The Effect of Alcohol Prohibition on Alcohol Consumption: Evidence from Drunkenness Arrests

Angela K. Dills
John E. Walker Department of Economics, Clemson University

Mireille Jacobson
Department of Planning, Policy & Design, University of California, Irvine

Jeffrey A. Miron*
Department of Economics, Boston University

Abstract

We examine the relationship between Prohibition and alcohol consumption using city-level drunkenness arrests. We find that Prohibition had a substantial short-term but little long-term impact. The implied pattern of alcohol consumption is similar to that suggested by cirrhosis.

Keywords: Prohibition; drunkenness arrests; alcohol consumption
JEL codes: I18; K00

* Corresponding author. Department of Economics, Boston University, Boston, MA 02215; Tel.: 781-856-0086; e-mail: jmiron@bu.edu.

1. Introduction

The effect of Alcohol Prohibition on alcohol consumption has been the subject of long-standing debate. Since data on alcohol consumption are not available for the Prohibition period, most authors have used cirrhosis death rates as a proxy for alcohol consumption.[1] Cirrhosis is a reasonable proxy, but it suffers several limitations. There is a substantial lag between alcohol consumption and death from cirrhosis, and the relation between cirrhosis and alcohol consumption is potentially asymmetric, with decreases in consumption producing roughly contemporaneous declines in cirrhosis (since the liver regenerates to some degree if drinking stops) but increases in consumption taking years or decades to cause cirrhosis (Berkow 1992, pp. 890-893).

This paper utilizes city-level data on drunkenness arrests to examine the relation between Prohibition and alcohol consumption. Earlier analyses have examined aggregate data on drunkenness arrests (Warburton 1932, Miron and Zwiebel 1991) and found only a modest effect of Prohibition on alcohol consumption. We extend this work by considering disaggregated data. Moreover, unlike previous work, we control for a range of factors that might affect drunkenness arrests or alcohol consumption, such as pre-1920 federal anti-alcohol policies, demographic factors, tax rates, and economic conditions. In particular, we examine the impact of state prohibitions, which is not possible with aggregate data.

The advantage of drunkenness arrests as a proxy for alcohol consumption is that lags or asymmetries in the relation between consumption and arrests are probably less important than for cirrhosis. The disadvantage of arrests is that they cannot distinguish between enforcement of drunkenness laws and alcohol consumption. To the extent that enforcement differed between the Prohibition and non-Prohibition periods, arrests understate or overstate alcohol consumption. Thus, drunkenness arrests are not a perfect proxy, but they provide a check on the conclusions derived from cirrhosis death rates.

2. Data

Data on drunkenness arrests in a sample of cities are available for the period before Prohibition and for the first several years of Prohibition. There are two sources for these data, the World League Against Alcoholism (WL), a pro-Prohibition organization, and the Moderation League (ML), an anti-Prohibition organization.[2] Both organizations collected data on drunkenness arrests by surveying police departments. The WL data set contains arrests for up to 301 cities while the ML data set contains data for up to 599 cities.[3,4] The WL data are available for 1910 – 1923, while the ML data are available for 1914 – 1925. The WL data set includes at least one city in 47 states and accounts for roughly 31% of the population in 1920. The ML data set includes at least one city in 47 states and accounts for roughly 35%.

---

[1] See, for example, Dills and Miron (2004), Aaron and Musto (1981), Moore and Gerstein (1981), Edwards et al. (1994), Musto (1996), MacCoun and Reuter (2001), and Yoon et. al (2001).

[2] The WL data are from Cherrington (1923, 1925). The ML data are from Wickersham (1931). We exclude Monkkonen's (1994) *Police Departments, Arrests, and Crime in the United States* because the data contain a number of bizarre fluctuations

[3] The ML data include arrests for up to 605 cities, but 1920 city population data are missing for 6 cities.

[4] Both panels are unbalanced. The results below are robust to using balanced panels.

As seen below, the two data sets agree in most cases. There are, however, a few discrepancies, as well as instances where one or both series contains obvious measurement error. We address these two issues by examining both the complete data sets and data sets purged of questionable observations.

3. Results

We first verify that arrests are a reasonable proxy for alcohol consumption and then examine the impact of Prohibition on arrests.

Figure 1 plots aggregate alcohol consumption per capita and two measures of the aggregate drunkenness arrest rate for the period 1910-1925. The consumption data are from Dills and Miron (2004); consumption is measured in gallons of pure alcohol per capita. The arrest data are the logs of city arrests divided by the U.S. population, aggregated up to the national level using city population in 1920. We use this procedure because annual, city-level data on population are not available.

