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Alcohol Availability and Consumption: Iowa Sales Data Revisited*

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ABSTRACT. Recent changes in Iowa liquor control laws ended the 51-year-old state alcohol monopoly distribution system and turned the sales of bottled wine and spirits over to the private sector. The resulting increase in the availability of these beverages provided a unique opportunity to study the relationship between increased wine

and spirits availability and changes in their consumption. Time series analyses of monthly sales (apparent consumption) trends showed that the increased availability had no lasting impact on consumption. (*J. Stud. Alcohol* 53: 487-494, 1992)

FOR 51 YEARS following the repeal of Prohibition Iowans could buy bottled wines and spirits containing more than 4% alcohol by weight (increased to 5% in May 1980) in only a limited number of state-operated stores. Then, on July 1, 1985, the state abandoned its monopoly on bottled-wine wholesale and retail sales, and in March 1987 gave up its retail (but not wholesale) monopoly on bottled distilled spirits. This shift from a state monopoly to a private distribution system constituted the most abrupt and dramatic increase in alcohol availability that any state has experienced since the repeal of Prohibition (Holder, 1988). Not only did the number of outlets rapidly increase from approximately 200 state stores to approximately 800 private off-premise wine outlets and 400 spirits outlets,¹ but also wine and spirits were brought within arm's reach of nearly all grocery and convenience store shoppers. Sunday sales were legalized, hours of sales were extended, advertising was allowed and purchases could be made on credit terms.

Earlier we investigated the impact of the 1985 increase in wine availability on wine consumption by comparing both monthly sales (apparent consumption) and survey data (self-reported consumption) that were collected before and after wine privatization. Although monthly wine sales increased considerably in the months immediately following the July 1985 intervention, they steadily declined in subsequent months. By May and June of 1987

they had returned to the preintervention levels of May and June 1985. Also, self-reported wine consumption, assessed by surveys conducted some 4 months prior to and 9 months after the wine intervention, was unchanged. These findings led us to conclude that the results of Iowa's wine privatization experience contradicted the conventional assumption that a substantial increase in alcohol availability would necessarily produce a significant and lasting increase in alcohol consumption (Mulford and Fitzgerald, 1988).

Since our earlier report, Wagenaar and Holder (1991) analyzed Iowa monthly wine sales data and came to the markedly different conclusion that privatization "permanently" increased wine consumption by 93%. Seeking to resolve these dramatically contradictory conclusions, the present study: (1) analyzes monthly wine sales for a longer postintervention time period, (2) identifies certain differences in the data and the analysis procedures used in the two Iowa wine studies that came to such contrary conclusions and (3) adds an analysis of Iowa's spirits privatization experience to the investigation of the availability/consumption relationship.

Method

Sales data

Although alcohol sales are a widely accepted measure of alcohol consumption, consumption is not the only factor that affects sales. Depending upon the point in the distribution system at which they are obtained, sales figures can be affected by pipeline-filling as well as by wholesale and retail stockpiling that might be disposed of in ways other than consumption. And, even purchases by the end buyer are not necessarily consumed; they may be stockpiled for an indefinite period of time or even discarded.

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Hence, in the short run sales can be an inaccurate, deceptive measure of consumption. In the long run, however, consumption is the primary force that drives sales. The longer the period of time that sales are observed, the more likely it is that inaccurate short-term sales patterns will have run their course and sales trends will again more accurately reflect actual consumption trends.

Wine and spirits sales data sources

Monthly wine and spirits sales data were obtained from official reports of the Alcoholic Beverages Division, Iowa Department of Commerce, Ankeny, Iowa (personal communication). They cover the period from January 1980 through May 1990, 66 months prior to and 59 months after wine privatization, and 86 months prior to and 39 months after spirits privatization. At all times both the wine and spirits sales data are measured at a point in the distribution system that is as close to the consumer as possible.

Under the monopoly system Iowa's official sales reports were based on state-operated store sales either directly to consumers or to by-the-drink retailers for on-premise consumption. Beginning with the wine and spirits privatizations a growing proportion of each beverage's bottled sales were estimated from wholesalers' inventory reductions. By August 1987 all state-operated stores were closed or turned over to licensed private operators, and since that time wine sales have been based on wholesale inventory reductions. Because the state retained a monopoly on the wholesale of spirits, spirits sales records are based on the volume of spirits delivered by the state to private retailers.

Wine sales are based on taxes collected on inventory withdrawals. Each month private wine wholesalers report to the state the amount of inventory on hand at the beginning of the month, the shipments received during the month and the amount in inventory at the end of the month. The first two amounts are summed and the difference between this sum and the inventory on hand at month's end constitutes, with a few allowable adjustments, the volume that is taxed. The adjustments include breakage and sales to another wholesaler, provided that they are documented by the wholesaler. Also, any inventory with expired shelf life that is destroyed in the presence of a state witness is treated as a nontaxed inventory withdrawal.

