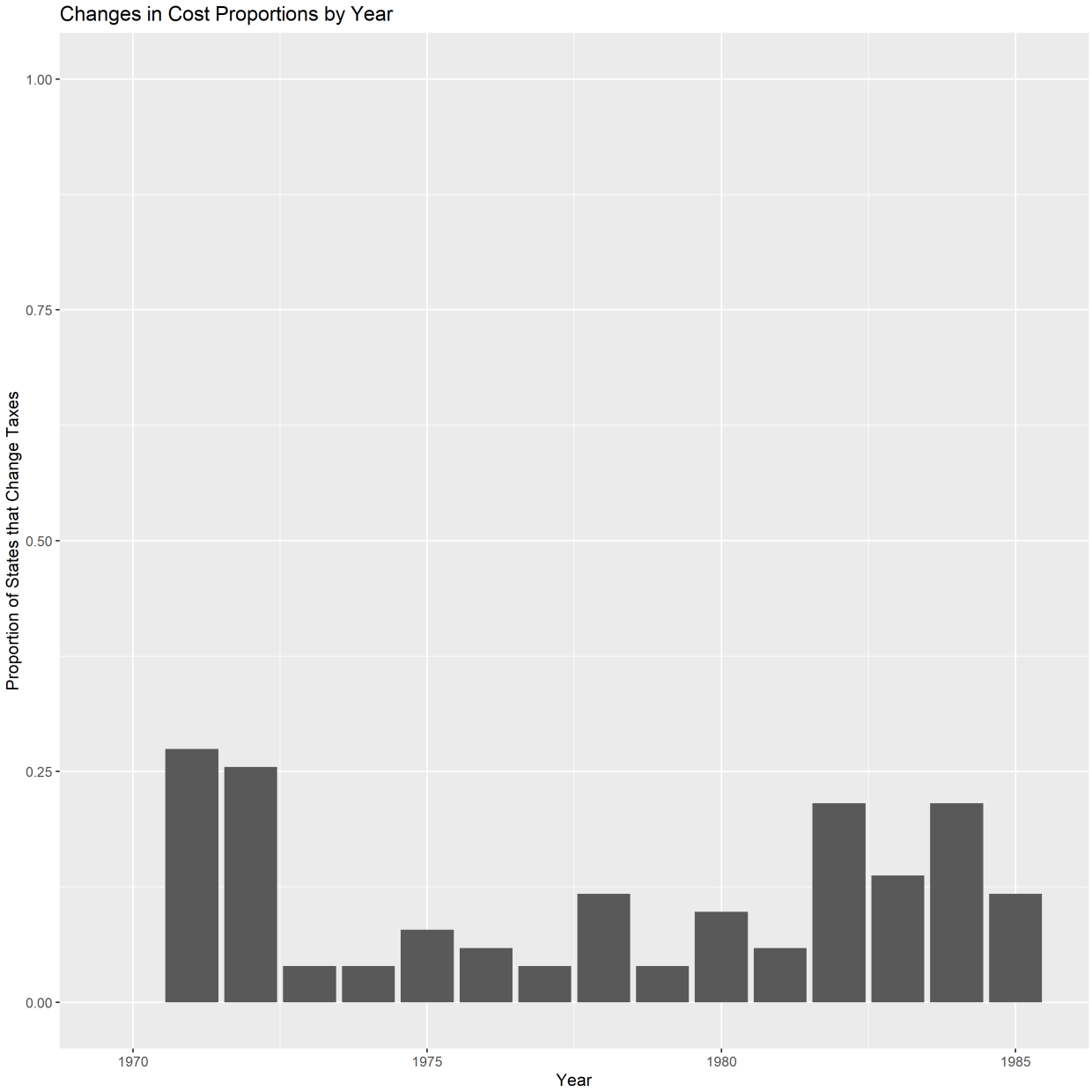
Hwk3

Sam Cohen

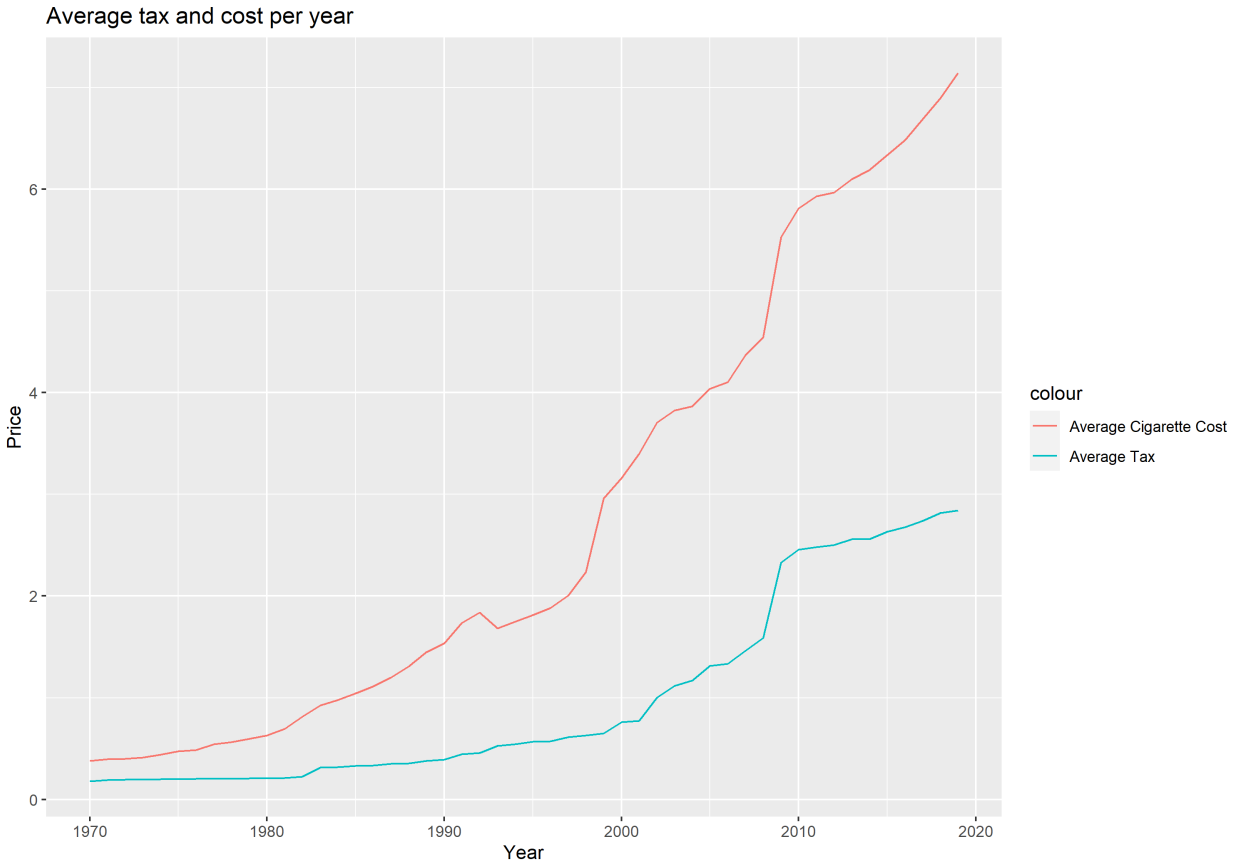
