibition Law, which presumably limited the overall level of alcohol consumption and thus restricted the level of female alcohol consumption. If the overall consumption displays a decreasing trend, I assume that the female consumption rate would demonstrate a decreasing trend as well. However, the non-availability of female alcohol consumption data left many possibilities open. Though I have observed a large decrease in the amount of general alcohol consumption, women might not be the huge contributors to the overall alcohol consumption. It is highly possible that in 1920s, women were not as open-minded as today; therefore, many women did not develop habits in drinking alcohol beverage. Even if the Prohibition Law were successfully executed, there would not be a large discrepancy in the female alcohol consumption before and after the law enforcement period.

VII.Conclusion

In this paper, I present the first study using individuals' demographics along with state-level Prohibition Law timing to predict the effect of maternal alcohol exposures on adult outcomes. My results suggest that when alcohol consumption is greatly decreased, human capital would potentially improve: people are less likely to have disabilities, more likely to have higher education attainment, and slightly higher marriage rates. These findings validate the persisting idea that maternal alcohol consumption could bring a variety of adverse effects on children and decrease both children's mobility and intellectual abilities. These findings, along with the prior researches done in the health disciplines, will help enhance people's awareness in the severity in the related issues of the Fetal Alcohol Syndrome and potentially offer women more data-driven proofs about the prenatal alcohol exposure adverse effects.

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IX. Tables and Figures

Table 1

Estimated percentages and adjusted odds ratios of female alcohol use and binge drinking behaviors (2006-2010)

	Pregnant (n = 13,880)				Nonpregnant (n = 331,196)			
	Any use		Binge drinking		Any use		Binge drinking	
	%	AOR	%	AOR	%	AOR	%	AOR
Total	7.6		1.4		51.5		15	
Age group (yrs)								
18–24	4.5	1	1.3	1	48.5	1	20.5	1
25–29	6.9	1.5	1.3	1.3	53.8	1.1	18.5	1
30–34	7.9	1.7	1.4	1.4	51.6	0.9	13.3	0.7
35–44	14.3	3.3	1.5	1.5	52.2	0.9	11.8	0.6
Race/Ethnicity								
White, non-Hispanic	8.3	1.2	1.5	1.2	58.3	1.9	17.7	1.8
Black, non-Hispanic	7.3	1	0.7	0.4	43.9	1.1	9.8	0.8
Hispanic	5.7	1	1.4	1	35.7	1	10.3	1
Other	8.1	1.2	1.3	1	43.4	1	12.1	1.1
Education								
High school diploma or less	5	1	1.4	1	37	1	12.5	1
Some college	7.7	1.4	1.3	1	53.4	1.7	16.6	1.3
College degree	10	1.6	1.4	1	64.6	2.7	16.3	1.4
Employed								
Yes	9.6	1.6	1.8	2.4	57.9	1.7	16.7	1.5
No	5.2	1	0.8	1	41.3	1	12.4	1
Married								
Yes	7.6	1	1	1	52.3	1	12	1
No	7.6	1.8	2.1	3.1	50.6	1.2	18.9	1.7

SOURCE.- Morbidity and Mortality Weekly Report (MMWR) 2012

Note.- AOR = adjusted odds ratio.

