



Data Analysis of Breweries and Beer

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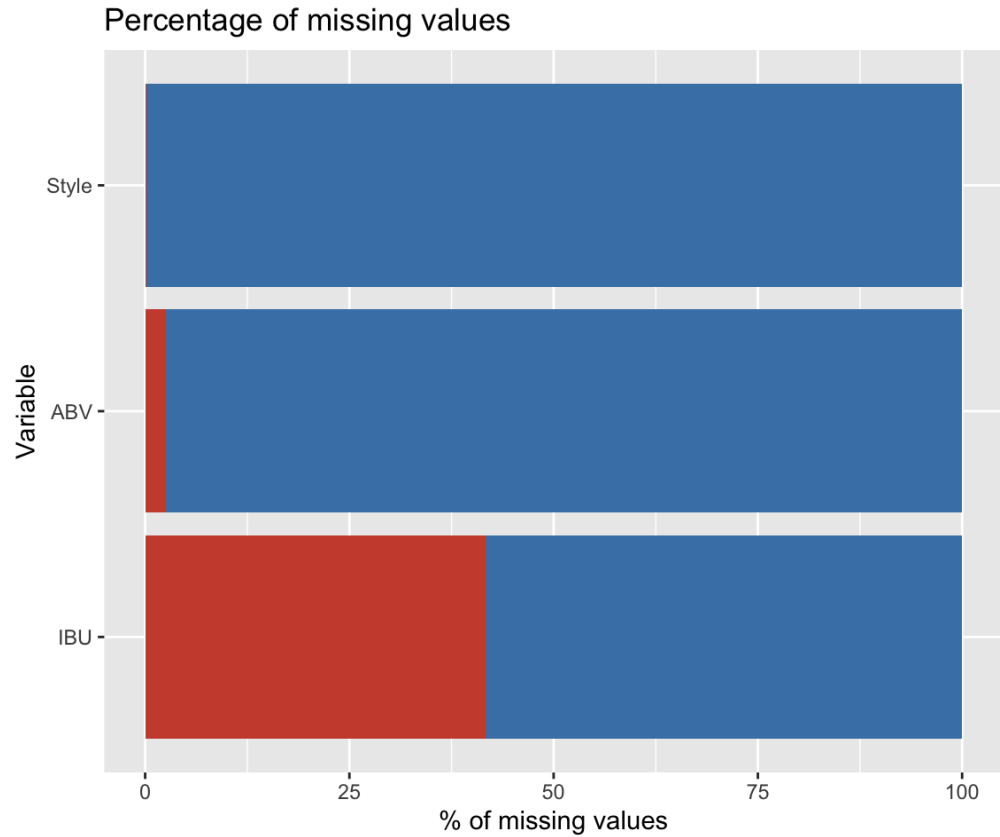
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1. Breweries by State
2. Handling Missing Values
3. ABV and IBU by State
4. Highest ABV and IBU Beers
5. Distribution of ABV
6. Relationship between ABV and IBU



