

Comparison of State Alcoholic Beverage Sales Data with Industry Shipment Data, 2001–2013

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Background

There are currently 29 surveillance reports on apparent per capita alcohol consumption in the United States produced by the National Institute on Alcohol Abuse and Alcoholism (NIAAA). These reports provide updated annual alcohol consumption trends on a national, state, and regional level. The Alcohol Epidemiologic Data System (AEDS) collects alcoholic beverage sales data directly from the states or the National Alcohol Beverage Control Association (NABCA) and obtains industry shipment data to derive the alcohol consumption estimates. Industry shipment data are used as a supplementary data source when state sales data are unavailable or unusable. A previous AEDS technical report by Campbell and colleagues (1994) compared 1986–1991 per capita consumption trends using beverage industry shipment data and combined state sales and industry shipment data and concluded that the mixed use of data from state and industry sources appears to have little effect on overall trends in per capita alcohol consumption. However, no direct comparisons between state and industry data were conducted in that report. Therefore, the purpose of this methodological addendum is to examine the differences between alcoholic beverage volumes obtained from state sales and tax receipts reports and those obtained from industry shipment reports.

To produce the surveillance report annually with updated alcohol consumption trends, AEDS staff collect state alcoholic beverage sales data by directly contacting each state's department of revenue, department of taxation, alcoholic beverage commission, and similar agencies that produce relevant data. Wine and spirits volume data for control states are also obtained from NABCA. All sales and tax receipts reports provided are recorded in a database, where necessary volume conversions are made. Not all state data can be collected due to lack of responses or the

¹CSR, Incorporated operates the Alcohol Epidemiologic Data System (AEDS) under Contract No. HHSN275201300016C for the National Institute on Alcohol Abuse and Alcoholism (NIAAA). Dr. Rosalind A. Breslow (Division of Epidemiology and Prevention Research) serves as the NIAAA Contracting Officer's Representative on the contract.

state's inability to provide such information. Data received that do not correspond to specific volumes or beverage types or that cannot be converted to calendar years are determined invalid and are not used in the surveillance reports.

Because sales data provided by states more accurately reflect consumption of alcohol than shipment data provided from industry sources, state data is the preferred source. When state data are unavailable or unusable, AEDS staff use industry data from the annual beer, wine, and liquor handbooks (<http://beverage-handbook-store.myshopify.com/>) produced by the Beverage Information Group (BIG). BIG was formerly the Adams Beverage Group prior to the publication of the 2008 handbooks. The BIG handbooks provide annual volumes of alcoholic beverage shipment data for each state. Before 2001, AEDS used multiple industry sources, including the Beer Institute, the Wine Institute, and the Distilled Spirits Council of the United States. Because the Adams Beverage Group and then BIG became the sole source of industry data beginning in 2001, AEDS staff compared state and industry data in the years 2001–2013 for this report.

Methods

Using SAS (Version 9.3, SAS Institute Inc., Cary, NC), AEDS staff compared state and industry alcoholic beverage volumes and the estimated apparent per capita consumption. States that provided usable data for all 13 years were selected for the comparison (Table 1). Their beverage volume data were compared with the industry volume data. To calculate the differences in volumes, industry volume data in million gallons were subtracted from state volume data. This difference was divided by the average of state and industry volumes and multiplied by 100 to find the percentage difference and to show the magnitude of the difference relative to the average volumes of these two sources.

Using the same estimation method in the surveillance report, apparent per capita consumption (PCC) for each beverage type was calculated as follows:

$$PCC_i = \frac{volume_i \times AEC_i}{population_{(ages\ 14\ and\ older)}}$$

where *AEC* denotes an estimate of average ethanol content in each alcoholic beverage *i* (i.e., beer, wine, or spirits), and *volume* is the gallons of beverages sold or shipped from state or industry reports. AEC is 0.045 for beer, 0.129 for wine, and 0.411 for spirits. State or national population estimates for ages 14 and older are obtained from the Centers for Disease Control and Prevention WONDER online query system, which provides bridged-race population estimates produced by the U.S. Census Bureau in collaboration with the National Center for Health Statistics (U.S. Department of Health and Human Services 2015). AEDS staff compared PCC estimates derived from state and industry data sources by subtracting the industry PCC estimate from the state PCC estimate for each year. Given that the AEC in the numerator and population in the denominator remain fixed for a given state, year, and beverage type, the only difference in

PCC estimates derived from state and industry data sources is from the volume in the numerator. Therefore, the percentage difference (i.e., a relative measure) calculated based on PCC is equal to the percentage difference based on volume. Figures for each state and beverage type were developed to show the difference in PCC over time between state and industry data.

In addition to comparing state and industry PCC for the states that provided data each year, AEDS staff examined the U.S. consumption trends from 2001–2013 to determine whether the mixed use of data from state and industry sources still appears to have little effect on overall trends. Published PCC estimates from the surveillance report, which were calculated using both state and industry data, were compared with PCC estimates derived using only industry data for each beverage type separately and for total alcohol consumption.

Results

State Compared with Industry (Selected States Only)

From the 50 states and the District of Columbia, AEDS staff found valid and consistently reported state data for every year between 2001–2013 in 19 states for beer, 24 states for wine, and 34 states for spirits (Table 1). Tables 2–4 show the difference and percentage difference in volume and PCC between state and industry beverage data for 2001–2013. The median percentage differences between state and industry data from 2001 to 2013 were 1.86%, 4.92%, and 0.71% for beer, wine, and spirits, respectively.

Figures 1–3 detail the distribution of differences in PCC between state and industry for each data year and beverage type. Over time, the range of differences between state and industry data appears to expand. The increased differences correspond to the transitioning period of the Adams Beverage Group to the Beverage Information Group. While method changes between Adams Beverage Group and Beverage Information Group remain unclear, 2007 beverage data mark the year Adams Beverage Group switched to Beverage Information Group. To further investigate the differences between state and industry PCC, particularly for those outlier states shown in Figures 1–3, state and industry consumption trends were generated for each state (Figure 4). Overall, differences in beer data between the two sources fluctuate over the years, but the differences remain less than 0.1 gallons of ethanol per capita ages 14 and older in most states (Figures 1 and 4).

State wine PCC estimates in 21 out of 24 states were consistently higher than industry PCC estimates in recent data years, beginning around 2007 (Figure 4). One such state is Idaho, which was consistently identified as an outlier in Figure 2. Further, the differences between the two data sources appear to be increasing over time. Although the reason for the widening gap between the state and industry data sources is unknown, the increasing consumption trend observed based on state data may be more than an artifact. The Idaho Wine Commission (2015) describes the state’s growing wine community, which increased from 11 wineries in 2002 to 50

in 2013, and expects continued growth with increasing wine consumption. In contrast to states like Idaho, wine state data in Massachusetts have been consistently lower than industry data since 2007 (Figure 4).

Overall, the differences in spirits PCC estimates between the two sources remained less than 0.1 gallons of ethanol per capita ages 14 and older in most states (Figures 3 and 4). State spirits PCC estimates are nearly identical to industry PCC estimates in 12 out of 34 states (Figure 4). These 12 states are all control states for spirits (i.e., spirits wholly or partially sold in state-run retail stores or through state-run wholesalers). A potential explanation for the little variation between state and industry spirits data could be the overlap in state and industry sources. Spirits volume data for control states were obtained from NABCA, which in the past has also provided limited state-level data to BIG.

State and Industry Combined Compared with Industry (50 States and the District of Columbia)

Figures 5–8 show the national PCC estimates of beer, wine, spirits, and total alcohol between combined state and industry data compared with industry data only. It appears that the mixed use of state and industry data had very little effect on the national PCC trend data, with the exception of recent wine consumption.

Starting in 2005, BIG produced consistently lower national wine volume data compared with combined state and industry data (i.e., published data in the surveillance reports). To provide an explanation for this split, AEDS staff reviewed the volume and PCC of wine provided by three industry sources—BIG, the Wine Institute, and IMPACT. Figures 9 and 10 compare the wine volume and PCC, respectively, for the three industry sources and combined state and industry data. BIG provided consistently lower wine volume data whereas the Wine Institute provided consistently higher data compared to our published data. Although BIG reported lower wine volume data, AEDS staff still consider it to be the best industry source available to AEDS; IMPACT does not provide new editions in the necessary data collection timeframe and the Wine Institute only provides annual national wine volume data, with limited access to state-level information for members only.

Discussion

The apparent per capita alcohol consumption surveillance report notes certain data limitations, such as the fact that the consumption data are estimates and may include error or random fluctuations over time. The report also explains that some states may have inflated consumption reporting due to cross-border sales to buyers from neighboring states (e.g., in New Hampshire) or due to tourists' alcohol consumption (e.g., in Washington D.C.).

For industry data, BIG does not provide any detailed information on its data collection methods, besides stating that the alcoholic beverage volumes are based on shipment data. For state data, state departments of revenue each have their own methods of reporting beverage sales, which could contribute to the variation in differences between state and industry data identified in this report. In some states, volumes are reported by wholesalers or producers, leading to reporting differences due to time delays in distribution of beverages compared with sales to the user (Nephew et al. 2004). Military sales may not be completely represented due to lack of reporting in state reports and separation of this sales category in industry reports. Although BIG provides information on each beverage subtype, such as wine coolers, champagne, and vermouth for the wine category, not all states have the ability to provide such detailed information. Whenever state reports provide separate beverage subtypes, AEDS staff include them in the beverage volume calculation. Neither state nor industry data include illicit beverage production, importation, or sales. Also excluded are legal home production and the ethanol present in medications and food (Rehm et al. 2014).

Finally, due to the varied nature of state reports, AEDS staff perform additional calculations to convert the received beverage data to usable alcoholic beverage volume when necessary. AEDS staff convert state data provided in taxes to gallons by using state tax rates. Errors may also occur when using tax data because all of the alcohol on which taxes are levied in a given time period may not be consumed in the same period (Nephew et al. 2004). Tax refunds that are reported in the following year can also lead to monthly fluctuations, sometimes leading to over- or underestimations of PCC. Any data rounding and conversions made by AEDS staff could play a role in state and industry consumption differences.

The largest difference between state and industry data exists in wine consumption for more recent years. Because combined state and industry wine consumption trends fall in the middle of the different industry sources examined, AEDS staff's methods appear to neither overestimate nor underestimate the consumption data. Overall, our results show minor differences between state and industry volume data and confirm that the mixed use of data from state and industry sources appears to have little effect on determining U.S. trends in per capita alcohol consumption. The impact of using combined data sources on estimating state-level PCC could vary by state. However, no supporting documents were found to provide a clear explanation for state variation. AEDS staff still believe that state sales data more accurately, although not perfectly, reflect alcohol consumption than do shipment data reported from industry sources. Additionally, to avoid missing data or artificially generating state-level data from statistical modeling, industry data are still the preferred supplementary data source.