2023-03-13

1



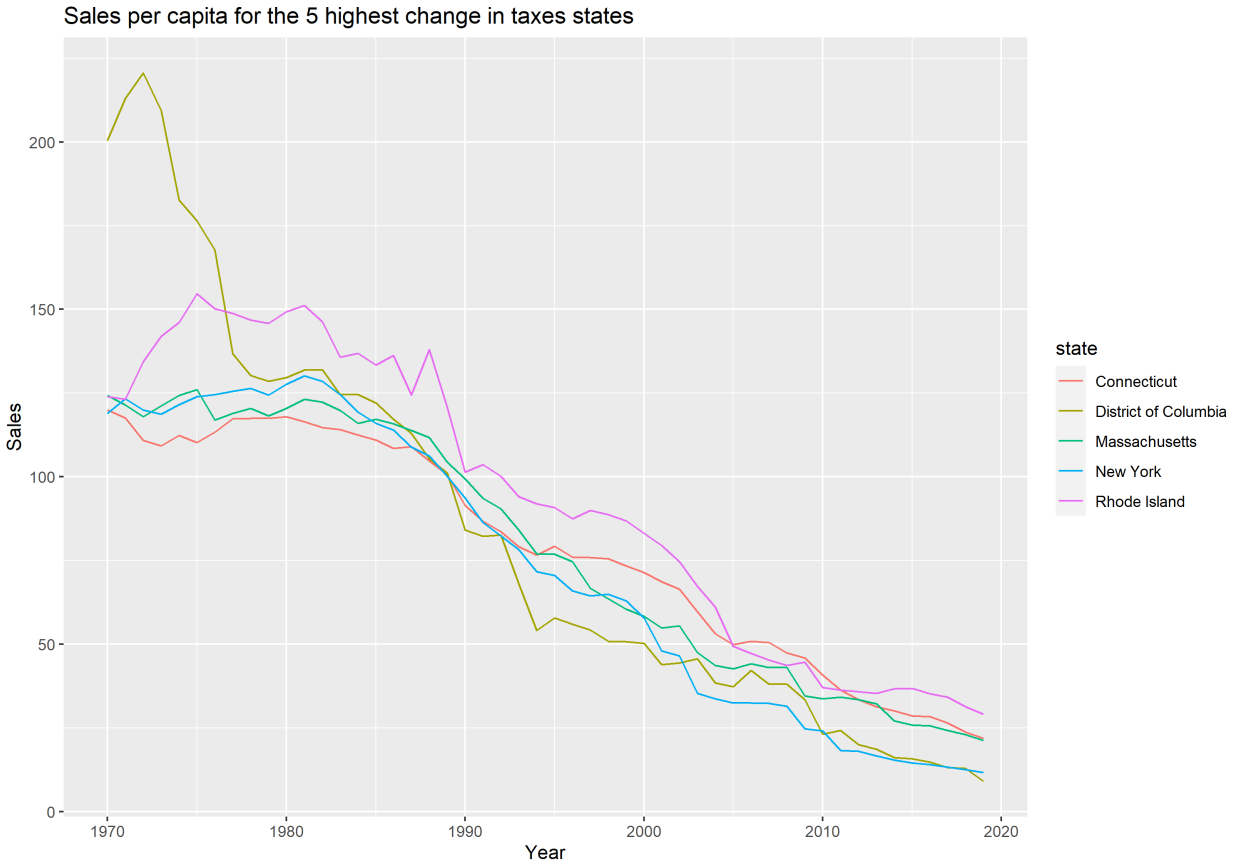
This bar chart demonstrates the proportion of states that did not change taxes each year.