Handling Missing Values

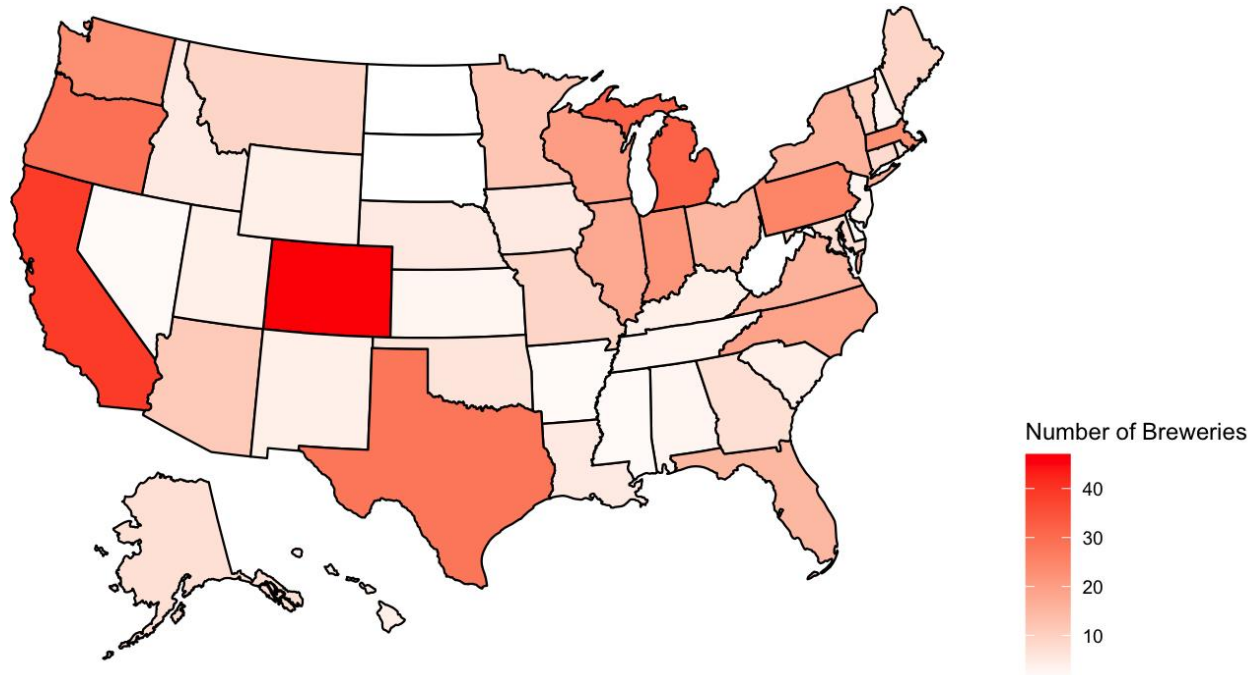


- IBU is not regularly reported per beer
- Replace missing values with average IBU/ABV in that style
- 9 styles of beer do not contain any reported IBUs including 37 Ciders
- Set IBU to zero for Cider. Drop remaining styles with no IBUs.
- Result: Drops 20 beers out of 2410.