Suggested Citation

Haughwout, S. P., Castle, I-J. P., & LaVallee, R. A. (2015). Comparison of State Alcoholic Beverage Sales Data with Industry Shipment Data, 2001–2013. Apparent Per Capita Alcohol

Consumption Surveillance Report Methodological Addendum prepared by the Alcohol Epidemiologic Data System, Rockville, MD: National Institute on Alcohol Abuse and Alcoholism. Accessed at <http://pubs.niaaa.nih.gov/publications/surveillance.htm>

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Table 1. List of states that provided usable data for all 13 years from 2001 to 2013, by beverage type.

Beverage Type	Number of States	List of States
Beer	19	AK, AZ, CO, CT, FL, ID, IN, KS, MA, MD, MI, MO, ND, NV, NY, RI, TX, VA, and WY
Wine	24	AK, AZ, CO, CT, FL, ID, IN, KY, LA, MA, MD, MI, MO, MS, ND, NH, NV, NY, PA, RI, TX, UT, VA, and WY
Spirits	34	AK, AL, AZ, CO, CT, FL, IA, ID, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, MT, NC, ND, NH, NV, NY, OH, OR, PA, RI, TX, UT, VA, VT, WV, and WY

Table 2. Difference and percentage difference in volume and apparent per capita consumption between state and industry beer data, 19 States,¹ 2001–2013.

	Difference (in million gallons)			Difference (in gallons of ethanol per capita age 14 and older)			% difference		
	Q1	Median	Q3	Q1	Median	Q3	Q1	Median	Q3
2001	-0.50	-0.05	0.71	-0.01	0.00	0.00	0.22	0.75	1.34
2002	-2.39	-0.91	-0.22	-0.02	-0.01	-0.01	0.57	1.01	1.91
2003	-2.42	-0.70	0.31	-0.03	-0.02	0.00	0.56	1.65	2.82
2004	-0.76	-0.34	0.97	-0.03	-0.01	0.01	0.82	2.21	2.62
2005	-2.26	-0.42	0.54	-0.04	-0.01	0.01	0.50	2.06	3.26
2006	-2.53	-1.14	0.40	-0.04	-0.02	0.01	1.10	1.61	3.66
2007	-2.00	-0.90	0.53	-0.03	-0.01	0.01	0.63	1.42	3.26
2008	-2.42	-0.68	0.94	-0.03	-0.01	0.03	1.13	2.60	3.49
2009	-1.12	0.15	1.02	-0.02	0.00	0.03	0.66	1.91	3.71
2010	-1.66	-0.06	1.61	-0.04	0.00	0.02	0.61	1.89	5.55
2011	-2.88	-0.36	0.59	-0.03	-0.01	0.02	1.18	2.61	4.17
2012	-6.89	-1.93	0.54	-0.07	-0.02	0.00	0.97	3.44	6.60
2013	-6.70	-2.05	0.30	-0.07	-0.04	0.00	1.77	4.17	6.73
2001–2013	-2.31	-0.50	0.54	-0.03	-0.01	0.01	0.81	1.86	3.46

Difference in Volume = (State Beer Volume – Industry Beer Volume); $PCC = \frac{(\text{Beer Volume} + 0.045)}{\text{Population}}$;

Difference in PCC = (State Beer PCC – Industry Beer PCC);

%difference = $\frac{(\text{State Beer Volume or PCC} - \text{Industry Beer Volume or PCC})}{\frac{1}{2}(\text{State Beer Volume or PCC} + \text{Industry Beer Volume or PCC})} \times 100$; Q1, the 1st quartile; Q3, the 3rd quartile.

¹ 19 states include AK, AZ, CO, CT, FL, ID, IN, KS, MA, MD, MI, MO, ND, NV, NY, RI, TX, VA, and WY.

Table 3. Difference and percentage difference in volume and apparent per capita consumption between state and industry wine data, 24 States,¹ 2001–2013.

	Difference (in million gallons)			Difference (in gallons of ethanol per capita age 14 and older)			% difference		
	Q1	Median	Q3	Q1	Median	Q3	Q1	Median	Q3
2001	-0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.13	1.39
2002	-0.19	-0.01	0.01	-0.01	0.00	0.00	0.31	1.41	2.84
2003	-0.25	-0.01	0.10	-0.01	0.00	0.00	0.74	2.03	3.59
2004	-0.18	-0.01	0.18	-0.01	0.00	0.01	0.76	3.01	5.84
2005	-0.11	0.11	0.36	0.00	0.01	0.02	1.17	3.52	7.55
2006	0.08	0.23	0.63	0.00	0.01	0.03	2.87	6.32	7.88
2007	0.05	0.24	0.57	0.00	0.01	0.03	2.10	3.66	12.80
2008	0.17	0.37	1.13	0.01	0.02	0.04	2.22	6.28	14.94
2009	0.20	0.59	1.09	0.01	0.03	0.05	4.09	8.06	19.31
2010	0.32	0.78	1.57	0.02	0.04	0.06	5.61	11.50	19.81
2011	0.34	1.07	2.00	0.03	0.04	0.07	7.50	15.46	21.81
2012	0.53	1.12	2.28	0.03	0.04	0.08	7.03	12.89	27.91
2013	0.40	0.82	2.59	0.02	0.04	0.08	4.00	14.41	29.67
2001–2013	0.00	0.24	0.93	0.00	0.01	0.04	1.83	4.92	12.58

Difference in Volume = (State Wine Volume – Industry Wine Volume); $PCC = \frac{(\text{Wine Volume} * 0.129)}{\text{Population}}$,

Difference in PCC = (State Wine PCC – Industry Wine PCC);

%difference = $\frac{(\text{State Wine Volume or PCC} - \text{Industry Wine Volume or PCC})}{\frac{1}{2}(\text{State Wine Volume or PCC} + \text{Industry Wine Volume or PCC})} \times 100$; Q1, the 1st quartile; Q3, the 3rd quartile.

¹ 24 states include AK, AZ, CO, CT, FL, ID, IN, KY, LA, MA, MD, MI, MO, MS, ND, NH, NV, NY, PA, RI, TX, UT, VA, and WY.

Table 4. Difference and percent difference in volume and apparent per capita consumption between state and industry spirits data, 34 States,¹ 2001–2013.

	Difference (in million gallons)			Difference (in gallons of ethanol per capita age 14 and older)			% difference		
	Q1	Median	Q3	Q1	Median	Q3	Q1	Median	Q3
2001	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.43
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.37
2003	-0.06	0.00	0.03	0.00	0.00	0.00	0.07	0.36	1.95
2004	-0.13	0.00	0.01	-0.01	0.00	0.00	0.10	0.47	2.85
2005	-0.13	0.00	0.01	-0.01	0.00	0.00	0.09	0.55	4.42
2006	-0.05	0.00	0.06	-0.01	0.00	0.01	0.10	1.23	3.09
2007	-0.06	0.00	0.14	-0.01	0.00	0.02	0.10	1.62	4.43
2008	-0.01	0.00	0.20	0.00	0.00	0.02	0.11	1.71	6.04
2009	-0.01	0.00	0.17	0.00	0.00	0.03	0.06	2.30	7.19
2010	0.00	0.00	0.26	0.00	0.00	0.03	0.09	2.29	6.43
2011	-0.03	-0.01	0.21	-0.01	0.00	0.04	0.69	1.89	7.48
2012	-0.02	0.00	0.22	0.00	0.00	0.04	0.15	1.67	7.31
2013	-0.09	0.00	0.23	-0.01	0.00	0.03	0.11	1.75	7.82
2001–2013	-0.02	0.00	0.06	0.00	0.00	0.01	0.09	0.71	4.38

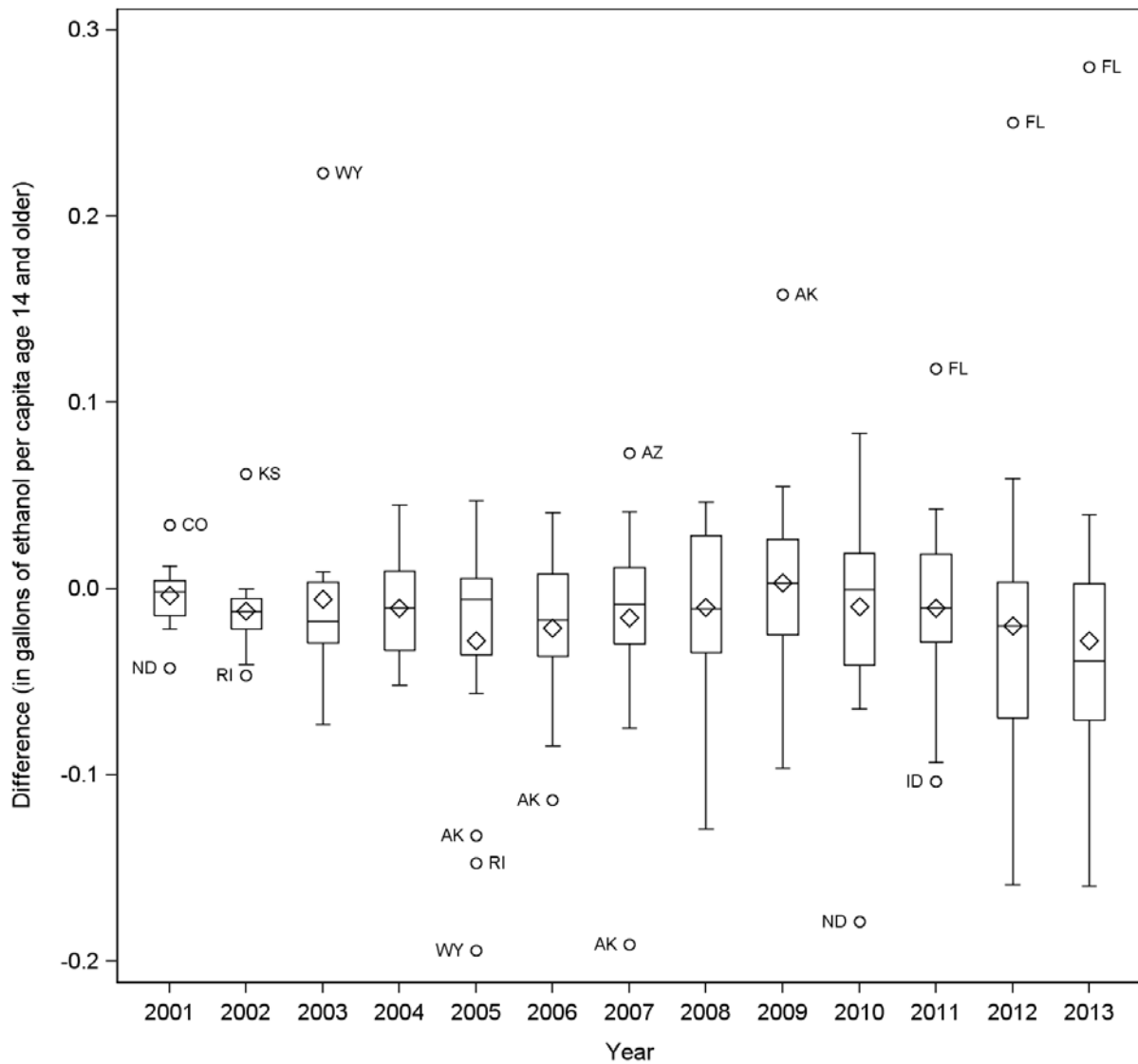
Difference in Volume = (State Spirits Volume – Industry Spirits Volume); $PCC = \frac{(\text{Spirits Volume} \times 0.411)}{\text{Population}}$;

Difference in PCC = (State Spirits PCC – Industry Spirits PCC);

%difference = $\frac{(\text{State Spirits Volume or PCC} - \text{Industry Spirits Volume or PCC})}{\frac{1}{2}(\text{State Spirits Volume or PCC} + \text{Industry Spirits Volume or PCC})} \times 100$; Q1, the 1st quartile; Q3, the 3rd quartile.