We converted liters of wine and spirits to liters of absolute alcohol using conversion factors of .14 and .45, respectively.

Wine and spirits coolers sales

Two new products, wine and spirits coolers, were introduced into the Iowa beverage alcohol markets in the early

1980s. From the time of their introduction, both coolers, like beer, were distributed by private wholesalers to private retailers. Because Iowa's privatization legislation did not affect the availability of coolers, it is inappropriate to include them in a study that is designed to assess the consumption changes for products made much more conveniently available by privatization.

Time series analysis

Although a simple comparison of plotted monthly wine and spirits sales prior to and after privatization provides a helpful visual representation of sales trend changes, statistical models are needed to quantify these changes. The privatization dates are referred to as "intervention points," and time series intervention models similar to those used by Wagenaar and Holder (1991) are used in our formal analysis. These models combine elements from regression and time series analysis. Regression models specify seasonal time trends and use indicator variables to model the effects of the interventions. Time series models allow for serially correlated errors. For a discussion of time series intervention models, see Box and Tiao (1975). The SCA statistical software package (1989) was used to carry out the analysis and to estimate the model coefficients.

A time series intervention model for wine sales

In order to develop an appropriate model we must first examine the raw data. The plot of Iowa monthly wine sales (in liters of pure alcohol) for the period January 1980 through May 1990 is shown in Figure 1. This graph reveals several facts: First, the reduction in average monthly sales from 101,000 liters in 1980 to 79,200 liters in 1989 amounts to an average 2.4% annual decline in wine sales. Second, Iowa wine sales are highly seasonal, being highest in December. Third, starting with July 1985, the first month that wine could be purchased in licensed private stores, wine sales increased substantially and were especially high in the second half of 1985. However, these elevated sales figures gradually diminished during 1986 and 1987. By the last half of 1987, they had returned to their preprivatization trend line. Finally, a close look at the data also shows that wine sales for May and June of 1986 are unusually high. During these months the state-run liquor stores were liquidating their wine stock at discount prices in anticipation of discontinuing wine sales after the end of June 1986.

Based on the above time sequence plot, we model monthly wine sales as

$$\log Y_t = \beta_0^s + \beta_1 t + \sum_{i=1}^{10} \delta_i \text{IND}_{ti} + \omega_1 P_{t1} + \omega_2 P_{t1} + n_t$$

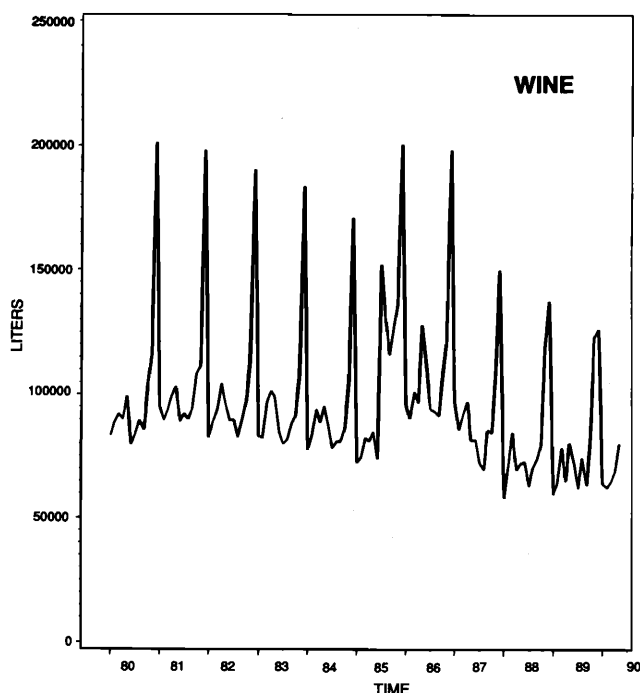


FIGURE 1. Iowa monthly wine sales (excluding wine coolers) in liters of absolute alcohol, Jan. 1980-May 1990

where β_1 is the slope of the trend line, β_0^s , $s = 1, \dots, 12$, are 12 different monthly intercepts, and IND_{ti} are the indicators that model the effects of the privatization. The first indicator variable IND_{t1} takes the value 1 for the 6 months of the second half of 1985, and is 0 for all other months. The second indicator IND_{t2} takes the value 1 for the first half of 1986, and is 0 otherwise, and so on. Finally, IND_{t10} is 1 for the months January through May 1990, and 0 otherwise. The coefficient δ_1 measures the increase in wine sales during the second half of 1985; δ_2 , the increase during the first half of 1986; and so on. P_{t1} and P_{t2} are pulse indicator variables that are zero for all months, except 1 in May and June 1986, respectively. The coefficients ω_1 and ω_2 measure the effect of discount sales occurring in May and June of 1986.