Distribution of Breweries across the United States

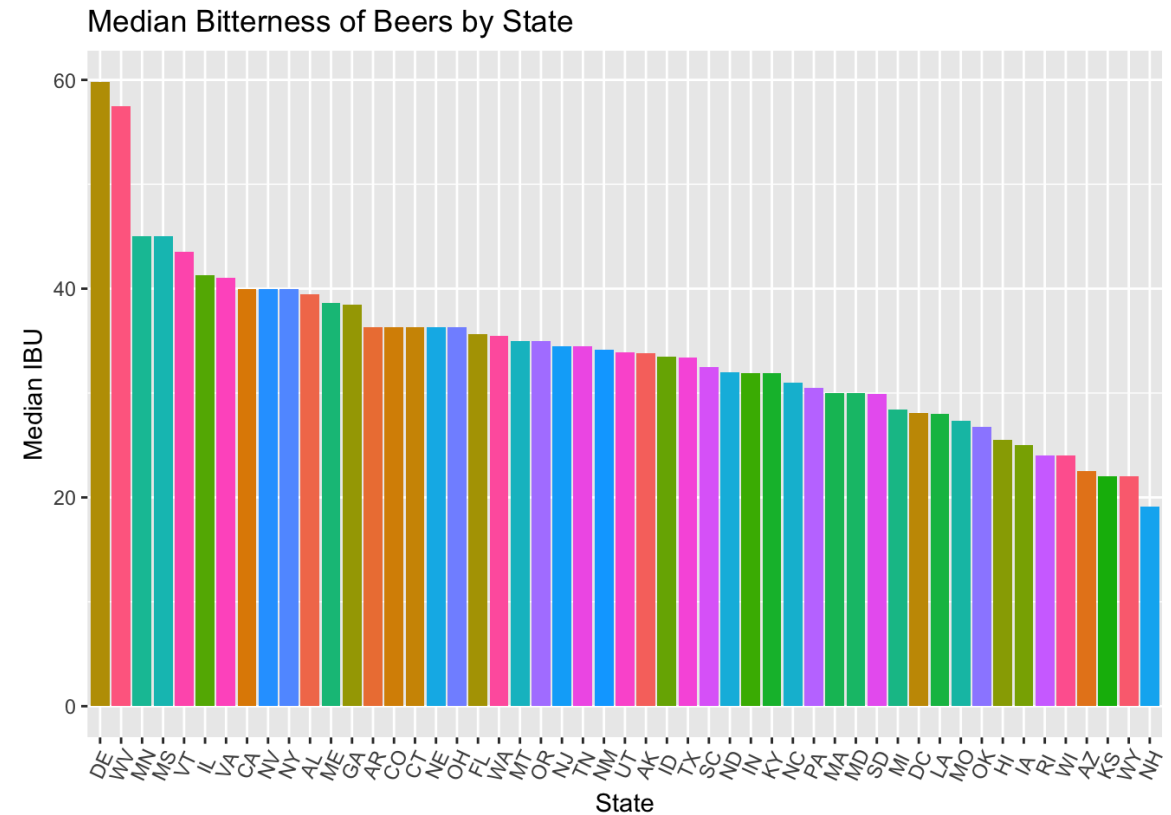
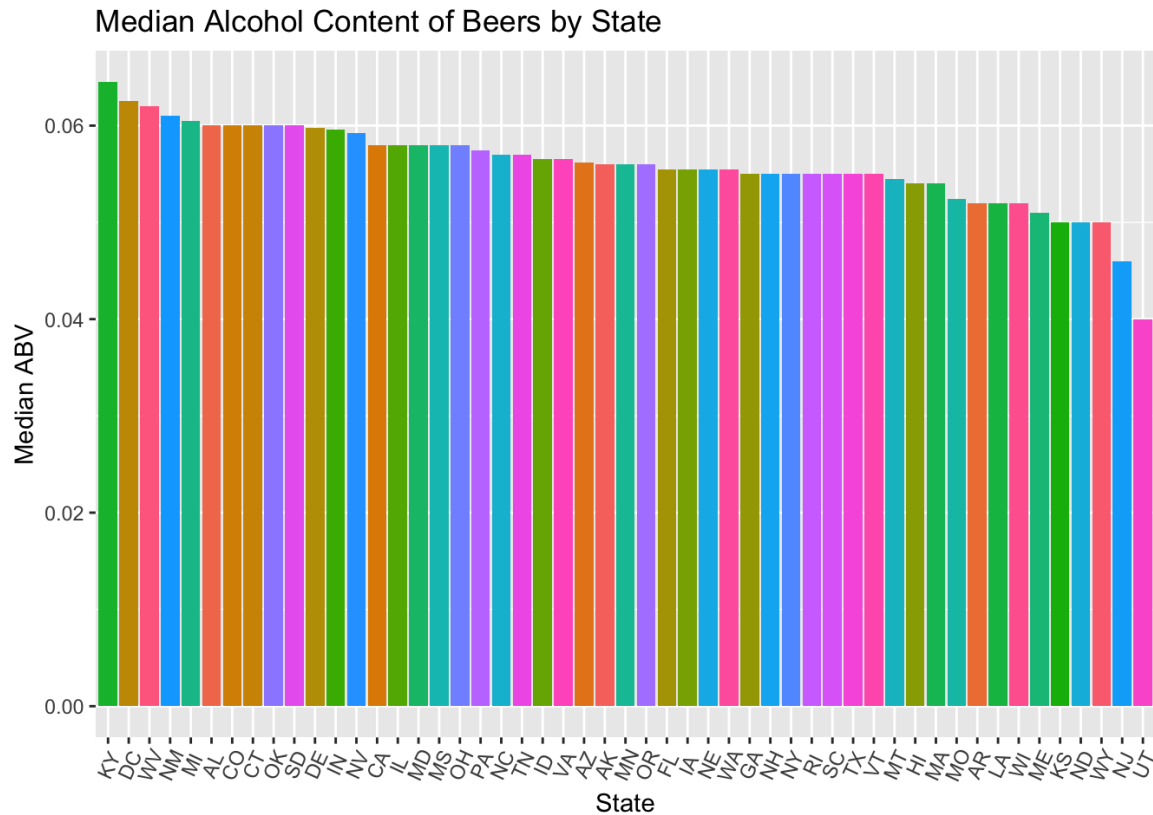
Breweries in the United States