¹ 34 states include AK, AL, AZ, CO, CT, FL, IA, ID, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, MT, NC, ND, NH, NV, NY, OH, OR, PA, RI, TX, UT, VA, VT, WV, and WY.

Figure 1. Difference in apparent per capita consumption between state and industry beer data, 19 States,¹ 2001–2013.

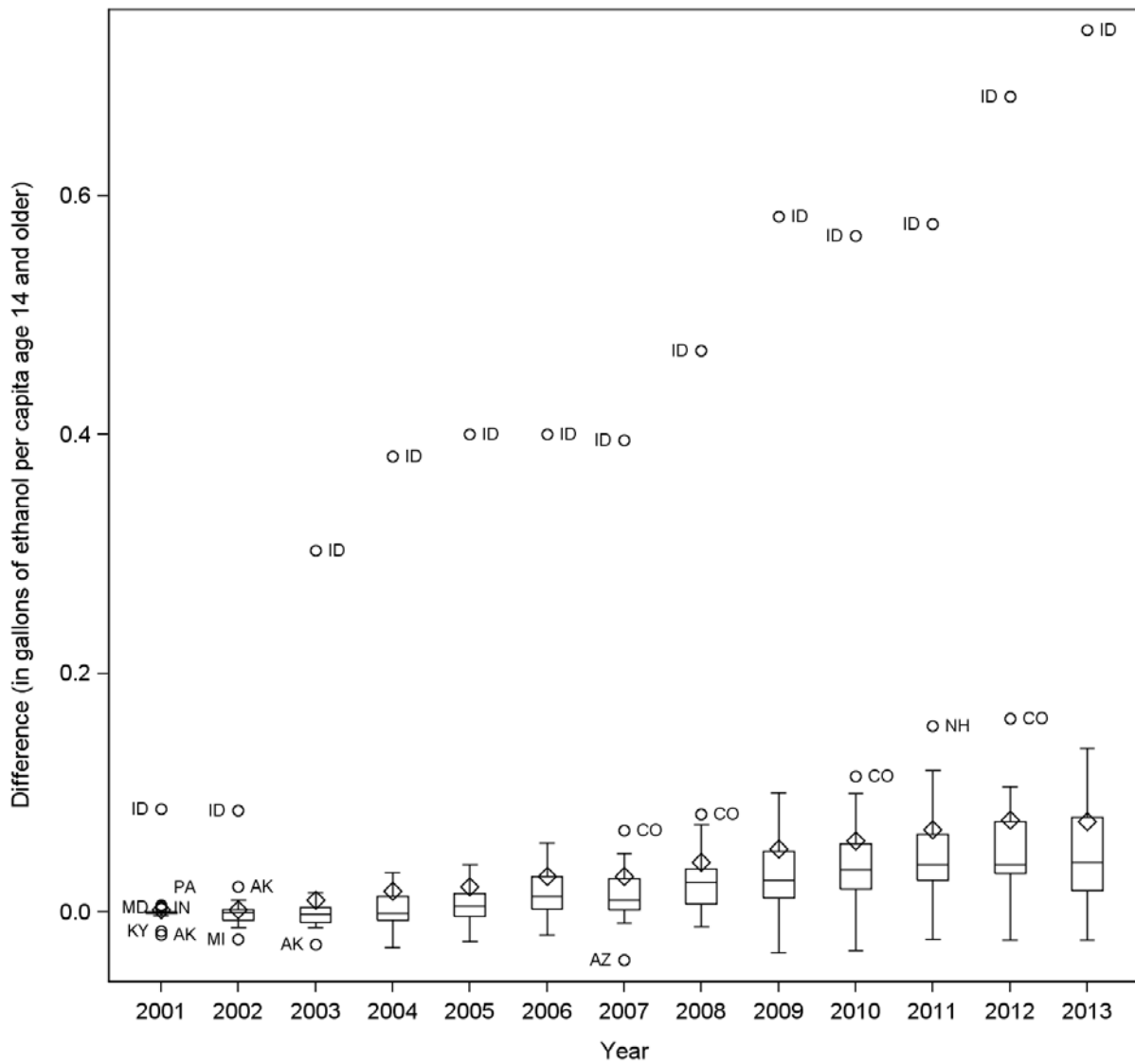


Box plots show median beer PCC values (solid horizontal line), mean values (open diamond), 50th percentile values (box outline), minimum and maximum values (whiskers), and outlier values (open circles).

$$\text{PCC} = \frac{(\text{Beer Volume} \times 0.045)}{\text{Population}}; \text{Difference} = (\text{State Beer PCC} - \text{Industry Beer PCC})$$

¹ 19 states include AK, AZ, CO, CT, FL, ID, IN, KS, MA, MD, MI, MO, ND, NV, NY, RI, TX, VA, and WY.

Figure 2. Difference in apparent per capita consumption between state and industry wine data, 24 States,¹ 2001–2013.

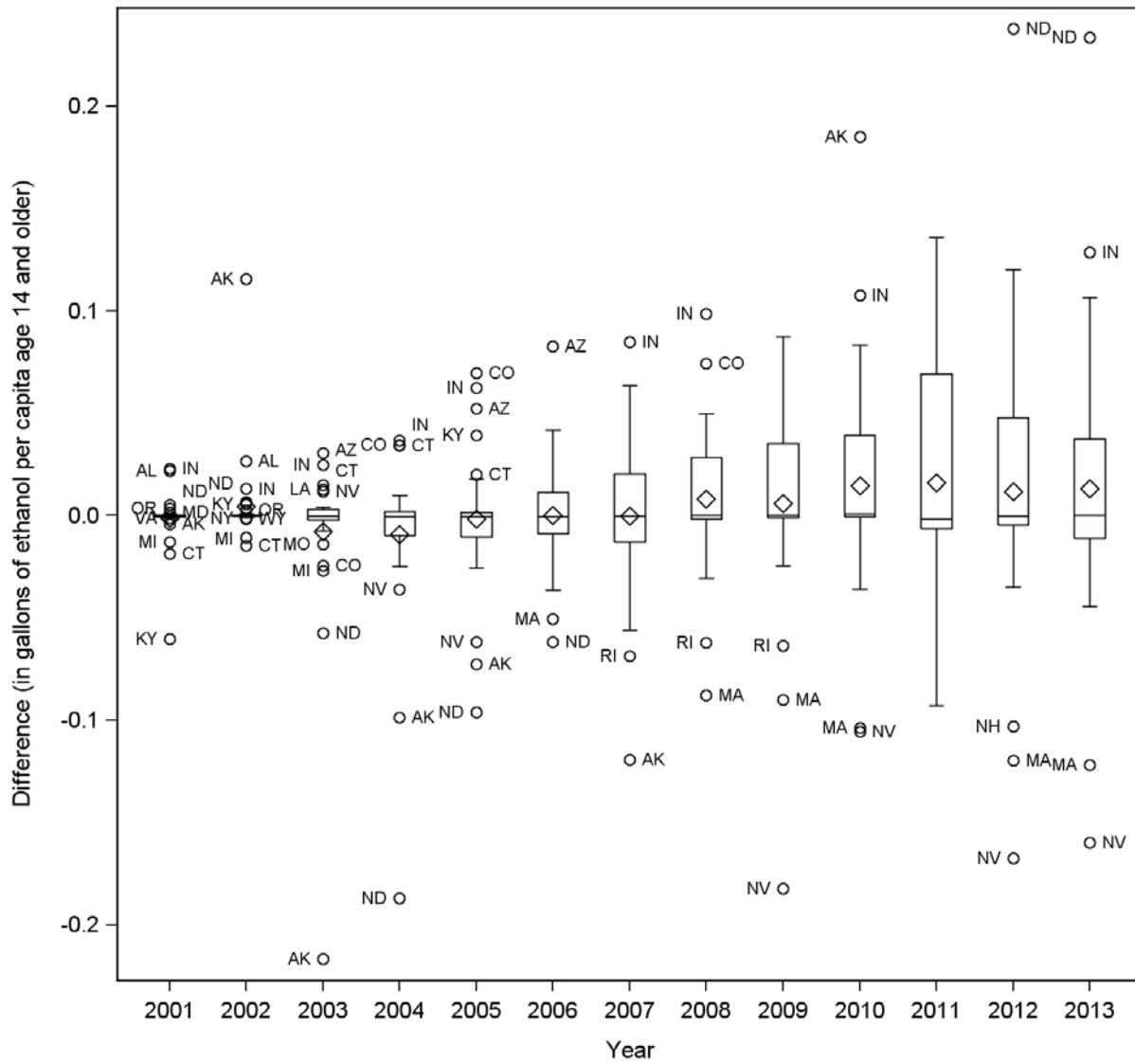


Box plots show median wine PCC values (solid horizontal line), mean values (open diamond), 50th percentile values (box outline), minimum and maximum values (whiskers), and outlier values (open circles).

$$\text{PCC} = \frac{(\text{Wine Volume} \times 0.129)}{\text{Population}}; \text{Difference} = (\text{State Wine PCC} - \text{Industry Wine PCC})$$

¹ 24 states include AK, AZ, CO, CT, FL, ID, IN, KY, LA, MA, MD, MI, MO, MS, ND, NH, NV, NY, PA, RI, TX, UT, VA, and WY.

Figure 3. Difference in apparent per capita consumption between state and industry spirits data, 34 States,¹ 2001–2013.



Box plots show median spirits PCC values (solid horizontal line), mean values (open diamond), 50th percentile values (box outline), minimum and maximum values (whiskers), and outlier values (open circles).

$$PCC = \frac{(\text{Spirits Volume} \times 0.411)}{\text{Population}}; \text{Difference} = (\text{State Spirits PCC} - \text{Industry Spirits PCC})$$

¹ 34 states include AK, AL, AZ, CO, CT, FL, IA, ID, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, MT, NC, ND, NH, NV, NY, OH, OR, PA, RI, TX, UT, VA, VT, WV, and WY.

Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013.

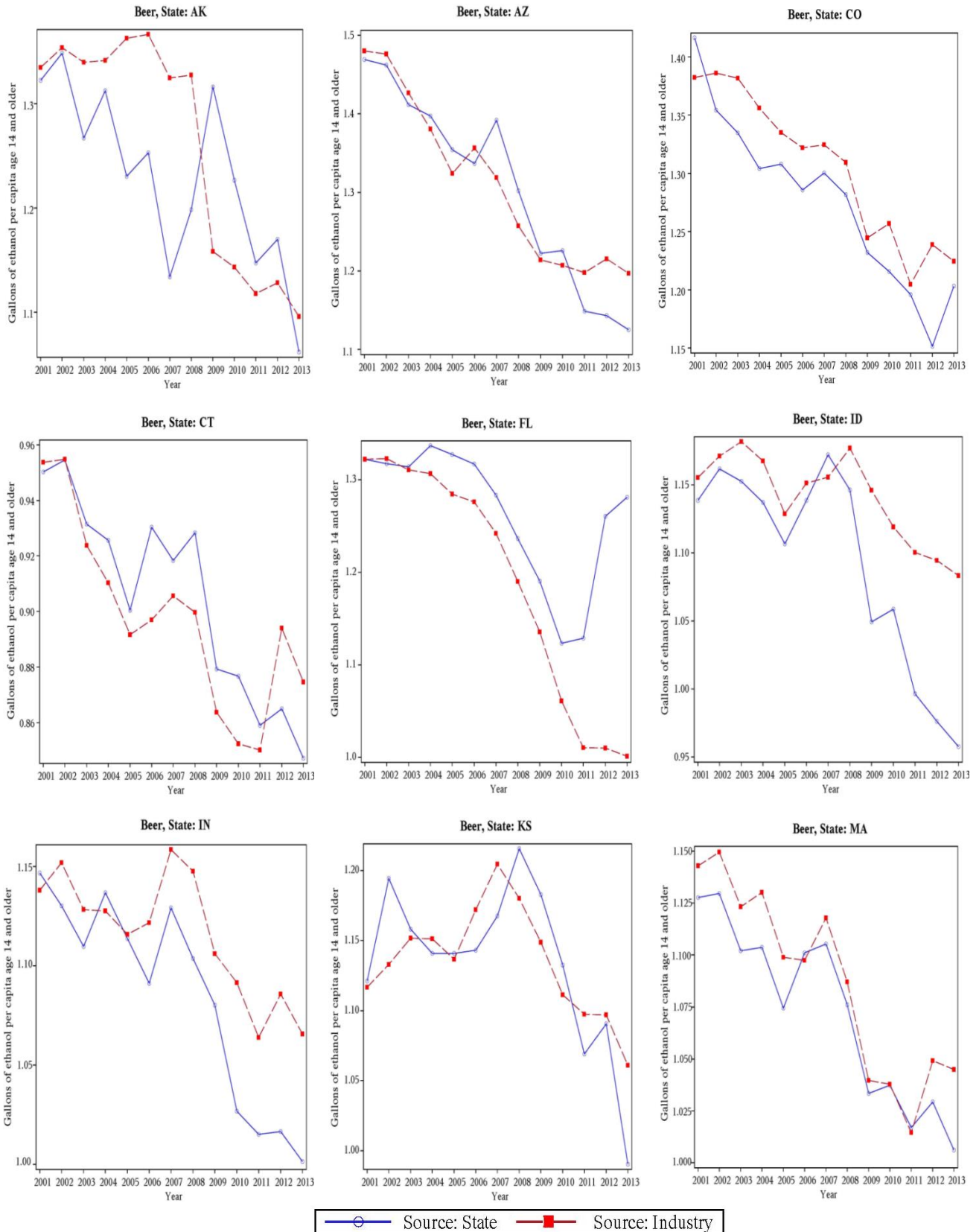


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013. (Continued)

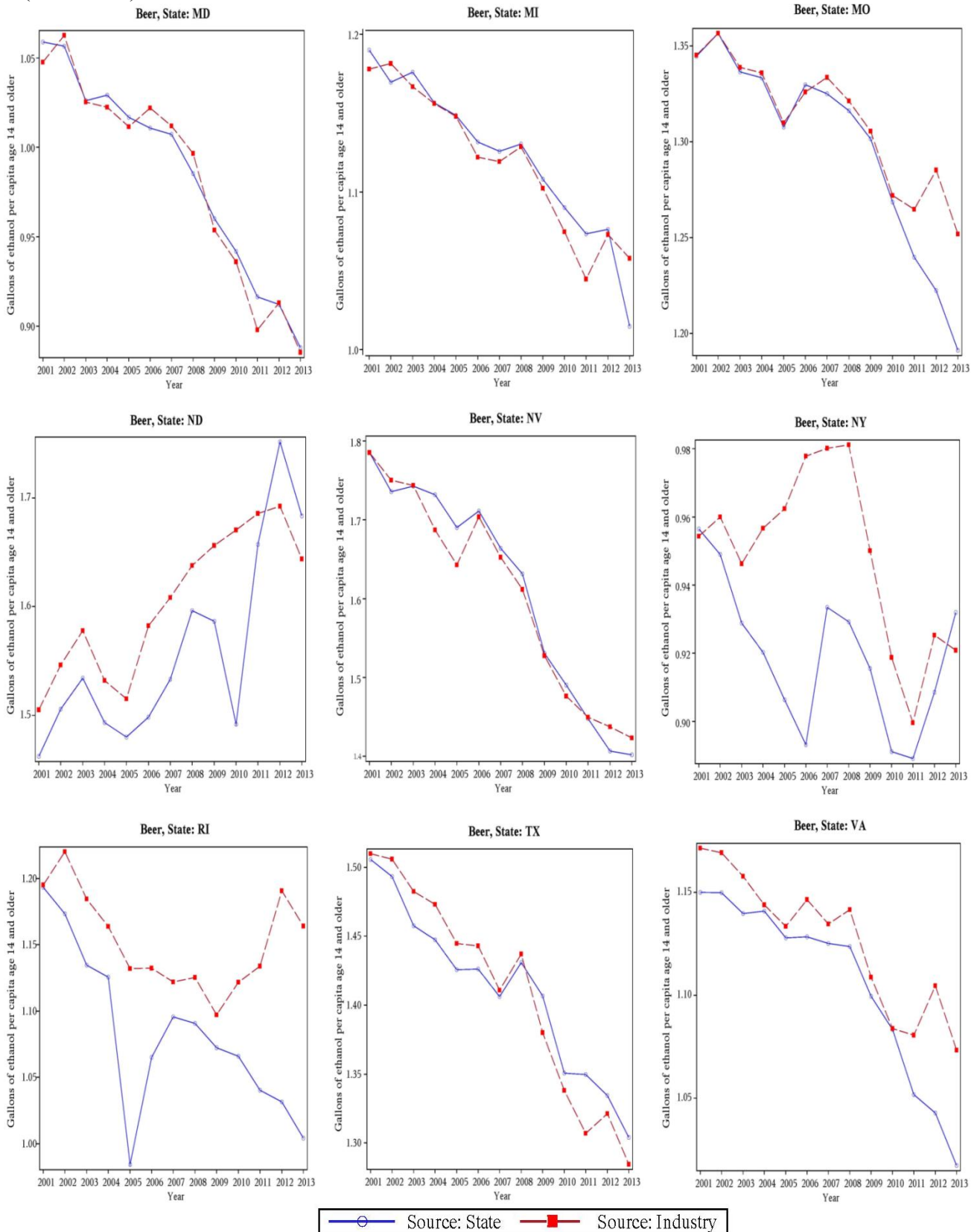


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013. (Continued)

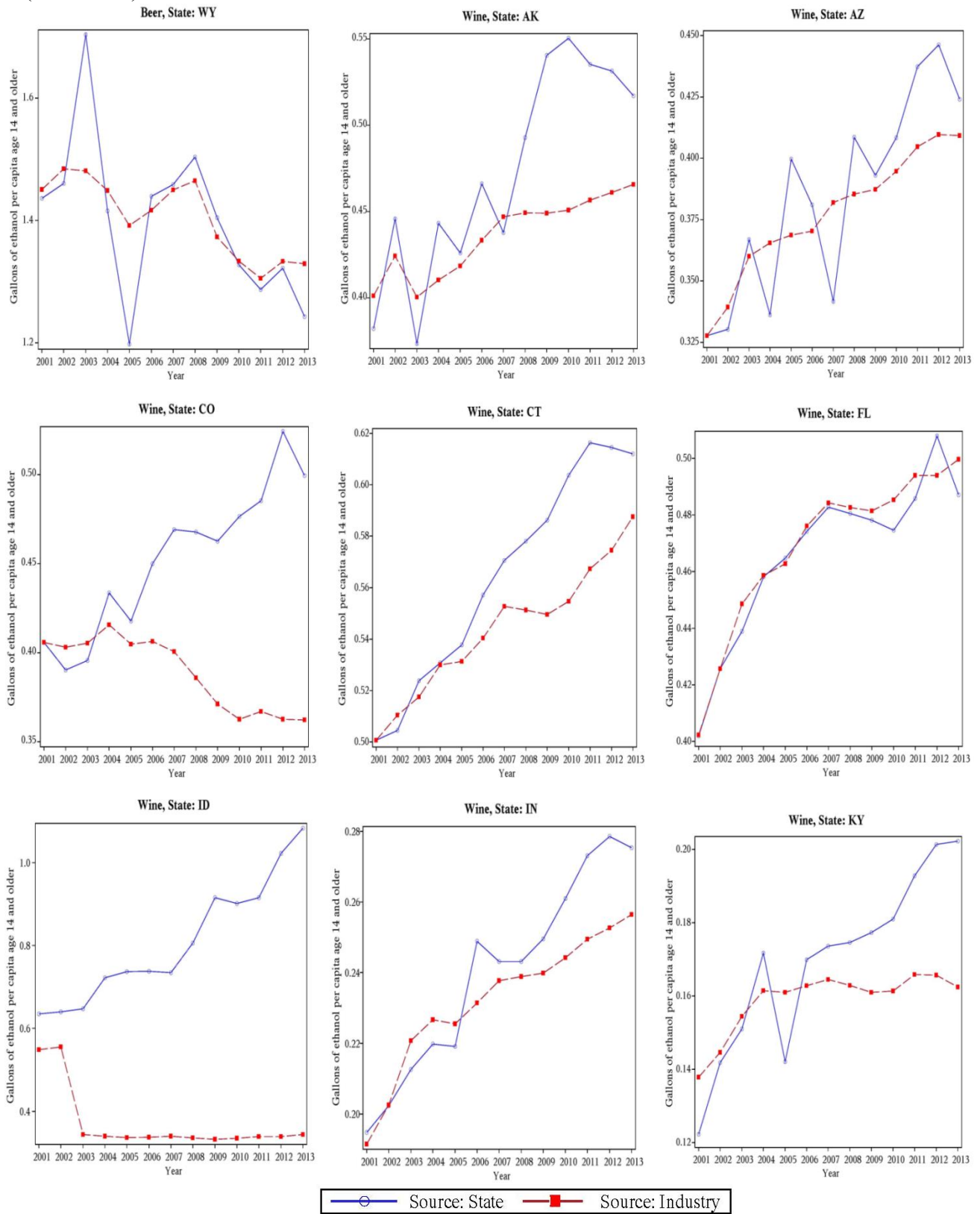


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013. (Continued)