2



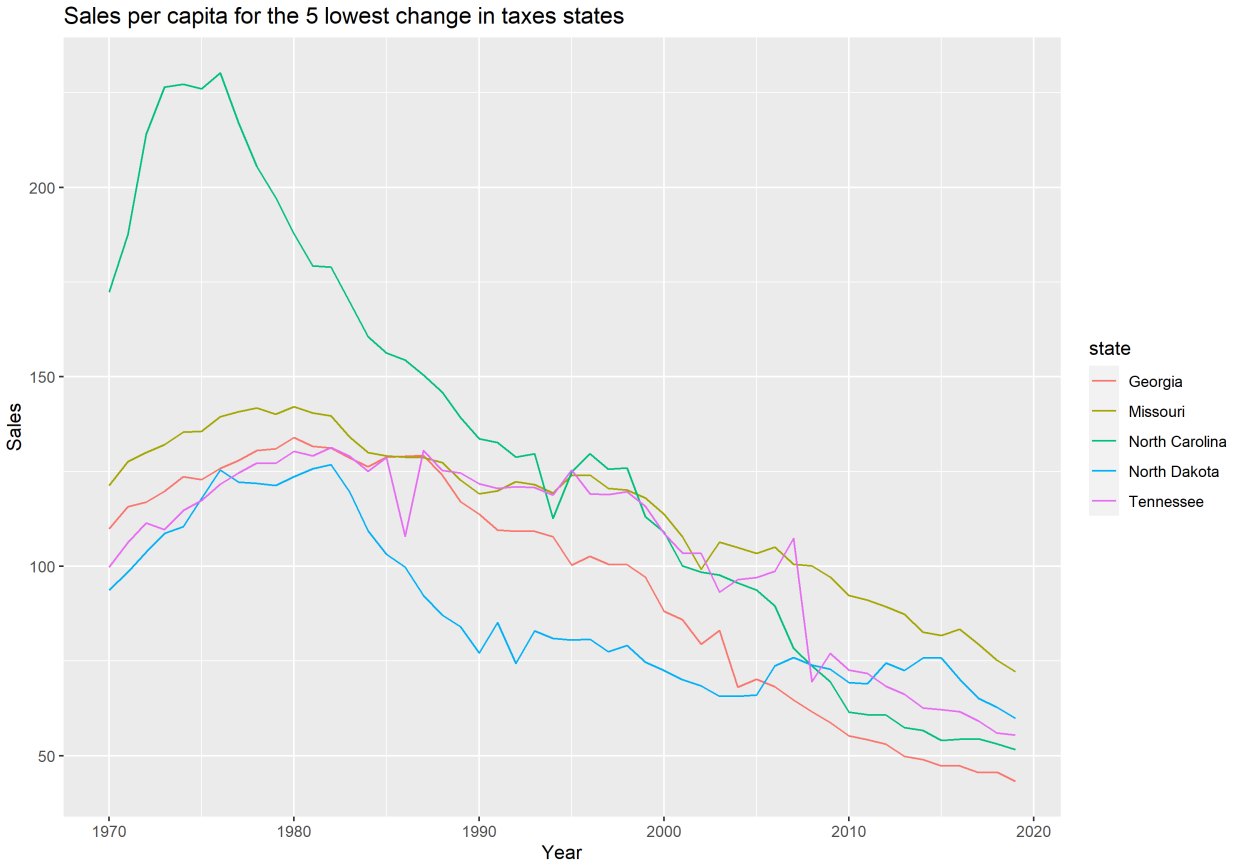
This graph shows the average tax and cost of cigarettes over the years.

3



This chart shows the 5 states that had the largest difference in the price of cigarettes from 1970 and 2019 and the sales of cigarettes per capita in that time frame.

4



This chart is very similar except it shows the 5 states with the lowest change in price in those years, as well as their sales per capita.

5

Both groups of states, those with higher changes in costs and lower, saw a decrease in sales per capita of cigarettes over the years. They both start at similar values but near the end, the sales per capita for the states with less change saw also a higher sales per capita at around 50-75. Those with higher changes of cigarette cost saw a larger decrease with the sales per capita ending around 25.

Average Treatment Effects

1

This shows that as the log of the price of a pack of cigarettes increases, the log of the sales per capita of cigarette packs decreases by .17 packs per capita. This would mean that cigarettes are an elastic good.

```
##
## Call:
## lm(formula = log(sales_per_capita) ~ log(cost_per_pack), data = prob6)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.77629 -0.09967 -0.00787  0.09969  0.78423
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         4.750402   0.008116   585.3   <2e-16 ***
## log(cost_per_pack) -0.171540   0.013829   -12.4   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2107 on 1069 degrees of freedom
## Multiple R-squared:  0.1258, Adjusted R-squared:  0.125
## F-statistic: 153.9 on 1 and 1069 DF,  p-value: < 2.2e-16
```

2

These results are similar to the previous, except the effect seems to be stronger when using an instrumental variable. Both coefficients are negative and are statistically significant in both estimates, but when using an IV we see a stronger effect. This makes sense as it takes into account a difference in something external affecting price that does not directly affect a change in consumption.

```
##
## Call:
## ivreg(formula = log(sales_per_capita) ~ log(cost_per_pack) |
##     totalTax, data = prob6)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.826582 -0.125236  0.006098  0.120734  0.725777
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         4.703099   0.009508  494.63   <2e-16 ***
## log(cost_per_pack) -0.303976   0.018861  -16.12   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2196 on 1069 degrees of freedom
## Multiple R-Squared: 0.05082, Adjusted R-squared: 0.04994
## Wald test: 259.7 on 1 and 1069 DF,  p-value: < 2.2e-16
```