Our model is expressed in the logarithm of sales. This is because we feel that it is more natural to think in terms of percentage changes. For example, the coefficient β_1 implies a $100[\exp(\beta_1) - 1]$ monthly percentage change in wine sales. Similarly, the parameter δ_1 implies that monthly wine sales in the second half of 1985 changed by $100[\exp(\delta_1) - 1]$ percent.

The parameters in the above model can be estimated by least squares, provided that the errors n_t are independent. However, this independence assumption is usually violated when one estimates such regression models on time series data. This leads one to time series models that characterize the serial correlation among the errors n_t . Instead of assuming that $n_t = a_t$, where a_t are independent random

errors, one considers autoregressive integrated moving average (ARIMA) models for n_t . These models are described in detail in Box and Jenkins (1976) and Abraham and Ledolter (1983). We found that in our particular application an error model of the form

$$(1 - B^{12})n_t = (1 - \theta_1 B - \theta_2 B^2 - \theta_3 B^3)(1 - \theta_4 B^{12})a_t$$

provides a good representation of the serial correlation. Here B is the backshift operator such that $Bn_t = n_{t-1}$. The time series parameters θ model the serial correlation in the seasonal differences $n_t - n_{t-12}$. If we combine the above regression model with this ARIMA model for the errors, we get a model of the form

$$(1 - B^{12})\log Y_t = \beta_1^* + \sum_{i=1}^{10} \delta_i (1 - B^{12})IND_{ti} + \omega_1 (1 - B^{12})P_{t1} + \omega_2 (1 - B^{12})P_{t2} + (1 - \theta_1 B - \theta_2 B^2 - \theta_3 B^3)(1 - \theta_4 B^{12})a_t. \quad (\text{Model 1})$$

Because of seasonal differencing, $(1 - B^{12})\log Y_t = \log Y_t - \log Y_{t-12}$, we cannot estimate the seasonal intercepts of our original regression model. Also note that $\beta_1^* = \beta_1 t - \beta_1(t - 12) = 12\beta_1$ in the above model represents the yearly change in wine sales.

In addition to the above model with 10 half-yearly intervention effects, we also considered a model that specifies a temporary effect of the 2.5 years after privatization and a possible permanent, or lasting, effect. This model can be written as

$$(1 - B^{12})\log Y_t = \beta_1^* + \sum_{i=1}^5 \delta_i (1 - B^{12})IND_{ti} + \beta_0 (1 - B^{12})S_t + \omega_1 (1 - B^{12})P_{t1} + \omega_2 (1 - B^{12})P_{t2} + (1 - \theta_1 B - \theta_2 B^2 - \theta_3 B^3)(1 - \theta_4 B^{12})a_t. \quad (\text{Model 2})$$

The five δ coefficients express the temporary effect of the wine privatization on wine sales. S_t is a step indicator that is 0 for months prior to July 1985 and 1 for months after June 1985. The coefficient β_0 models an intercept change of the trend line. It allows the trend line to shift and it measures the lasting effect of the privatization.

A time series intervention model for spirits

Similar to our model for wine sales we developed a model for spirits based on the time sequence plot of monthly spirits sales (see Figure 2). As with wine, there is a strong seasonal pattern with high sales in December and a substantial long-term decline since 1980. There are unusually high sales in February and March of 1987 due