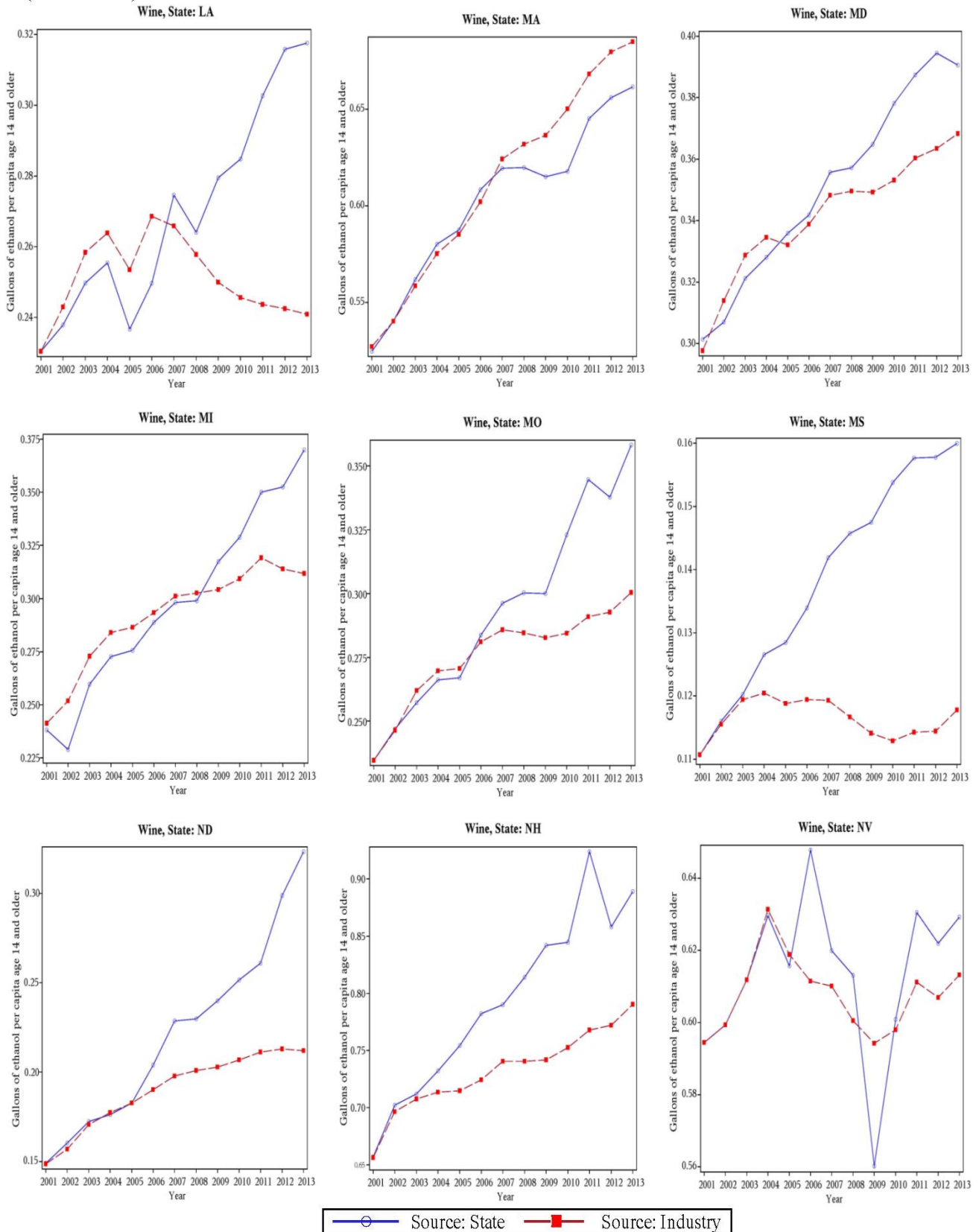


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013. (Continued)

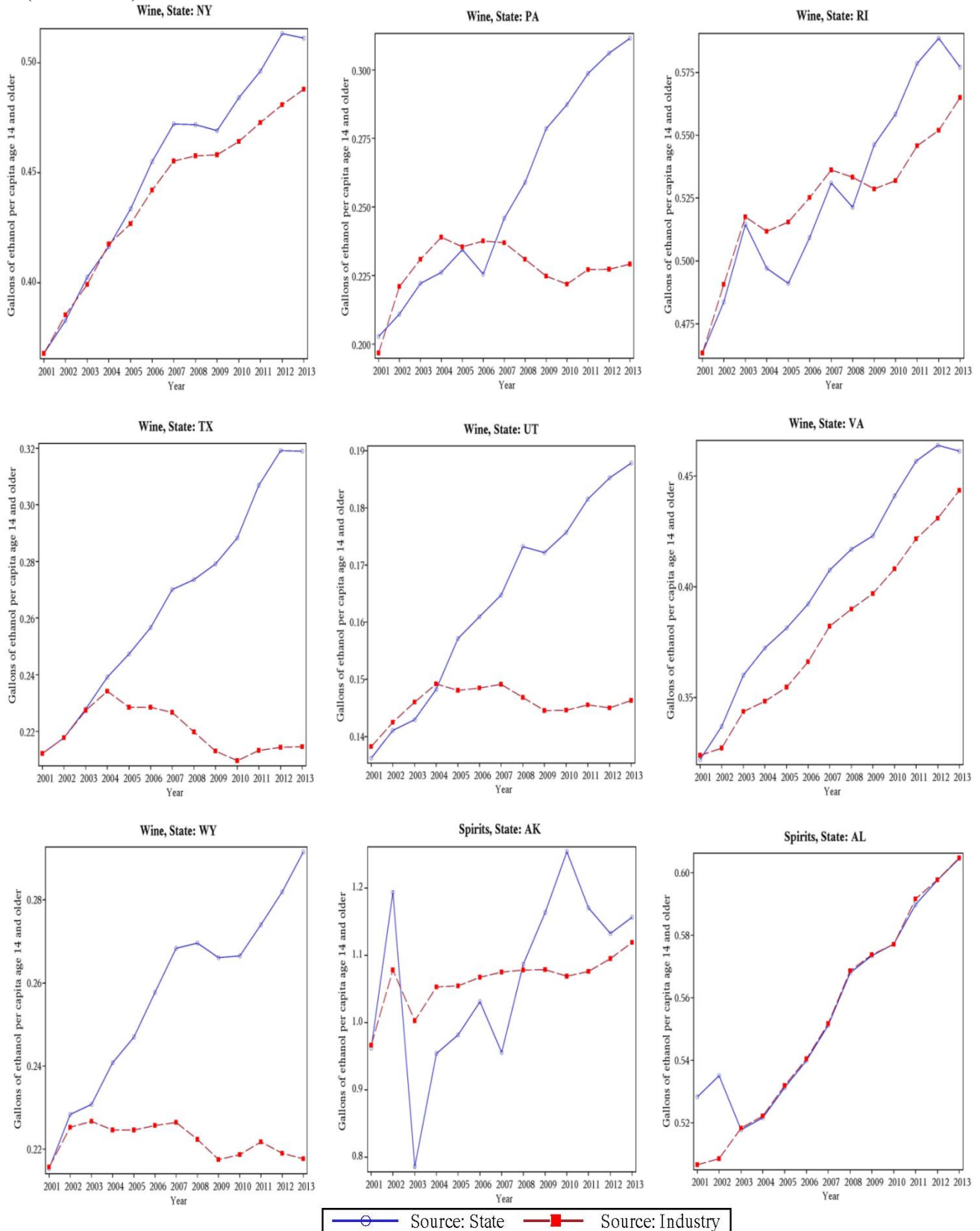


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013. (Continued)

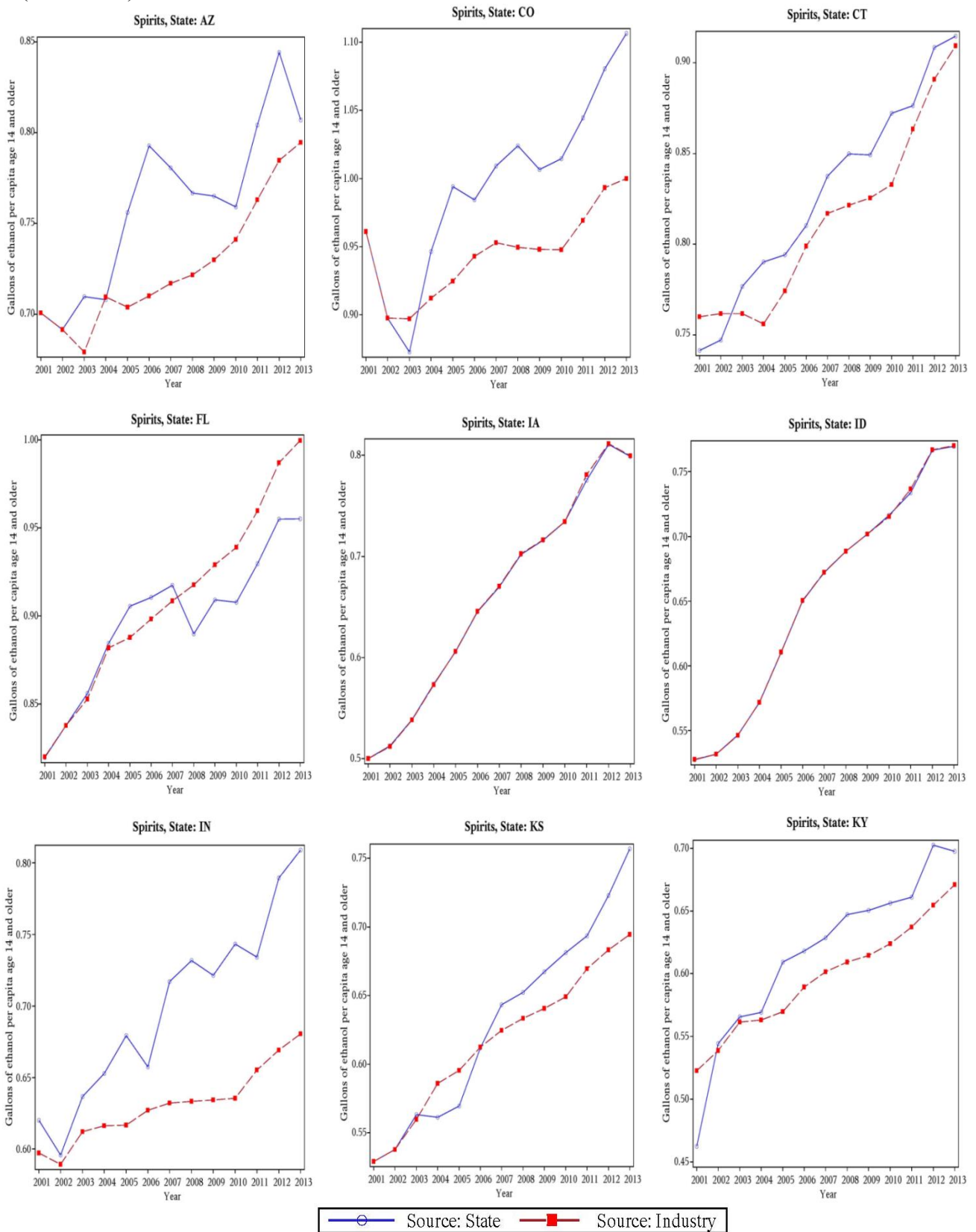


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013.
(Continued)