- California, Colorado, Michigan contain the most breweries in the US
- No specific region that is dominated by breweries
- Population is not the only factor affecting the presence of breweries



Median IBU and ABV by State

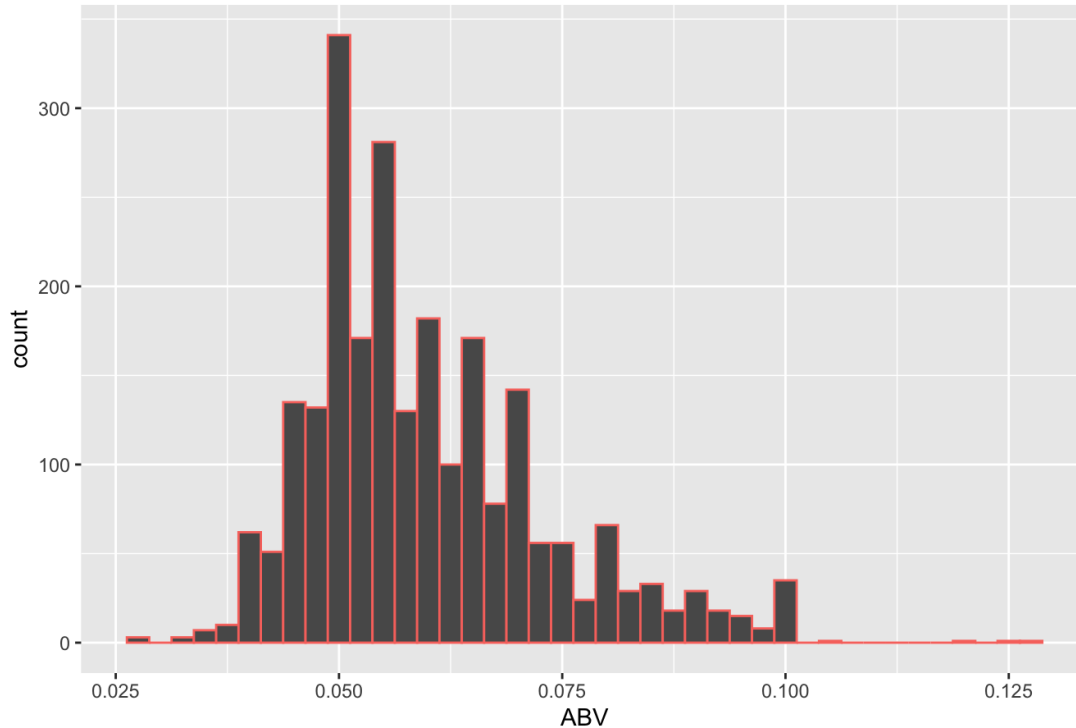


- Median ABV varies less across states than median IBU
- No obvious geographical/regional pattern.
- A higher Median ABV does not necessarily indicate higher ABV (see next slide)