Table 2

Prohibition Law Progress in Alphabetical List of States

State	Weak Law Start	Weak Law End	Strong Law Start	Strong Law End	Total Effective Years
Alabama	1907.00	1915.25	1915.50	1926.00	18.75
Alaska			1918.00	1926.00	8.00
Arizona	1909.00	1914.75	1915.00	1926.00	16.75
Arkansas	1913.00	1915.75	1916.00	1926.00	12.75
California	1909.00	1919.25	1919.50	1926.00	16.75
Colorado	1907.00	1915.75	1916.00	1926.00	18.75
Connecticut	1915.00	1919.25	1919.50	1926.00	10.75
Delaware	1907.00	1919.25	1919.50	1926.00	18.75
DC			1917.50	1926.00	8.50
Florida	1913.00	1914.75	1915.00	1926.00	12.75
Georgia	1908.00	1916.00	1916.25	1926.00	17.75
Hawaii			1918.25	1926.00	7.75
Idaho	1909.00	1915.75	1916.00	1926.00	16.75
Illinois	1907.00	1919.25	1919.50	1926.00	18.75
Indiana	1908.00	1910.75	1918.25	1926.00	10.50
Iowa			1916.00	1926.00	10.00
Kansas			1880.00	1926.00	46.00
Kentucky	1894.00	1919.25	1919.50	1926.00	31.75
Louisiana	1909.00	1919.25	1919.50	1926.00	16.75
Maine			1884.00	1926.00	42.00
Maryland	1916.00	1919.25	1919.50	1926.00	9.75
Massachusetts			1919.50	1926.00	6.50
Michigan	1908.00	1918.00	1918.25	1926.00	17.75
Minnesota	1915.00	1919.25	1919.50	1926.00	10.75
Mississippi	1886.00	1908.75	1909.00	1926.00	39.75
Missouri	1913.00	1919.25	1919.50	1926.00	12.75
Montana	1917.00	1918.50	1918.75	1926.00	8.75
Nebraska	1911.00	1917.00	1917.25	1926.00	14.75
Nevada			1919.00	1926.00	7.00
New Hampshire	1903.00	1918.00	1918.25	1926.00	22.75
New Jersey	1918.00	1919.25	1919.50	1926.00	7.75
New Mexico	1913.00	1918.50	1918.75	1926.00	12.75
New York	1917.25	1919.25	1919.50	1926.00	8.50
North Carolina			1909.00	1926.00	17.00
North Dakota			1889.75	1926.00	36.25
Ohio	1888.00	1919.00	1919.25	1926.00	37.75
Oklahoma			1907.75	1926.00	18.25
Oregon	1904.50	1914.75	1915.00	1926.00	21.25

Table 2 (Continued)
Prohibition Law Progress in Alphabetical List of States

State	Weak Law Start	Weak Law End	Strong Law Start	Strong Law End	Total Effective Years
Pennsylvania			1919.50	1926.00	6.50
Rhode Island			1919.50	1926.00	6.50
South Carolina			1892.00	1926.00	34.00
South Dakota	1898.00	1917.25	1917.50	1926.00	27.75
Tennessee			1909.50	1926.00	16.50
Texas			1918.50	1926.00	7.50
Utah	1911.00	1917.25	1917.50	1926.00	14.75
Vermont	1903.00	1919.25	1919.50	1926.00	22.75
Virginia	1904.00	1916.50	1916.75	1926.00	21.75
Washington	1909.00	1915.75	1916.00	1926.00	16.75
West Virginia	1910.00	1914.25	1914.50	1926.00	15.75
Wisconsin			1919.50	1926.00	6.50
Wyoming			1919.50	1926.00	6.50

SOURCE.- Anti-Saloon League Year Books, 1920

NOTE.- Approximations were used to denote years into specific periods.

.-For Alabama, the first Weak Law period started in 1907.00 and ended in 1908.75 and the second Weak Law period started in 1911.25 and ended in 1915.25. The first Strong Law period started in 1909.00 and ended in 1911.00 and the second Strong Law period started in 1915.50 and ended in 1926.00. For Oregon, the first Weak Law period started in 1904.50 and ended in 1910.75 and the second Weak Law period started in 1913.00 and ended in 1914.75. In terms of consistencies of different law periods for all states, law periods combinations are made in this table, however exact law periods are used in actual regressions.

Table 3

Impact of Prohibition Law on Education, Disability and Marriage between 1900-1933

	Disability		Education		Marriage	
strong	0.020***	-0.015***	-0.276***	0.040***	0.021***	0.002**
	(0.001)	(0.002)	(0.010)	(0.011)	(0.001)	(0.001)
weak	0.022***	0.003**	0.029***	0.079***	0.013***	-0.001
	(0.001)	(0.001)	(0.008)	(0.009)	(0.001)	(0.001)
postlaw	0.067***	0.022***	-0.496***	-0.058***	0.024***	-0.000
	(0.002)	(0.003)	(0.017)	(0.018)	(0.001)	(0.001)
pregnancy	1.592***	1.562***	1.827***	3.132***	0.368***	0.371***
	(0.025)	(0.026)	(0.182)	(0.182)	(0.013)	(0.014)
pregnancy2	-0.000***	-0.000***	-0.000***	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sex	0.017***	0.017***	-0.012**	-0.017***	-0.014***	-0.014***
	(0.001)	(0.001)	(0.005)	(0.005)	(0.000)	(0.000)
black	0.088***	0.081***	-2.438***	-2.209***	-0.020***	-0.020***
	(0.001)	(0.001)	(0.008)	(0.008)	(0.001)	(0.001)
ame_ind	0.139***	0.130***	-2.648***	-2.789***	-0.029***	-0.038***
	(0.006)	(0.006)	(0.044)	(0.043)	(0.003)	(0.003)
asian	-0.033***	-0.022***	-0.859***	-1.230***	-0.025***	-0.024***
	(0.003)	(0.004)	(0.025)	(0.028)	(0.002)	(0.002)
Constant	-1,518.809***	-1,491.526***	-1,839.302***	-3,073.612***	-350.415***	-353.973***
	(24.270)	(24.457)	(174.498)	(174.348)	(12.860)	(12.970)
Fixed Effect	No	Yes	No	Yes	No	Yes
Observations	1,300,112	1,300,112	2,025,793	2,025,793	2,025,793	2,025,793