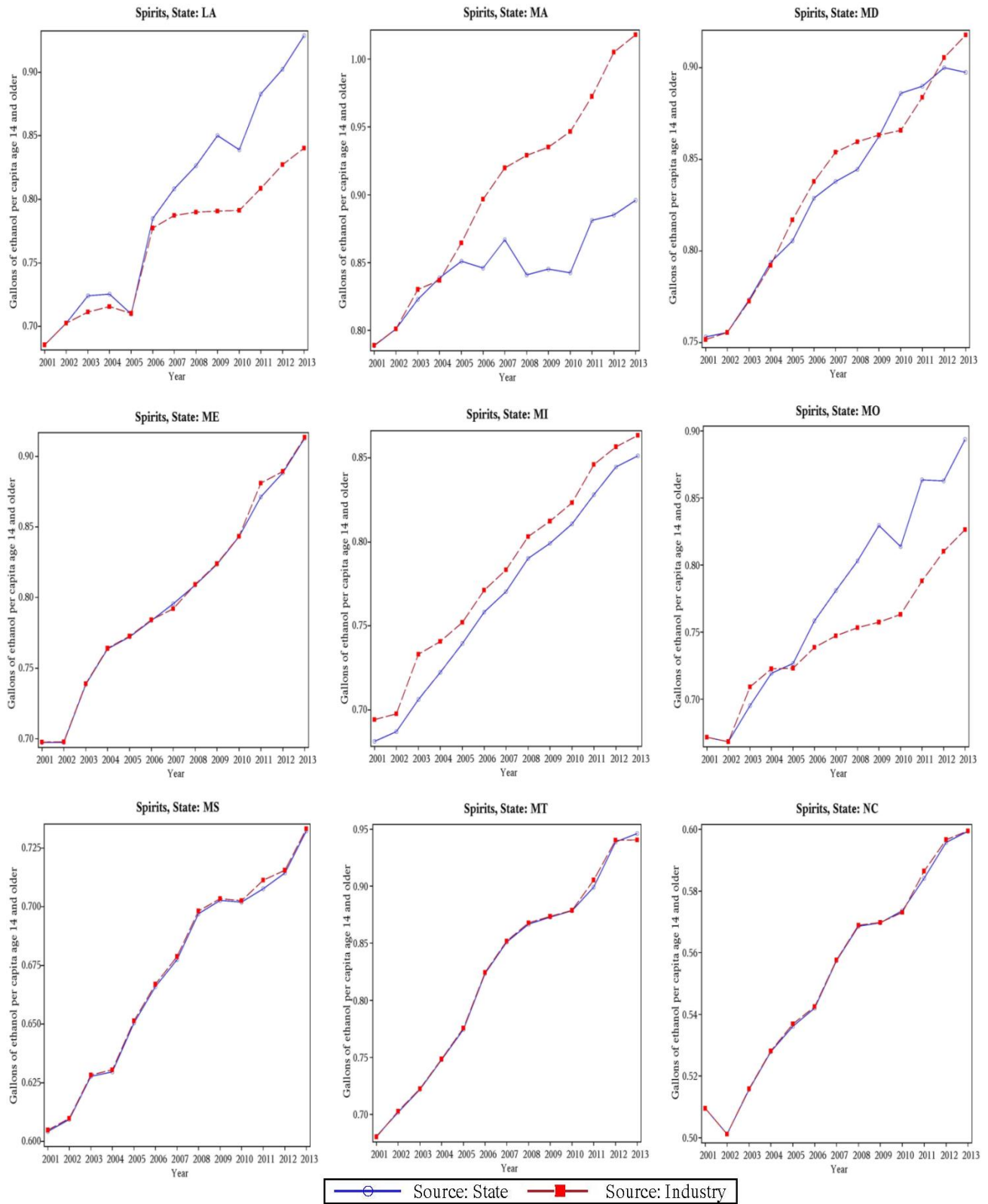


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013. (Continued)

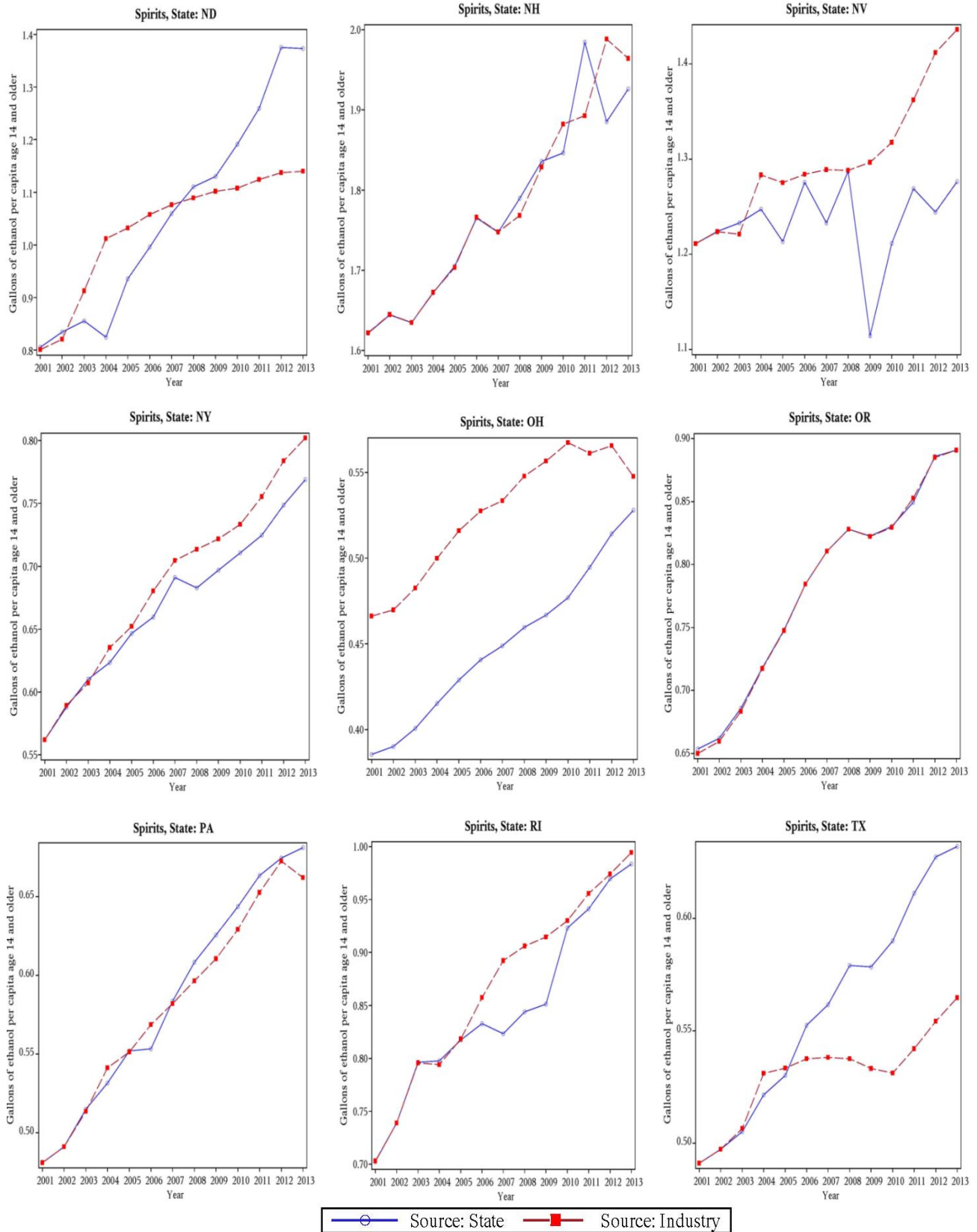


Figure 4. Apparent per capita consumption trends, by state and beverage type, 2001–2013.
(Continued)