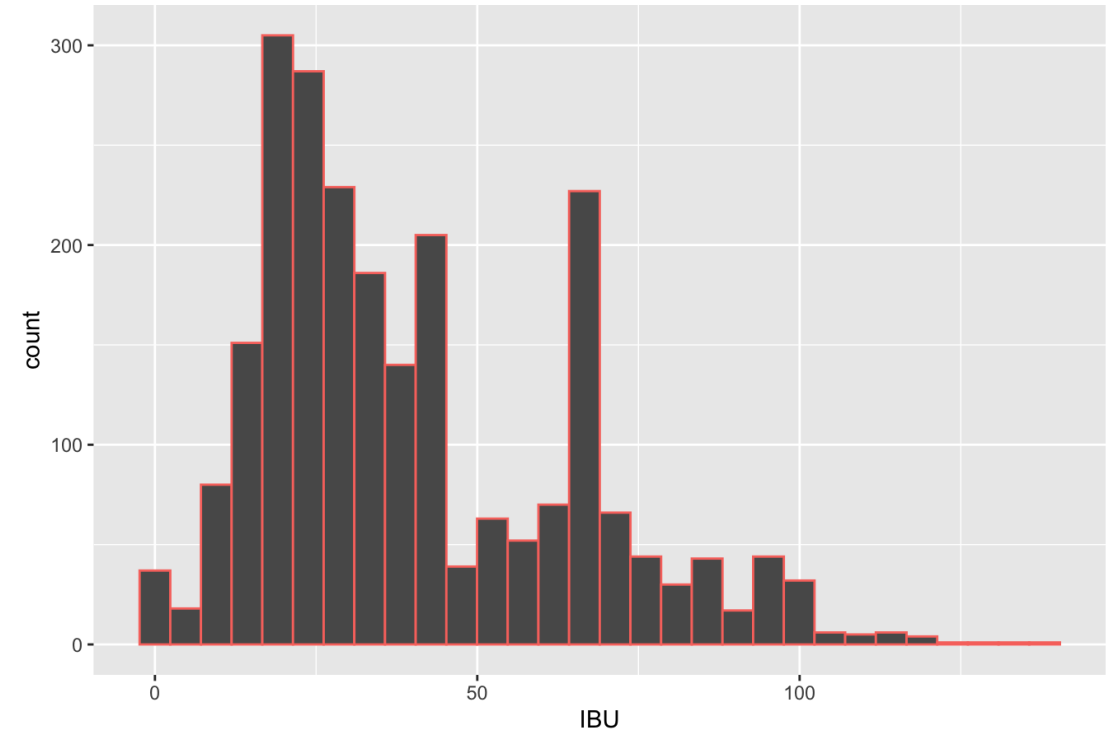
Distribution of Alcoholic Content of Beers

Distribution of ABV for All beers



- Median = 0.05600
- Mean = 0.05974
- Distribution is slightly right-skewed as beers are not typically strong alcoholic drinks.

Distribution of IBU for All beers



- Median = 33.81
- Mean = 40.27
- Distribution may be bi-modal.



Top IBU and ABV Beers in the US

Top 5 IBU Beers

| beer_name | Style | brewery_name | City | State | IBU | ABV |
|---------------------------------|--------------------------------|------------------------------------|-----------------|-------|-----|-------|
| Bitter Bitch Imperial IPA | American Double / Imperial IPA | Astoria Brewing Company | Astoria | OR | 138 | 0.082 |
| Troopers Alley IPA | American IPA | Wolf Hills Brewing Company | Abingdon | VA | 135 | 0.059 |
| Dead-Eye DIPA | American Double / Imperial IPA | Cape Ann Brewing Company | Gloucester | MA | 130 | 0.090 |
| Bay of Bengal Double IPA (2014) | American Double / Imperial IPA | Christian Moerlein Brewing Company | Cincinnati | OH | 126 | 0.089 |
| Abrasive Ale | American Double / Imperial IPA | Surly Brewing Company | Brooklyn Center | MN | 120 | 0.097 |