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4

Impact of Prohibition Law on Disability Using Different Census Years

	1970		1980	
strong	-0.009***	-0.038***	0.053***	0.014***
	(0.002)	(0.002)	(0.001)	(0.001)
weak	0.009***	-0.008***	0.038***	0.016***
	(0.001)	(0.002)	(0.001)	(0.001)
postlaw	0.067***	0.030***	0.062***	0.012***
	(0.003)	(0.003)	(0.002)	(0.002)
pregnancy	2.673***	2.645***	-0.104***	-0.118***
	(0.031)	(0.032)	(0.018)	(0.018)
pregnancy2	-0.001***	-0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
sex	0.019***	0.019***	0.021***	0.021***
	(0.001)	(0.001)	(0.000)	(0.000)
black	0.069***	0.064***	0.112***	0.102***
	(0.001)	(0.001)	(0.001)	(0.001)
ame_ind	0.107***	0.099***	0.136***	0.128***
	(0.008)	(0.008)	(0.004)	(0.004)
asian	-0.023***	-0.019***	-0.056***	-0.045***
	(0.005)	(0.005)	(0.002)	(0.002)
Constant	-2,557.991***	-2,532.452***	111.648***	123.712***
	(29.954)	(30.233)	(17.076)	(17.180)
Fixed Effect	No	Yes	No	Yes
Observations	682,261	682,261	3,085,359	3,085,359

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5

Impact of Prohibition Law on Education Using Different Census Years

	1960		1970		1980	
strong	-0.333***	0.041**	-0.252***	0.054***	-0.248***	0.045***
	(0.016)	(0.018)	(0.017)	(0.019)	(0.008)	(0.009)
weak	0.007	0.083***	0.042***	0.081***	0.028***	0.072***
	(0.013)	(0.015)	(0.014)	(0.016)	(0.007)	(0.008)
postlaw	-0.643***	-0.117***	-0.433***	-0.012	-0.461***	-0.058***
	(0.029)	(0.031)	(0.030)	(0.032)	(0.014)	(0.015)
pregnancy	1.539***	3.285***	2.932***	4.203***	0.026	0.998***
	(0.297)	(0.297)	(0.310)	(0.310)	(0.155)	(0.155)
pregnancy2	-0.000***	-0.001***	-0.001***	-0.001***	0.000	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sex	-0.078***	-0.084***	-0.019**	-0.023***	0.095***	0.088***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.004)	(0.004)
black	-2.585***	-2.319***	-2.417***	-2.202***	-2.274***	-2.064***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.007)	(0.007)
ame_ind	-3.131***	-3.191***	-2.972***	-3.112***	-2.312***	-2.482***
	(0.080)	(0.079)	(0.079)	(0.079)	(0.032)	(0.032)
asian	-0.894***	-1.215***	-0.726***	-1.101***	-1.027***	-1.406***
	(0.049)	(0.056)	(0.046)	(0.051)	(0.018)	(0.019)
Constant	-1,562.429***	-3,216.231***	-2,896.397***	-4,097.908***	-113.353	-1,030.417***
	(284.126)	(284.036)	(296.652)	(296.562)	(148.382)	(148.027)
Fixed Effect	No	Yes	No	Yes	No	Yes
Observations	725,681	725,681	682,261	682,261	3,085,359	3,085,359