The figure shows first that during the pre-1920 period, arrests and alcohol consumption were closely related. The correlation is 0.95 (p-value = 0.0037) for the ML series and 0.89 (p-value = 0.0006) for the WL series. The correlation is potentially even higher, since a substantial increase in the federal alcohol tax in 1916 and the closing of the distilleries in 1917 and the breweries in 1918 may have caused underreporting of alcohol production. Thus, drunkenness arrests appear to be a reasonable proxy for alcohol consumption.

The figure also shows that arrests were roughly constant through 1912. Arrests then declined for eight consecutive years, reaching their minimum value in 1920. Beginning in 1921, arrests increased noticeably for several years. Starting in 1923, arrests leveled off 36-52% below the pre-1918 average.

Taken by themselves, these data provide mixed evidence on whether Prohibition reduced arrests. Arrests were lower on average during Prohibition. But arrests began declining before Prohibition took effect and increased substantially during the first years of Prohibition. Moreover, a number of other changes occurred during this period that might have affected alcohol consumption. To fully assess the role of Prohibition, therefore, it is necessary to consider other factors.

Table 1 takes a first step in this direction by presenting regressions of city-level drunkenness arrests on city fixed-effects, city trends, year dummies, and a dummy variable for whether the state of the city in question prohibited alcohol. The dependent variable is the log of city-level arrests divided by the U.S. population. State prohibition equals 0.5 in years that a state adopted prohibition, 1.0 in years with state-level prohibition, and zero otherwise. Other than the city fixed-effects and city trends, state prohibition is the only variable available on an annual basis at a sub-national level. The year dummies account for all national, time-varying factors, so this specification is the most robust method of estimating the impact of state prohibition.

The table contains results using the complete samples and several "cleaned" samples. The first cleaning procedure drops any city if the absolute value of the difference in arrests between any adjacent years exceeds 90%. The second cleaning procedure drops any city if the correlation between the ML and WL data for that city is less than 0.9. The third cleaning procedure identifies the largest 5% of squared residuals and omits the cities associated with those observations.

The results provide mixed evidence on whether state prohibitions reduced drunkenness arrests. In the ML data set, the estimated effect of state prohibition is always below 10% and never statistically significant; in one case the point estimate is positive. In the WL data set, the estimated effect is 34% in

the full sample and statistically significant. The point estimate and statistical significance are both substantially lower on average, however, in the cleaned data sets. Overall, therefore, these regressions suggest a small effect of state prohibitions. These regressions do not indicate, however, the impact of national prohibition.

Table 2 therefore presents regressions that include state prohibition, a dummy for early Prohibition (1920-1922), a dummy for later Prohibition (1923-1925), a dummy for wartime prohibition (1917-1919), real GNP per capita, the fraction of the population aged 15-24, and the federal tax rate on alcohol. The regressions exclude year dummies.

The coefficient on early prohibition is always strongly statistically significant. Both data sets imply that early Prohibition reduced arrests by roughly 20-30%. The coefficient on later Prohibition is always small, frequently positive, and never statistically significant. War prohibition enters negatively and significantly in most regressions, with an average effect of roughly 12%.

4. Interpretation

These results suggest that Prohibition had a substantial short-term effect but roughly a zero longer-term effect on drunkenness arrests. Perhaps most strikingly, the implied behavior of alcohol consumption is similar to that implied by cirrhosis. Dills and Miron (2004) find that Prohibition reduced cirrhosis by roughly 10-20%.

The chief issue in interpreting the results is whether enforcement of drunkenness laws changed when state or national prohibitions took effect. If enforcement increased for a given level of drinking, then arrests overstate alcohol consumption during prohibitions and therefore understate the effect of Prohibition on drinking. If police enforced drunkenness laws less vigorously to "prove" Prohibition had banished drinking, then arrests understate alcohol consumption during Prohibition. And if arrests that would have been recorded as drunkenness before Prohibition were recorded as Prohibition violations during Prohibition, arrests also understate alcohol consumption during Prohibition.

The results presented here cannot, therefore, resolve the fundamental problem that confronts the use of proxies to study Prohibition's impact on alcohol consumption. The fact that different proxies tell the same story, however, is at least suggestive of a limited effect of national Prohibition on alcohol consumption.

References

Aaron, P. and D. Musto, 1981, Temperance and Prohibition in America: A Historical Overview, in: M.H. Moore and D.R. Gerstein, eds., Alcohol and Public Policy: Beyond the Shadow of Prohibition (National Academies Press, Washington, D.C.) 127-181.