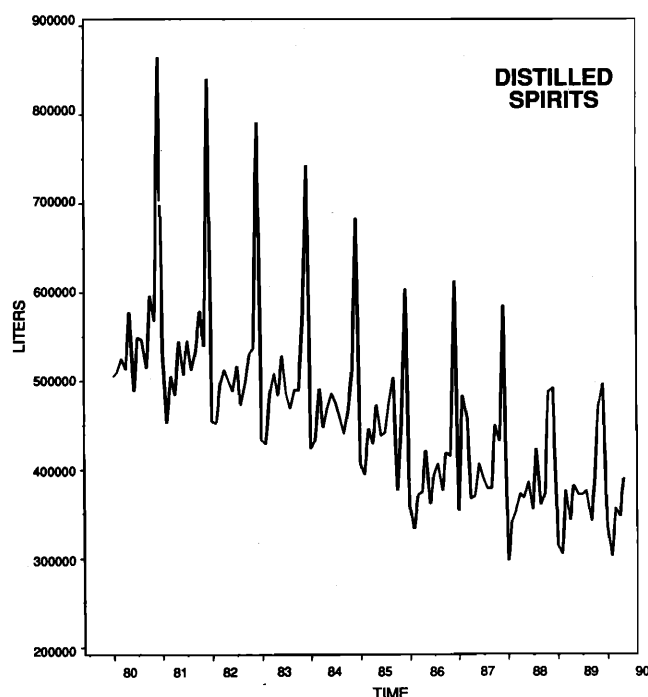


FIGURE 2. Iowa monthly distilled spirits sales (excluding spirits coolers) in liters of absolute alcohol, Jan. 1980-May 1990

to the stocking of shelves in new outlets. We also observe unusually high sales in September 1985, followed by unusually low sales the next month. This was probably due to consumer anticipation of a scheduled significant federal excise tax increase, effective October 1, 1985.

Based on the above data, we have chosen the following time series intervention model for spirits sales:

$$(1 - B^{12})\log Y_t = \beta_1 + \delta_1(1 - B^{12})P_{t1} + \delta_2(1 - B^{12})P_{t2} + \beta_0(1 - B^{12})S_t + \omega_1(1 - B^{12})P_{t3} + \omega_2(1 - B^{12})P_{t4} + (1 - \theta_1 B - \theta_2 B^2 - \theta_3 B^3)(1 - \theta_4 B^{12})a_t.$$

P_{t1} and P_{t2} are pulse indicators that are zero except for February and March 1987, respectively. The parameters δ_1 and δ_2 measure stocking effects that occurred in these 2 months. S_t is a step indicator variable that is 0 for the months prior to March 1987, and 1 after. The coefficient β_0 models a step change in the intercept of the trend line and measures any long-term permanent effect of the privatization on spirits sales. The indicators P_{t3} and P_{t4} are zero, except for months September and October 1985, respectively. These components model the preannounced federal tax increase that took effect in October 1985. The coefficients ω_1 and ω_2 reflect higher than usual sales in September and lower than usual sales in October of that year.

Results

Analysis of wine sales

Table 1 shows the estimation results for the two time series intervention models applied to the wine sales data. Only the estimates of the first four δ coefficients in Model 1 are significantly different from zero. This indicates that the privatization effect on wine sales was temporary; it gradually diminished over a period of about 2 years. Its effect on sales for the last 6 months of 1985 amounts to an increase of $100[\exp(0.42) - 1] = 53.2\%$. We see in Table 1 that the amount of elevation in wine sales gradually declines during 1986 and 1987, and disappears starting with the second half of 1987. The results in Table 1 also imply that Iowa wine sales have decreased an average of about 2.9% a year since 1980. Furthermore, the effects of close-out sales prior to July 1986 are significant, leading to an increase of 26% in May and of 18% in June of 1986.

Analysis of spirits sales

Table 2 shows the results of the time series intervention model applied to the spirits data. The estimates of δ_1 and δ_2 imply significant stocking effects in February and March 1987. However, after taking account of these temporary effects we see no indication that spirits privatization permanently affected spirits sales; the estimate of β_0 is statistically insignificant. Evidently Iowans did not increase their spirits purchases just because spirits became available in grocery stores. Table 2 shows an average spirits sales decline of about 4.5% a year since 1980. Furthermore, the estimates of ω_1 and ω_2 show a stockpiling reaction probably mostly by liquor-by-the-drink retailers to the preannounced federal tax increase. Sales went up by

TABLE 1. Estimation results for two time series intervention models applied to wine sales data—Iowa: January 1980–May 1990

	Model 1: Estimate \pm SE	Model 2: Estimate \pm SE
β^* (Yearly change)	$-0.030 \pm 0.013^*$	$-0.029 \pm 0.011^*$
δ_1 (1985/II)	$0.42 \pm 0.05^*$	$0.42 \pm 0.07^*$
δ_2 (1986/I)	$0.28 \pm 0.06^*$	$0.27 \pm 0.07^*$
δ_3 (1986/II)	$0.22 \pm 0.07^*$	$0.21 \pm 0.06^*$
δ_4 (1987/I)	$0.20 \pm 0.07^*$	$0.19 \pm 0.05^*$
δ_5 (1987/II)	0.06 ± 0.08	0.05 ± 0.05
δ_6 (1988/I)	0.00 ± 0.08	
δ_7 (1988/II)	0.01 ± 0.09	
δ_8 (1989/I)	0.02 ± 0.09	
δ_9 (1989/II)	0.02 ± 0.10	
δ_{10} (1990/I)	0.02 ± 0.11	
β_0 (Permanent change)		0.005 ± 0.075
ω_1 (1986/5)	$0.23 \pm 0.08^*$	$0.23 \pm 0.08^*$
ω_2 (1986/6)	$0.17 \pm 0.08^*$	$0.17 \pm 0.08^*$
θ_1	$-0.30 \pm 0.10^*$	$-0.30 \pm 0.09^*$
θ_2	-0.09 ± 0.10	-0.09 ± 0.10
θ_3	$-0.30 \pm 0.10^*$	$-0.30 \pm 0.10^*$
θ_4	$0.45 \pm 0.10^*$	$0.45 \pm 0.10^*$

*Significant at the .05 level.