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6

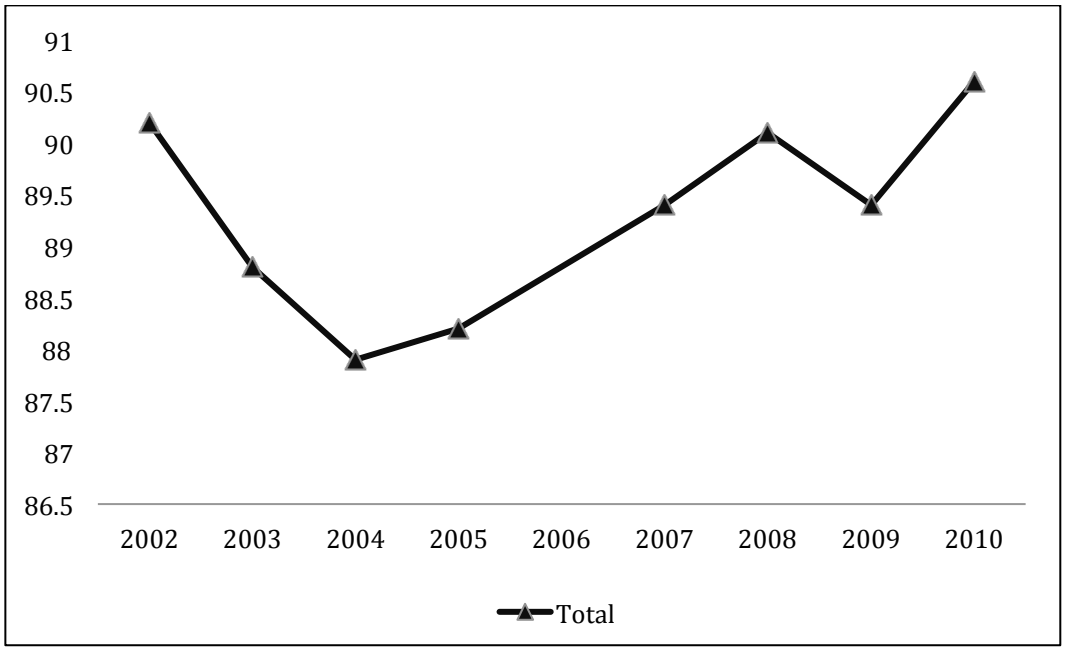
Impact of Prohibition Law on Marriage Using Different Census Years

	1960		1970		1980	
strong	0.029***	0.006***	0.016***	-0.001	0.017***	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
weak	0.014***	-0.004***	0.012***	-0.000	0.012***	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
postlaw	0.030***	0.002	0.018***	-0.003	0.020***	-0.002*
	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
pregnancy	0.793***	0.793***	0.175***	0.181***	0.082***	0.089***
	(0.025)	(0.025)	(0.023)	(0.023)	(0.010)	(0.010)
pregnancy2	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sex	-0.027***	-0.027***	-0.008***	-0.008***	-0.003***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
black	-0.019***	-0.020***	-0.019***	-0.019***	-0.021***	-0.020***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
ame_ind	-0.093***	-0.103***	-0.012**	-0.020***	0.001	-0.007***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.002)	(0.002)
asian	-0.074***	-0.080***	-0.028***	-0.030***	-0.005***	-0.005***
	(0.004)	(0.005)	(0.003)	(0.004)	(0.001)	(0.001)
Constant	-756.278***	-757.461***	-166.437***	-173.029***	-77.137***	-85.046***
	(23.452)	(23.691)	(21.615)	(21.804)	(9.449)	(9.515)
Fixed Effect	No	Yes	No	Yes	No	Yes
Observations	725,681	725,681	682,261	682,261	3,085,359	3,085,359