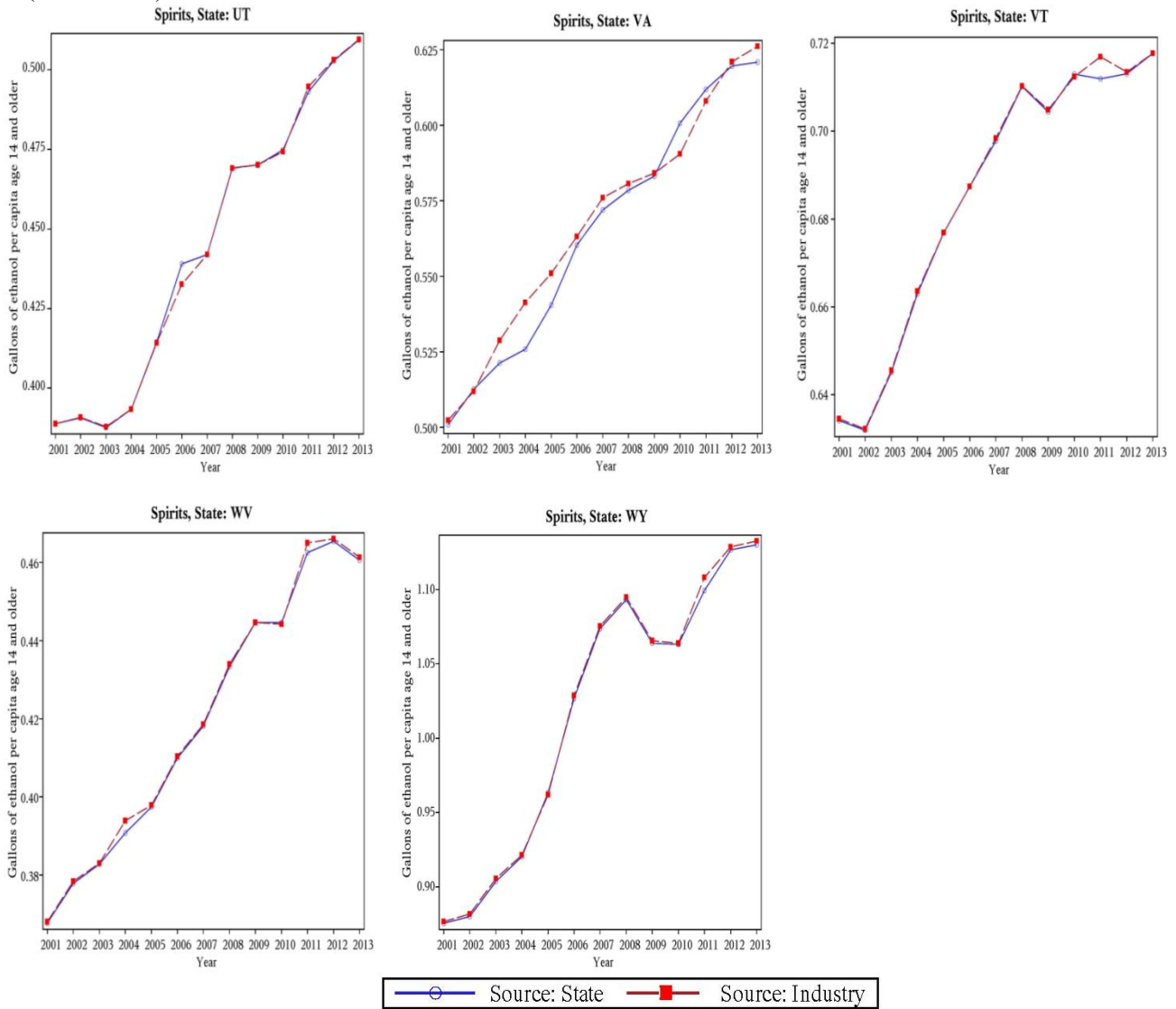


Figure 5. Apparent per capita consumption of beer by data source, United States, 2001–2013.

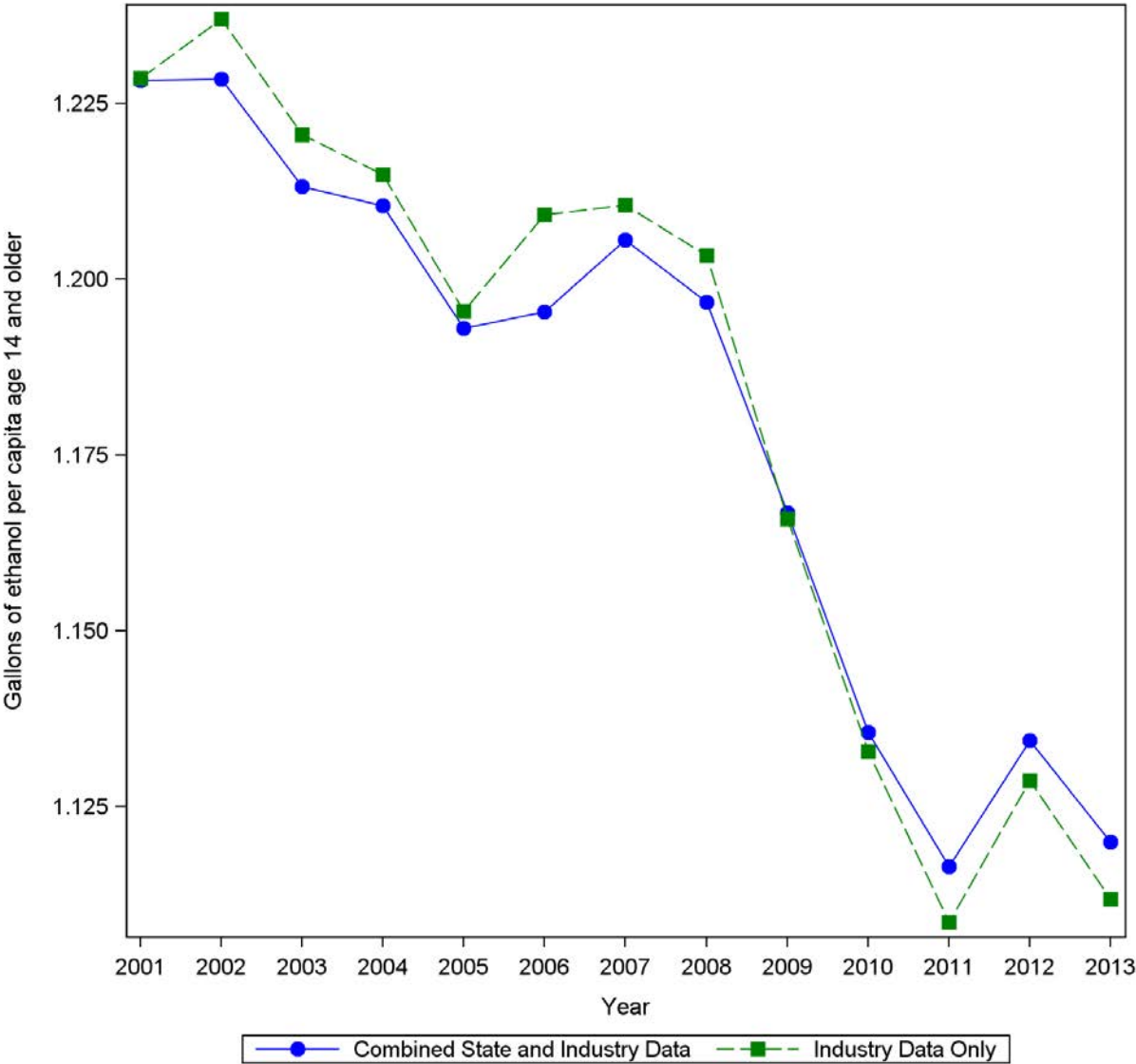


Figure 6. Apparent per capita consumption of wine by data source, United States, 2001–2013.

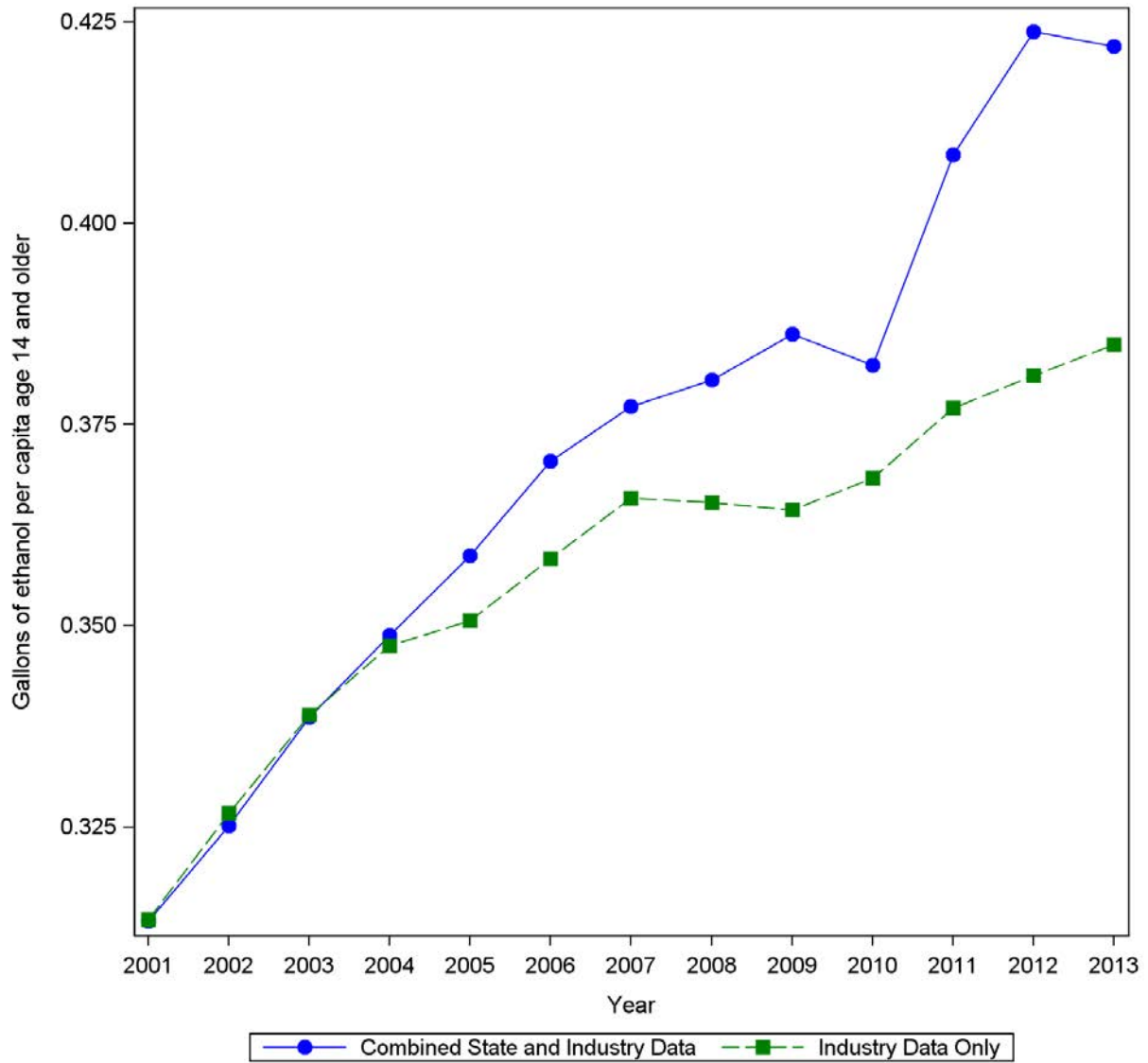


Figure 7. Apparent per capita consumption of spirits by data source, United States, 2001–2013.