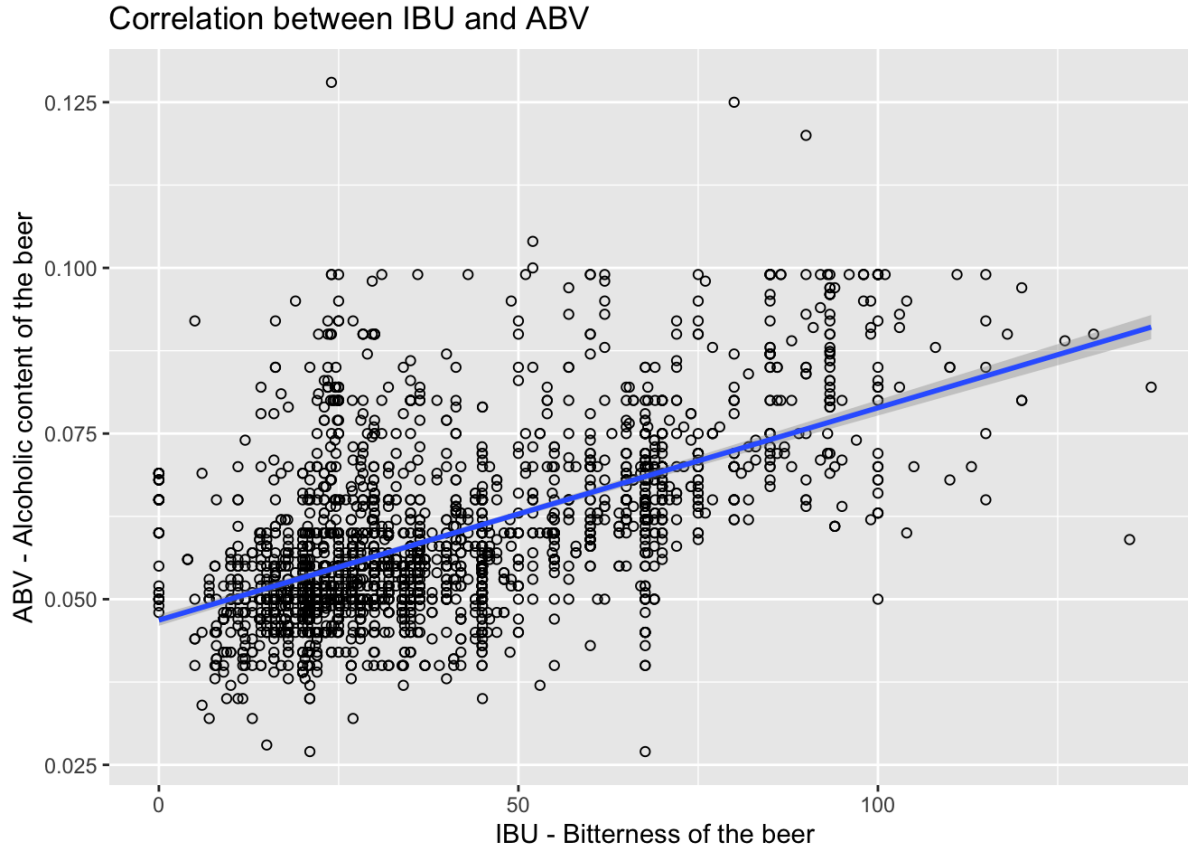
- Boulder, CO has 2 of the top 5 IBU beers
- Top 5 IBU beers are all American IPAs

Top 5 ABV Beers

| beer_name | Style | brewery_name | City | State | IBU | ABV |
|--|------------------------|---------------------------|------------|-------|-----|-------|
| Lee Hill Series Vol. 5 - Belgian Style Quadrupel Ale | Quadrupel (Quad) | Upslope Brewing Company | Boulder | CO | 24 | 0.128 |
| London Balling | English Barleywine | Against the Grain Brewery | Louisville | KY | 80 | 0.125 |
| Csar | Russian Imperial Stout | Tin Man Brewing Company | Evansville | IN | 90 | 0.120 |
| Lee Hill Series Vol. 4 - Manhattan Style Rye Ale | Rye Beer | Upslope Brewing Company | Boulder | CO | 52 | 0.104 |
| 4Beans | Baltic Porter | Sixpoint Craft Ales | Brooklyn | NY | 52 | 0.100 |



Relationship between IBU and ABV



- Positive correlation
- Correlation value = 0.58
 - 95% CI (0.55 , 0.61)
- Data is sparse beyond ~60 IBU.
- There is not strong evidence against equal variances indicating a linear regression may be an appropriate model here.



Conclusion

- Key takeaways

- No obvious regional patterns in the US of brewery locations
- IBU not regularly reported
- Positive linear relationship between IBU and ABV
- Bi-modal distribution of IBU – possibly different markets?

- Further research

- Classifications of beer based on IBU/ABV
- Distribution/Sales data – where is the beer going?
- Demographics, economics of states