TABLE 2. Estimation results for the time series intervention model applied to distilled spirits sales data—Iowa: January 1980–May 1990

	Estimate \pm SE
β^* (Yearly change)	$-0.046 \pm 0.005^*$
δ_1 (1987/2)	$0.41 \pm 0.05^*$
δ_2 (1987/3)	$0.12 \pm 0.05^*$
β_0 (Permanent change)	0.007 ± 0.026
ω_1 (1985/9)	$0.23 \pm 0.05^*$
ω_2 (1985/10)	$-0.21 \pm 0.05^*$
θ_1	0.16 ± 0.09
θ_2	$-0.29 \pm 0.09^*$
θ_3	$-0.27 \pm 0.09^*$
θ_4	$0.61 \pm 0.09^*$

*Significant at the .05 level.

about 26% in September 1985, the month prior to the tax increase, but decreased in the next month by about the same amount.

Supplementary analyses

Several diagnostic checks on the residuals of both the wine and spirits models confirmed the appropriateness of the models analyzed. No unusually large residuals and only small and insignificant autocorrelations among the residuals were found. We also considered several other time series specifications for the error component, and they did not change our conclusions.

Our analyses to this point show that, while privatization increased the sales of both wine and spirits, the increase was only temporary. Once the new private outlets had stocked their shelves, sales soon declined again to approximate preintervention levels. Iowa wine and spirits long-term sales trends were not affected.

However, could it be that, had it not been for the privatization and increased availability, Iowa monthly wine and spirits sales, which had been trending down since 1981, would have declined even more than they did after the private outlets' shelves were stocked? To investigate this possibility national monthly sales figures could be included as a covariate in our time series intervention models, as was done by Wagenaar and Holder (1991). However, such an analysis is difficult here, for both wine and spirits, because the available national and Iowa monthly sales data are not precisely comparable. Spirits sales figures exclusive of coolers are available for Iowa, but not for the nation. Although wine sales figures exclusive of coolers are available for both Iowa and the nation, the national figures are based on federal taxes collected at the *producer* level of the distribution system. This not only adds another level of potential stockpiling but, more importantly, producer shipments to wholesalers in any given month are often not delivered to retailers until a later month. Iowa monthly sales data, on the other hand, represent *wholesale* deliveries to retailers, a level closer to ultimate consumption. Since Iowa and national monthly

wine sales do not necessarily refer to the same months and since seasonality is an important feature of the data, it would be inappropriate to include national monthly sales figures as a covariate in our time series intervention models.

We can, however, compare Iowa and national long-term sales trends by plotting 12-month centered moving averages.² It is important to establish that the long-term trend in the national sales figures did not decline around the time of the privatization. Because if it did, then in the absence of privatization Iowa sales figures should have declined even more than they did.

Plots of 12-month centered moving averages for wine are shown in Figure 3. National wine producer monthly sales for January 1981 through March 1990 were obtained from the Wine Institute (San Francisco, Calif.). Iowa wholesale wine sales data for the period January 1980 through May 1990 were obtained from the Iowa Alcoholic Beverages Division (personal communication). While the most prominent feature of the national and Iowa trend lines in Figure 3 is the unique Iowa temporary sales surge associated with the 1985 privatization of wine sales,³ the more important feature for our trend comparison is the fact that there are no long-term trend changes in either series around the time of the intervention. This supports the earlier conclusion that privatization of wine sales did not permanently increase wine consumption.