Standard errors in parentheses

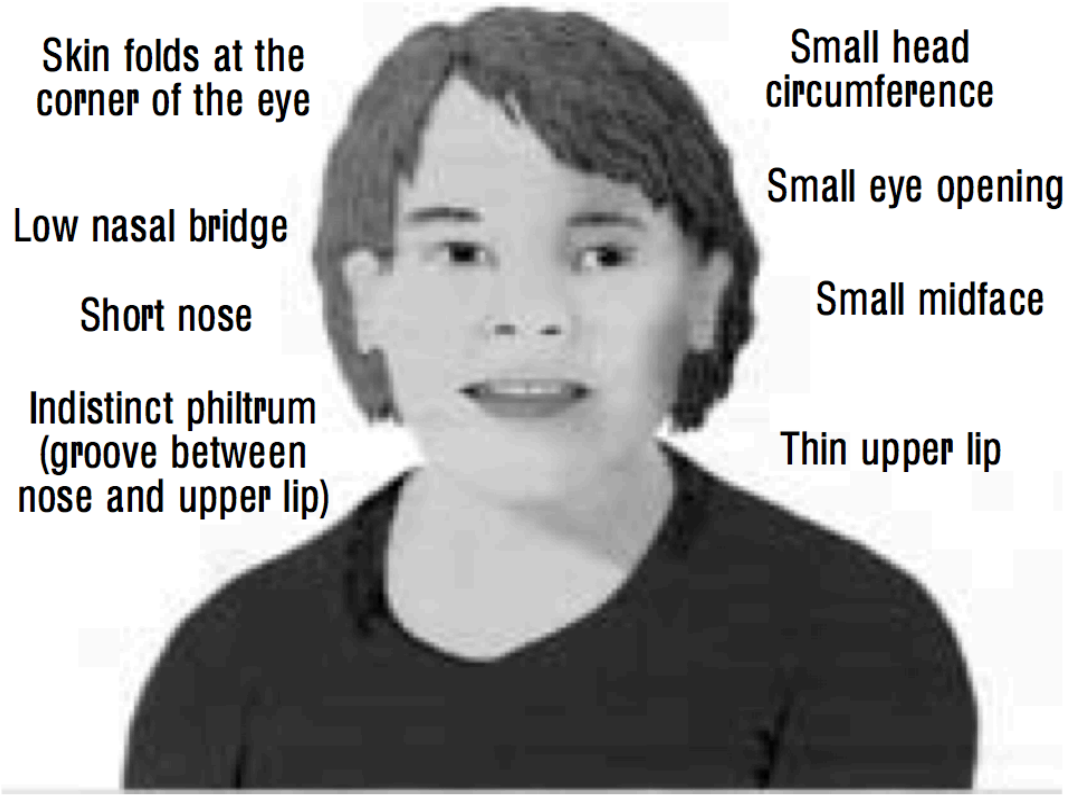
*** p<0.01, ** p<0.05, * p<0.1

Figure 1
Pregnant Women (15-44 years) Abstaining from Alcohol in Past 30 Days



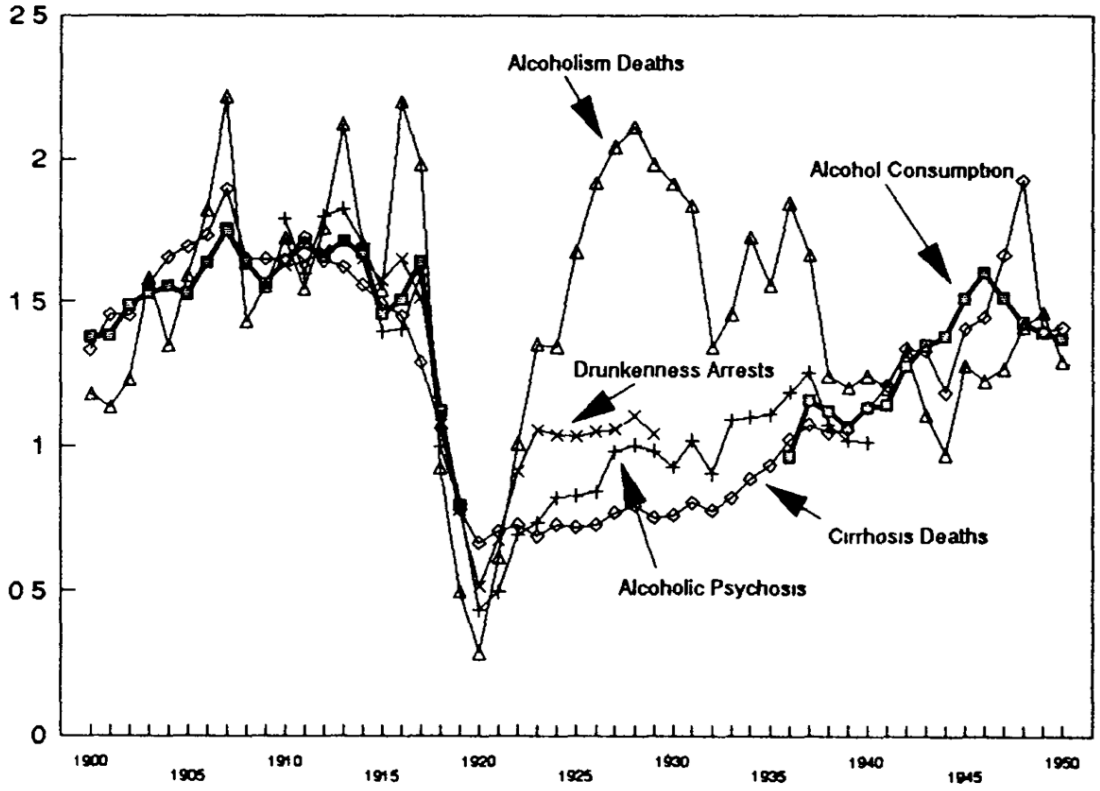
SOURCE.- National Survey on Drug Use and Health (NSDUH); Substance Abuse and Mental Health Services Administration (SAMHSA)