Berkow, R., 1992, ed., The Merck Manual, 16th ed. (Merck and Co., Inc., Rahway, N.J.).

Cherrington, E.H., 1923, The Anti-Saloon League Year Book: an encyclopedia of facts and figures dealing with the liquor traffic and the temperance reform (The League, Columbus, Ohio) 70-75.

Cherrington, E.H., 1925, The Anti-Saloon League Year Book: an encyclopedia of facts and figures dealing with the liquor traffic and the temperance reform (The League, Columbus, Ohio) 32-51.

Dills, A.K. and J.A. Miron, 2004, Alcohol Prohibition and Cirrhosis, American Law and Economics Review 6(2), 285-318.

Edwards, G. et. al., 1994, Alcohol Policy and the Public Good (Oxford University Press Inc., New York).

MacCoun, R.J. and P. Reuter, 2001, Drug War Heresies: Learning from Other Vices, Times and Places (Cambridge University Press, Cambridge).

Miron, J.A. and J. Zweibel, 1991, Alcohol Consumption During Prohibition, American Economic Review 81(2), 242-247.

Monkkonen, E., 1994, Police Departments, Arrests, and Crime in the United States, 1860-1920 [Raw Data for 23 U.S. Cities] [Computer file]. Compiled by Eric Monkkonen, University of California, Los Angeles. ICPSR ed. (Inter-university Consortium for Political and Social Research [producer and distributor], Ann Arbor, MI)

Moore, M.H. and D.R. Gerstein, eds., 1981, Alcohol and Public Policy: Beyond the Shadow of Prohibition (National Academy Press, Washington, D.C.).

Musto, D. F., 1996, Alcohol in American History, Scientific American, April, 78-83.

Warburton, C., 1932, The Economic Results of Prohibition (Columbia University Press, New York).

Wickersham, G.W., 1931, Enforcement of the Prohibition Laws, Vol. 5 (U.S. Government Printing Office, Washington).

Yoon, Y., H. Yi, B.F. Grant and M.C. Dufour, 2001, Liver Cirrhosis Mortality in the United States, 1970-1998, Surveillance Report #57 (U.S. Department of Health and Human Services, National Institute on Alcohol Abuse and Alcoholism, Washington, D.C.), available at http://www.niaaa.nih.gov/publications/Cirr98.pdf.

Figure 1 Alcohol Consumption per Capita and Logged Arrests for Drunkenness per Capita