Figure 4 compares Iowa and national spirits sales trends. For the sake of comparability, both include spirits

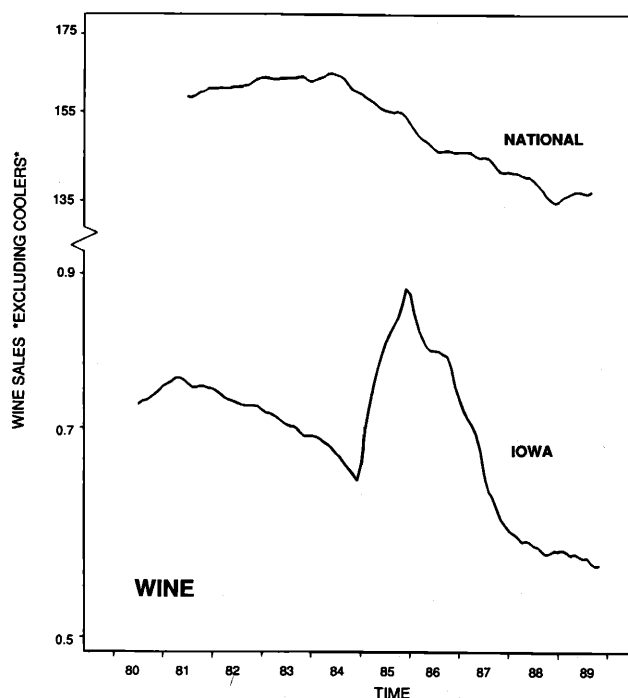


FIGURE 3. U.S. (Jan. 1981–Mar. 1990) and Iowa (Jan. 1980–May 1990) monthly wine sales (excluding wine coolers) in million liters (12-month centered moving average, plotted on logarithmic scale)

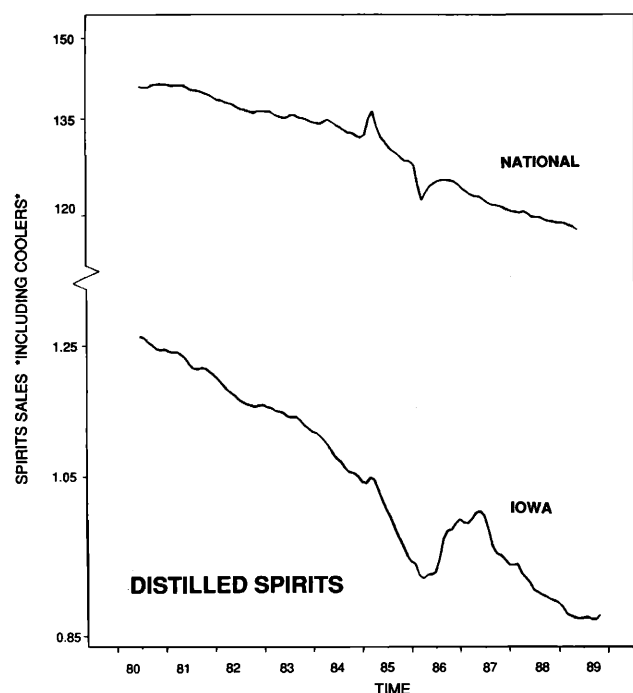


FIGURE 4. U.S. (Jan. 1980-Dec. 1989) and Iowa (Jan. 1980-May 1990) monthly distilled spirits sales (including spirits coolers) in million liters (12-month centered moving average, plotted on logarithmic scale)

coolers because national data exclusive of coolers are not available. National monthly spirits and cooler sales, mostly but not entirely collected at the wholesaler to retailer level, for the period January 1980 through December 1989 were obtained from the Distilled Spirits Council of the United States, Inc. (Washington, D.C.). Iowa spirits sales (state to consumers and retailers) and spirits cooler sales (wholesaler to retailer) for the period January 1980 through May 1990 were obtained from the Iowa Alcoholic Beverages Division (personal communication).

Figure 4 shows that overall spirits sales in Iowa decrease at a slightly faster rate than those of the nation. Furthermore, as in the wine sequence, there are no long-term trend changes in either series around the time of the intervention.⁴ This supports the earlier conclusion that, as with wine, the privatization of spirits sales did not permanently increase Iowa spirits consumption.

Discussion

These study findings, like our earlier findings, contradict Wagenaar and Holder's (1991) conclusion that the privatization of wine sales caused a permanent 93% consumption increase. Although there may be others, we can identify three major reasons for their different conclusion: First, their postintervention study time period was short. By December 1987, the last month used in their analysis,