Figure 2
Fetal Alcohol Syndrome Facial Features



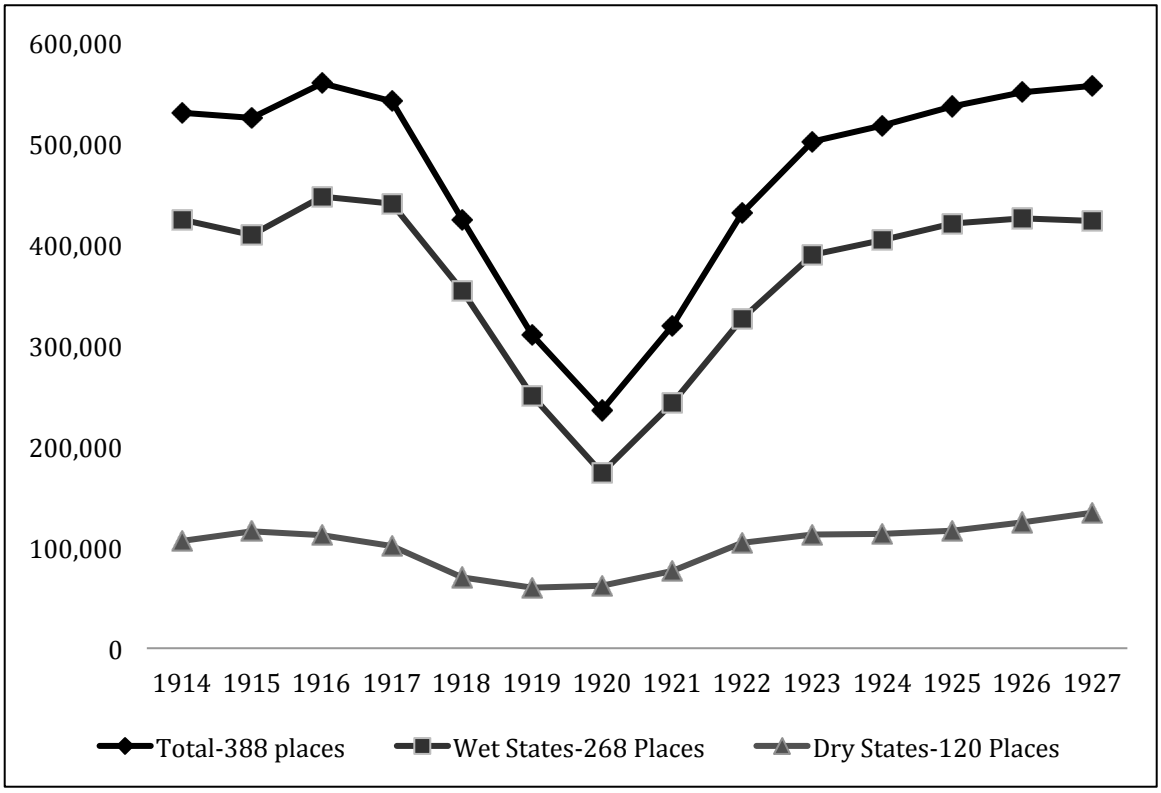
SOURCE.- Alcohol Research: Promise for the Decade

Figure 3
Estimated Alcohol Consumption in Pure Gallons of Alcohol Per Capita



SOURCE.- National Survey on Drug Use and Health (NSDUH); Substance Abuse and Mental Health Services Administration (SAMHSA)

Figure 4
Summary of Intoxication Arrests



SOURCE.- A National Survey of Conditions Under Prohibition 1928