3

```
##
## Call:
## lm(formula = cost_per_pack ~ totalTax, data = prob6)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -0.46590 -0.16564 -0.04219  0.13074  0.94368
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.02262    0.01957   1.156    0.248
## totalTax     1.89856    0.04578  41.469   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2297 on 1069 degrees of freedom
## Multiple R-squared:  0.6167, Adjusted R-squared:  0.6163
## F-statistic:  1720 on 1 and 1069 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = sales_per_capita ~ totalTax, data = prob6)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -75.317 -13.194  -2.717   9.197 160.898
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  162.877      2.330   69.90   <2e-16 ***
## totalTax     -91.916      5.451  -16.86   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 27.34 on 1069 degrees of freedom
## Multiple R-squared:  0.2101, Adjusted R-squared:  0.2094
## F-statistic: 284.4 on 1 and 1069 DF,  p-value: < 2.2e-16
```

4

This shows that as the log of the price of a pack of cigarettes increases, the log of the sales per capita of cigarette packs decreases by .66 packs per capita. This would mean that cigarettes are an elastic good.

```
##
## Call:
## lm(formula = log(sales_per_capita) ~ log(cost_per_pack), data = prob9)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.9375 -0.1781  0.0013  0.1860  1.1433
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         5.03949    0.02291  219.93   <2e-16 ***
## log(cost_per_pack) -0.66563    0.01747  -38.09   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 0.3056 on 1273 degrees of freedom
## Multiple R-squared:  0.5327, Adjusted R-squared:  0.5323
## F-statistic:  1451 on 1 and 1273 DF,  p-value: < 2.2e-16
```

These results are similar to the previous, except the effect seems to be stronger when using an instrumental variable. Both coefficients are negative and are statistically significant in both estimates, but when using an IV we see a stronger effect. This makes sense as it takes into account a difference in something external affecting price that does not directly affect a change in consumption.

```
##
## Call:
## ivreg(formula = log(sales_per_capita) ~ log(cost_per_pack) |
##     totalTax, data = prob9)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.82809 -0.20187 -0.01425  0.21424  1.18213
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)          5.24665    0.02768  189.52   <2e-16 ***
## log(cost_per_pack) -0.83593    0.02156  -38.78   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3167 on 1273 degrees of freedom
## Multiple R-Squared: 0.4978,  Adjusted R-squared: 0.4974
## Wald test:  1504 on 1 and 1273 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = cost_per_pack ~ totalTax, data = prob9)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.63293 -0.65419  0.04702  0.51495  2.44303
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.78294    0.02959   60.26   <2e-16 ***
## totalTax     0.95649    0.01082   88.38   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6768 on 1273 degrees of freedom
## Multiple R-squared:  0.8599, Adjusted R-squared:  0.8598
## F-statistic:  7812 on 1 and 1273 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = sales_per_capita ~ totalTax, data = prob9)
##
## Residuals:
```

```
##     Min      1Q  Median      3Q     Max
## -47.858 -13.794  -2.027  10.611 109.792
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 100.6904     0.9833  102.40   <2e-16 ***
## totalTax    -12.0968     0.3597  -33.63   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 22.49 on 1273 degrees of freedom
## Multiple R-squared:  0.4705, Adjusted R-squared:  0.4701
## F-statistic:  1131 on 1 and 1273 DF,  p-value: < 2.2e-16
```

5

There is a large difference in the elasticity between the two time periods. As time went on, cigarettes became a much more elastic good, meaning, as prices increased, people were less likely to consume cigarettes. I assume this may be due to more information coming out about the health detriments of cigarettes which then made it more motivating for people to quit so as prices went up, people became more willing to quit, or at least consume less.