it was still somewhat uncertain whether the increase in wine sales was temporary or permanent. Our additional 29 months (January 1988 through May 1990) of data is critical to distinguishing between temporary and permanent effects. Second, the time series intervention model used by Wagenaar and Holder appears to be misspecified. Their model inappropriately includes stocking effects for 2 months before (as well as 2 months after) the July 1985 intervention and erroneously assumes a permanent step change in the intercept. Because state laws prohibited both Iowa private wholesalers and retailers from receiving wine shipments prior to July 1, 1985, the substantial increases in wine sales for May and June 1985 shown by Wagenaar and Holder cannot be stockpiling effects. Instead, they reflect a large surge in wine cooler sales that began in 1985 and continued through 1988. Furthermore, the stocking variables that remain in their model are insufficient to capture the temporary nature of the intervention effect. The step change used in their model ignores the fact that the initial monthly wine sales surge steadily declined to preintervention levels. Consequently, they inappropriately interpret part of the temporary effect as a permanent one. Third, even though Iowa's privatization legislation did not change the wine cooler distribution system or its availability, Wagenaar and Holder nonetheless included wine cooler in their sales data analysis. Because the beginning of the wine cooler fad in Iowa happened to coincide roughly with the wine sales privatization and because wine cooler sales continued to grow quite rapidly through 1988, including coolers in the analysis is especially troublesome. We have confirmed the biasing effect that inappropriately including wine coolers has on the results. With wine coolers included, estimation results of Model 2 imply a 20% permanent increase in sales.

Whether the approximately 2-year (declining) wine sales elevation represents an actual consumption increase or is instead entirely an artifact of aberrant monthly sales is uncertain. Our previously reported finding that self-reported wine consumption had not increased when measured some 9 months following privatization (Mulford and Fitzgerald, 1988) supports the conclusion that wine consumption did not increase.

If privatization did actually cause a temporary significant consumption increase, as the sales data might imply, then something of equal significance must have happened to cause consumption to decline back down to preintervention levels. Iowa did raise its legal drinking age from 19 to 21 years, effective July 1, 1986. However, this legislative change in availability likely had little effect because all individuals born prior to September 1, 1967 were "grandfathered in." They could continue to purchase alcohol even though they had not reached age 21. Moreover, the fact that beer is the alcoholic beverage of choice for

most adolescents and young adults tends to counteract any effect that raising the minimum legal purchasing age might have had on wine consumption.

Wine and spirits prices did increase after privatization, but only slightly (American Chamber of Commerce Researchers Association, 1982-1988; Holder, 1988; Mitcham, 1989). However, any depressing effect that the slight price increase might have had on wine consumption would have been counterbalanced by the recovery of Iowa's economy, which was depressed during the early 1980s. That the state's economy made a strong turnaround in late 1987 is evidenced by substantial increases in disposable personal income (WEFA Group, 1990). Undoubtedly many other forces were influencing Iowans' drinking decisions, but we can think of no single force or combination of forces of a magnitude comparable to the change in the alcohol distribution system.

At the same time, several events occurred during the period in question that affected the accuracy of wine sales as a measure of consumption. The privatization of wine sales was strongly lobbied by the wine industry, and projections that privatization would increase wine consumption by as much as 300% were widely publicized (Kuhlman, 1990). Such optimistic projections led many private wholesalers and retailers to enter the wine market and to overstock. Many of them failed, only to be replaced by other hopefuls. This turmoil—the turnovers and the inexperience of new dealers—might well have resulted in sales-reporting errors. In addition, the dealer turnover led to many retail liquidation sales where many consumers, from both inside and outside Iowa, may have seized the opportunity to stock their own shelves for later consumption.

Today, Iowa's wine wholesalers themselves have concluded that wine privatization had little, if any, impact on Iowans' wine consumption (personal communication, Iowa Wholesale Wine Distributors Association). Consistent with this conclusion is the less ambiguous evidence that spirits privatization did not increase spirits consumption. Spirits privatization occurred with much less market turmoil and less optimistic consumption increase projections. Consequently, unlike wine, there was no spirits overstocking. The spirits sales surge associated with privatization lasted about 2 months and undoubtedly was entirely due to the need to stock the new private shelves and fill the new pipeline. Three months after the intervention spirits sales had declined to the normal preintervention trend line.

Evidently Iowans' appetite for both wine and spirits was already being satisfied when the privatization of the distribution system made these products more available. Considering that Iowans had already doubled their (apparent) per capita alcohol consumption from 1958 until it peaked in 1981 and were in the process of reducing it at the time of the interventions, all under the monopoly sys-

tem, it is not surprising that privatizing the distribution system had little, if any, effect on consumption. Also, the availability increase occurred at a time of growing American concern for health and physical fitness. This concern, together with ever more frequent media reports of health hazards attributed to drinking, likely offset any appeal that the sudden appearance of wine and spirits on the grocery shelves (perhaps alongside the increasingly popular oat cereals) might have had.