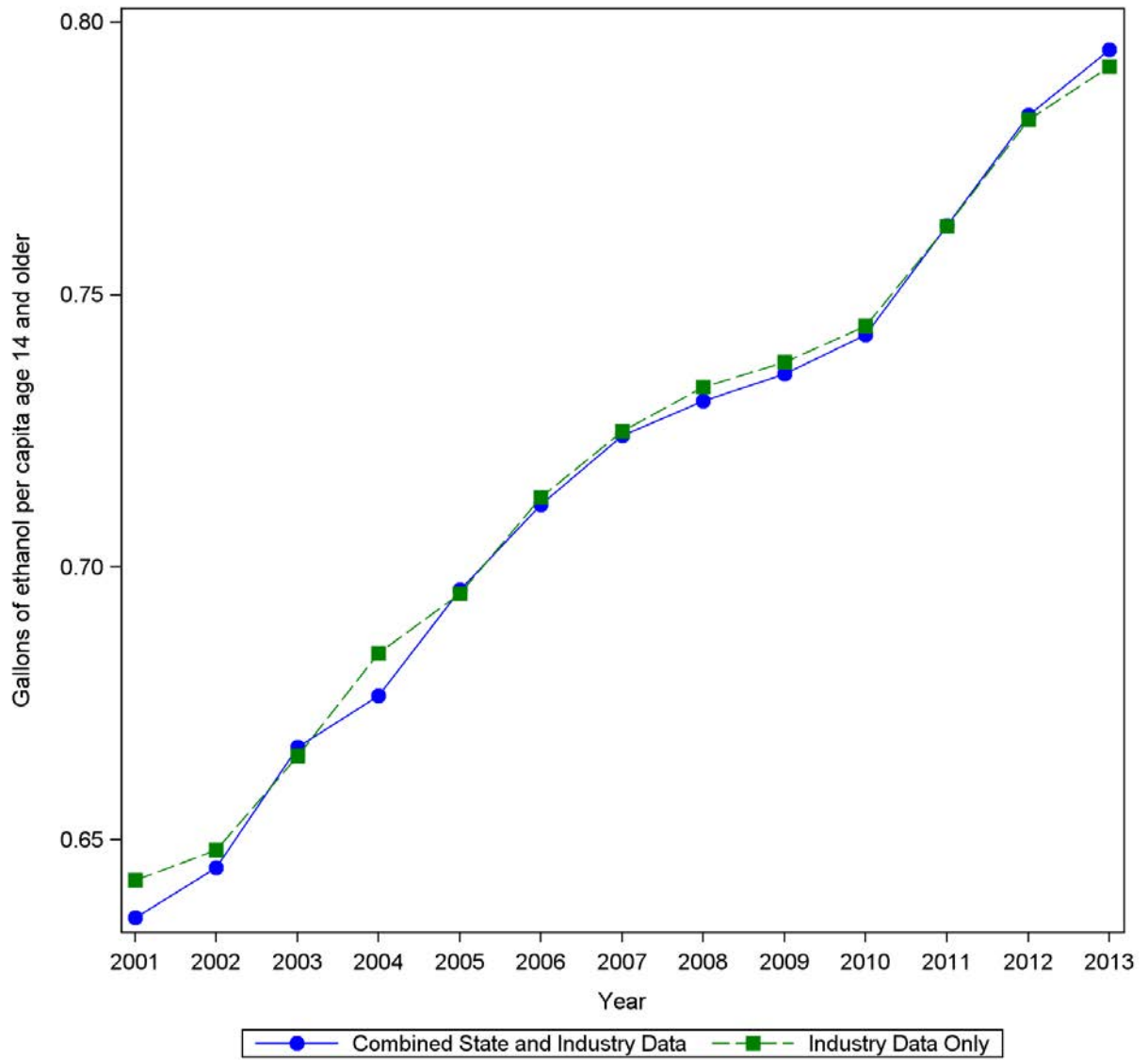


Figure 8. Apparent per capita consumption of alcohol by data source, United States, 2001–2013.

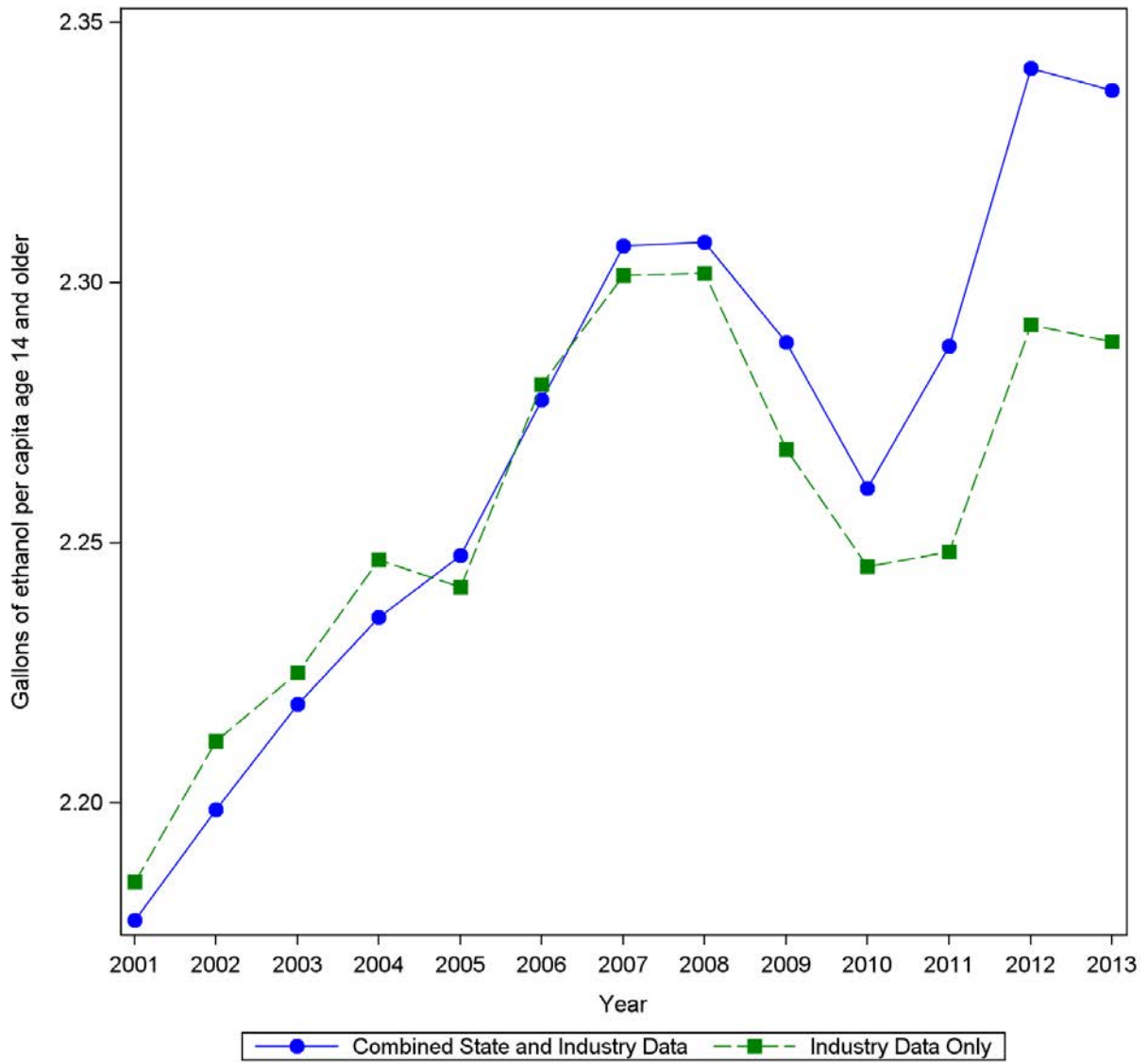


Figure 9. Wine volume, by data source, United States, 2001–2013.

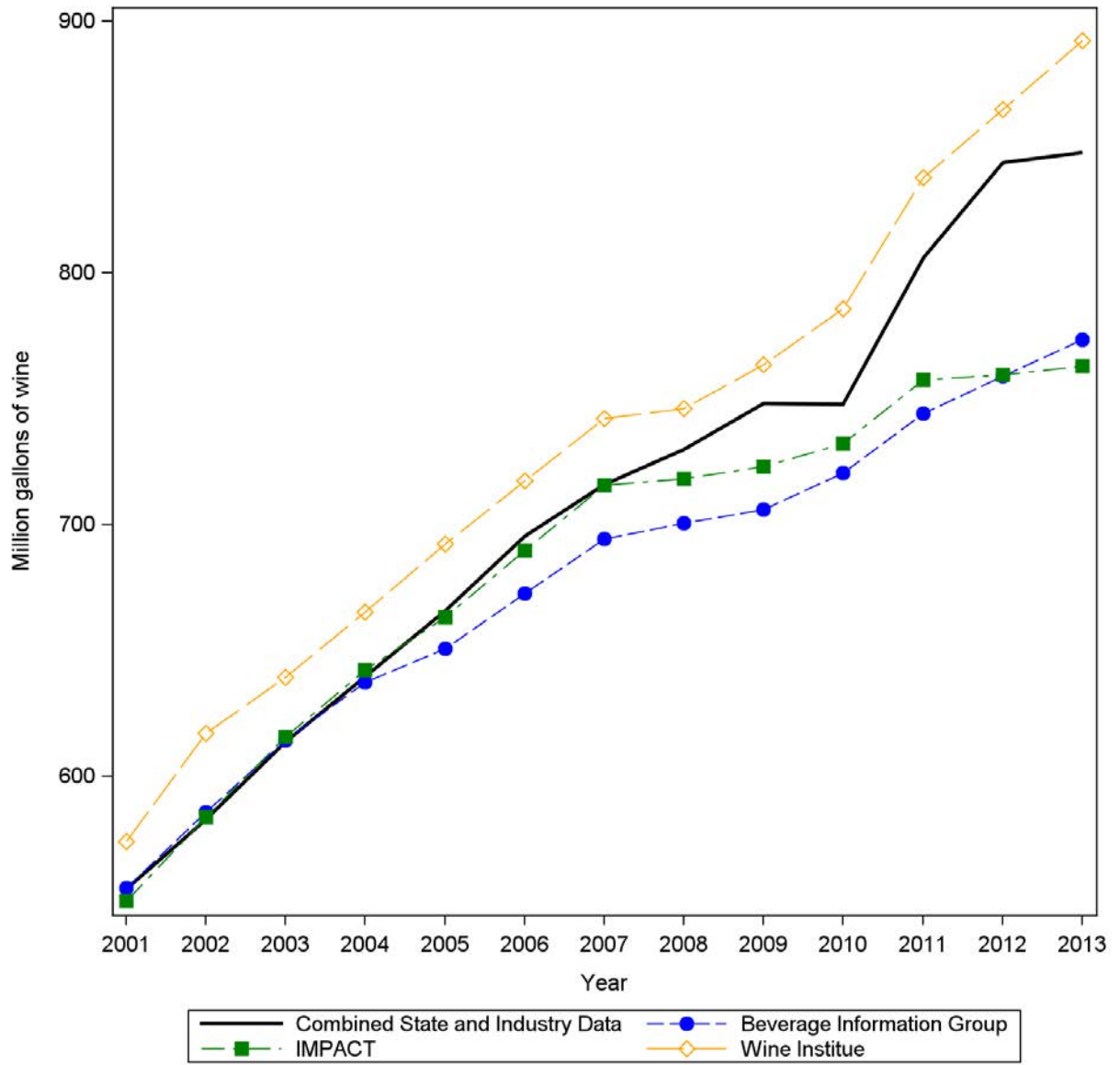


Figure 10. Apparent per capita consumption of wine, by data source, United States, 2001–2013.