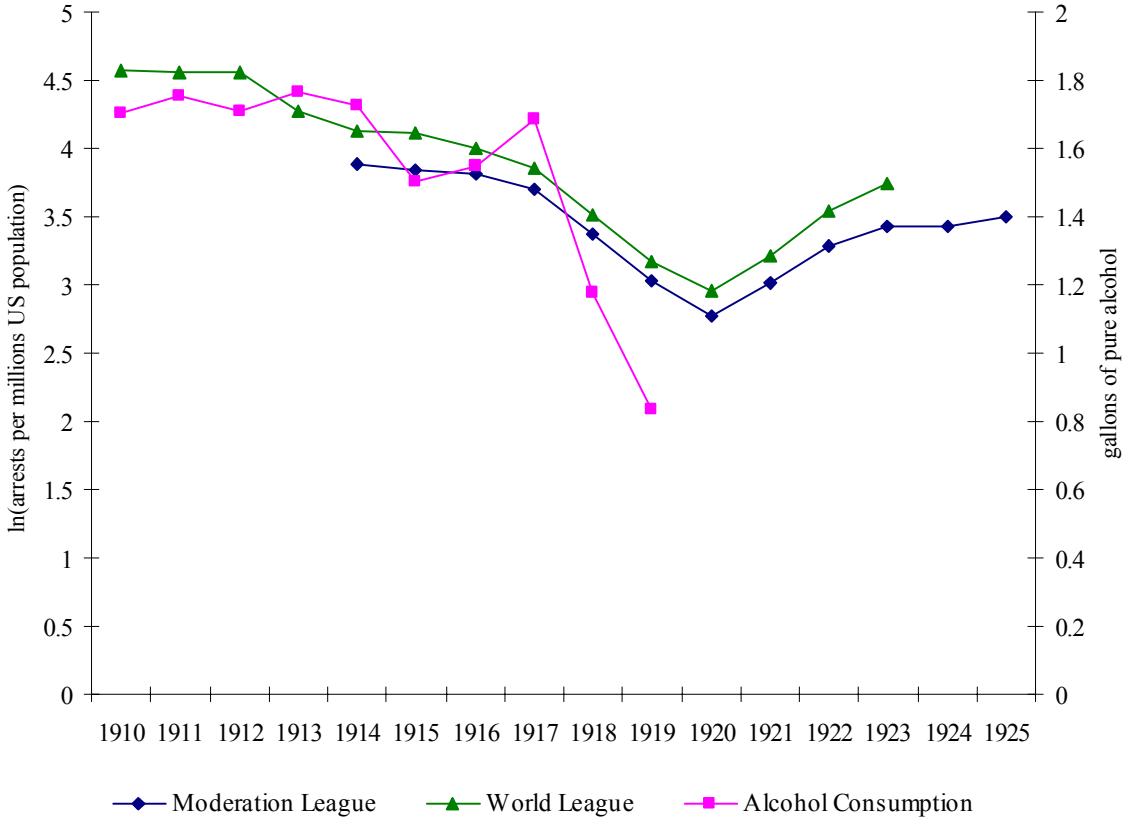

Table 1 Regressions of City Arrests on State Prohibition and Year Dummies

	(1) ML	(2) WL	(3) ML	(4) WL	(5) ML	(6) WL	(7) ML	(8) WL
	whole sample		yearly change < 90%		corr(ML, WL) > 0.9		omit top 5% residuals	
State prohibition	-0.054	-0.344	0.042	-0.102	-0.035	-0.186	-0.063	-0.224
	(0.42)	(2.06)	(0.34)	(0.55)	(0.28)	(1.09)	(0.42)	(1.16)
Constant	3.475	4.004	3.968	4.489	3.955	4.183	3.771	4.193
	(72.63)	(76.96)	(85.22)	(82.42)	(83.81)	(78.24)	(79.12)	(75.16)
Observations	6235	3234	2955	1618	2792	2729	3969	2320
R-squared	0.98	0.98	0.99	0.99	0.98	0.98	0.99	0.98
# cities	599	301	306	150	244	244	402	219

City fixed-effects, year dummies, and city-specific trends included in all regressions. Regressions weighted by city population in 1920. Standard errors clustered by state. Robust t-statistics in parentheses

Table 2 Regressions of City Arrests on Prohibition and Other Variables

	(1) ML	(2) WL	(3) ML	(4) WL	(5) ML	(6) WL	(11) ML	(12) WL
	whole sample		yearly change < 90%		corr(ML, WL) > 0.9		omit top 5% residuals	
State prohibition	-0.105	-0.433	0.017	-0.180	-0.109	-0.291	-0.113	-0.313
	(0.77)	(2.47)	(0.14)	(0.96)	(0.81)	(1.67)	(0.68)	(1.45)
Prohibition (1920-22)	-0.299	-0.268	-0.193	-0.222	-0.278	-0.311	-0.240	-0.249
	(2.78)	(4.73)	(2.74)	(4.79)	(2.48)	(5.14)	(2.57)	(4.70)
Prohibition (1923-25)	-0.024	0.041	0.038	0.059	0.007	0.016	0.027	0.063
	(0.18)	(0.39)	(0.37)	(0.62)	(0.05)	(0.13)	(0.23)	(0.68)
War prohibition (1917-19)	-0.133	-0.120	-0.108	-0.124	-0.132	-0.141	-0.101	-0.117
	(3.97)	(2.04)	(3.80)	(1.85)	(3.62)	(2.65)	(3.26)	(1.77)
Real GNP per capita (in 000s)	0.039	0.260	0.124	0.186	0.060	0.181	0.112	0.248
	(0.23)	(1.13)	(0.63)	(0.82)	(0.33)	(0.86)	(0.60)	(1.00)
Distilled spirits tax	-0.042	-0.047	-0.042	-0.048	-0.042	-0.047	-0.044	-0.048
	(7.68)	(7.00)	(8.45)	(7.77)	(7.44)	(6.72)	(7.83)	(7.31)
% population aged 15-24	35.296	44.320	39.573	43.529	36.677	41.628	38.595	44.046
	(5.57)	(8.60)	(5.63)	(9.07)	(4.87)	(9.10)	(6.02)	(8.52)
Constant	-3.147	-4.913	-3.549	-4.168	-2.959	-4.098	-3.558	-4.638
	(2.58)	(3.94)	(2.62)	(3.69)	(2.04)	(3.80)	(2.80)	(3.70)
Observations	6235	3234	2955	1618	2792	2729	3969	2320
R^2	0.98	0.97	0.98	0.98	0.97	0.97	0.98	0.97
# cities	599	301	306	150	244	244	402	219

City fixed-effects and city-specific trends included in all regressions. Regressions weighted by city population in 1920. Standard errors clustered by state. Robust t-statistics in parentheses.