The continuing decline in per capita alcohol consumption, both in Iowa and nationally, may be an encouraging sign that Americans are evolving more "responsible" drinking norms, just as they have been modifying their smoking norms in recent decades, and are doing so for reasons having little to do with changes in availability. There have, of course, been some changes in the availability of both substances, but availability changes may be consequences as often as causes of consumption changes. The dramatic availability increase associated with Iowa's modification of its alcohol distribution system came after Iowans had already doubled their consumption. A close examination of the chronology of historical events likely would reveal that availability changes of both alcohol and tobacco have followed, as often as they have preceded, a consumption change. How changes in drinking norms come about and how, if at all, historical events in Iowa interacted with availability changes and with numerous other forces to shape Iowans' decisions to virtually ignore the fact that beverage alcohol had suddenly become more conveniently available remain to be determined. The effort to do so could hardly be less rewarding than the continued search for the supposed lawful, causal connection between alcohol availability and consumption. Further studies of consumption changes following availability changes can be expected to yield more (apparently) contradictory findings. They will likely find that an availability increase will sometimes be followed by a consumption increase, sometimes by a decrease and sometimes by no change at all. Furthermore, the more precise our measures of availability and consumption become and the more powerful and sophisticated our analytic techniques are, the more likely we are to observe such apparent contradictions.

The findings of this study offer compelling evidence that increasing the availability of alcohol does not *necessarily* increase its consumption, but beyond that people's drinking decisions and the alcohol availability/consumption connection remain scientific mysteries. If, as it appears, there is no lawful, causal connection between alcohol availability and alcohol consumption, then perhaps we should redirect our research efforts and seek to understand better the interplay of the multitude of weak historical, cultural, psychological, biological and environmental forces that influence people's decision to drink or not,

how much to drink and whether to change their intake levels in response to an availability change.

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Notes

1. Separate permits are required to sell wine and spirits. The spirits permit is considerably more expensive than is the wine permit, and this probably explains why there are fewer spirits outlets.
2. A 12-month centered moving average for period t averages the current observation at time t and the six preceding and the six following observations. The observations at times $t - 6$ and $t + 6$ carry half the weight of each of the other 11 observations. 12-month centered moving averages estimate the trend of the series and they are not affected by seasonality.
3. In the plot of 12-month centered moving averages the temporary 2-year effect of the wine privatization extends to the 6 adjacent months on either side. For example, the moving average for January 1985 is already affected as it uses sales of July 1985.
4. The preannounced federal tax increase for spirits in October 1985 led to a large increase in sales in September 1985 and smaller sales in the

following month. This intervention affects the 12-month centered moving averages from March 1985 through April 1986, and its effect can be seen in Figure 4. Furthermore, the temporary increases in Iowa spirits sales in February and March 1987 are reflected in the 12-month centered moving averages from August 1986 through September 1987.

References

- ABRAHAM, B. AND LEDOLTER, J. *Statistical Methods for Forecasting*, New York: John Wiley & Sons, Inc., 1983.
- AMERICAN CHAMBER OF COMMERCE RESEARCHERS ASSOCIATION. *Inter-City Cost of Living Index (Section 3. Price Report)*, Indianapolis, Ind.: American Chamber of Commerce, 1982-1988.
- BOX, G.E.P. AND JENKINS, G.M. *Time Series Analysis: Forecasting and Control (Revised Edition)*, Oakland, Calif.: Holden-Day, Inc., 1976.
- BOX, G.E.P. AND TIAO, G.C. Intervention analysis with applications to economic and environmental problems. *J. Amer. stat. Assoc.* **70**: 70-79, 1975.
- HOLDER, H.D. *Privatization of Alcoholic Beverage Control: A Case Study From the State of Iowa, U.S.A.* Paper presented at Kettil Bruun Society 1988 Annual Meeting, Berkeley, Calif.: Prevention Research Center, 1988.
- KUHLMAN, J. *A Brief History of the Privatization of Wine: Report to the Alcoholic Beverages Commission*, Ankeny, Iowa: Iowa Department of Commerce, Alcoholic Beverages Division, 1990.
- MITCHAM, D. *Iowa Liquor Prices Survey*, Ankeny, Iowa: Iowa Department of Commerce, Alcoholic Beverages Division, 1989.
- MULFORD, H.A. AND FITZGERALD, J.L. Consequences of increasing off-premise wine outlets in Iowa. *Brit. J. Addict.* **83**: 1271-1279, 1988.
- SCA STATISTICAL SYSTEM. *Scientific Computing Associates*, Lisle, Illinois, 1989.
- WAGENAAR, A.C. AND HOLDER H.D. A change from public to private sale of wine: Results from natural experiments in Iowa and West Virginia. *J. Stud. Alcohol*, **52**: 162-173, 1991.
- WEFA GROUP. *Econbase: Time Series and Forecasts (Dialog File No. 565)*, Bala Cynwyd, Pa., 1990.