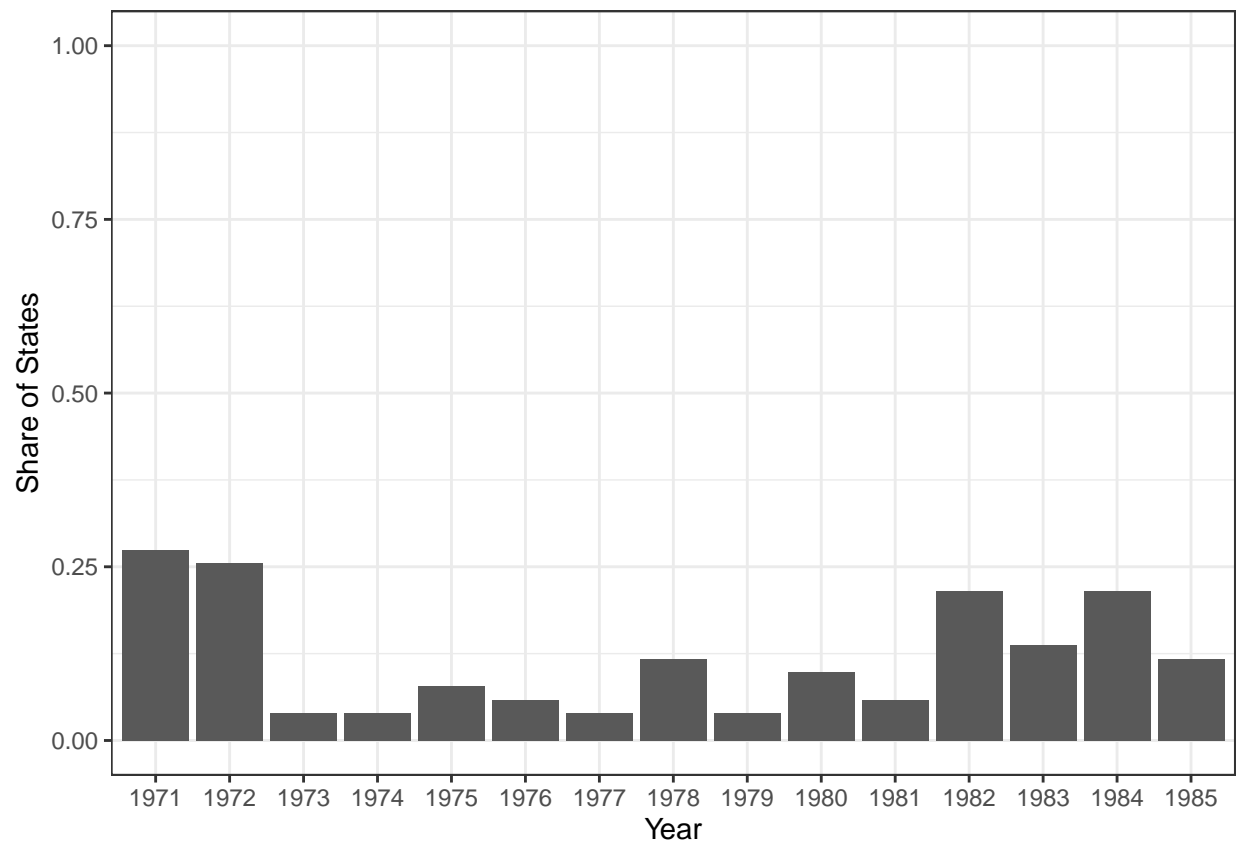


# Homework 3

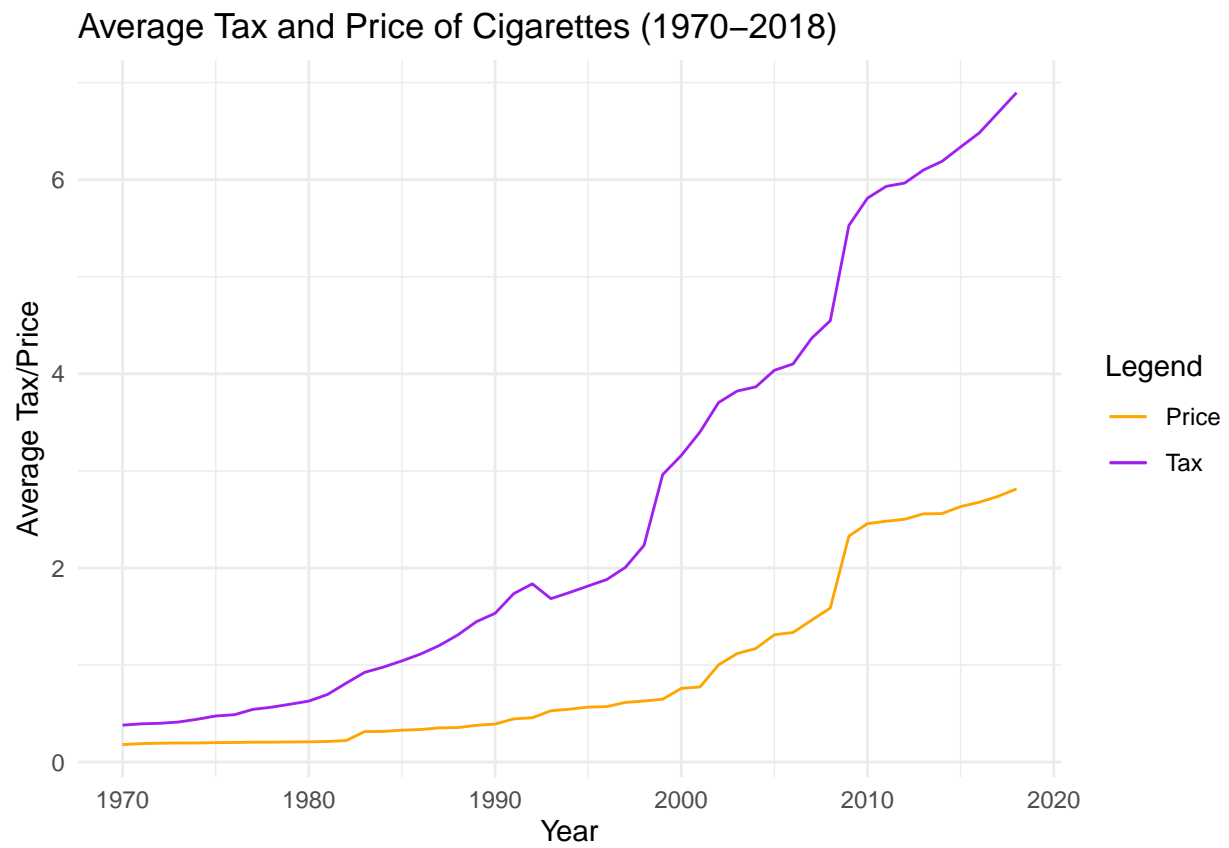
Virginia Sanson

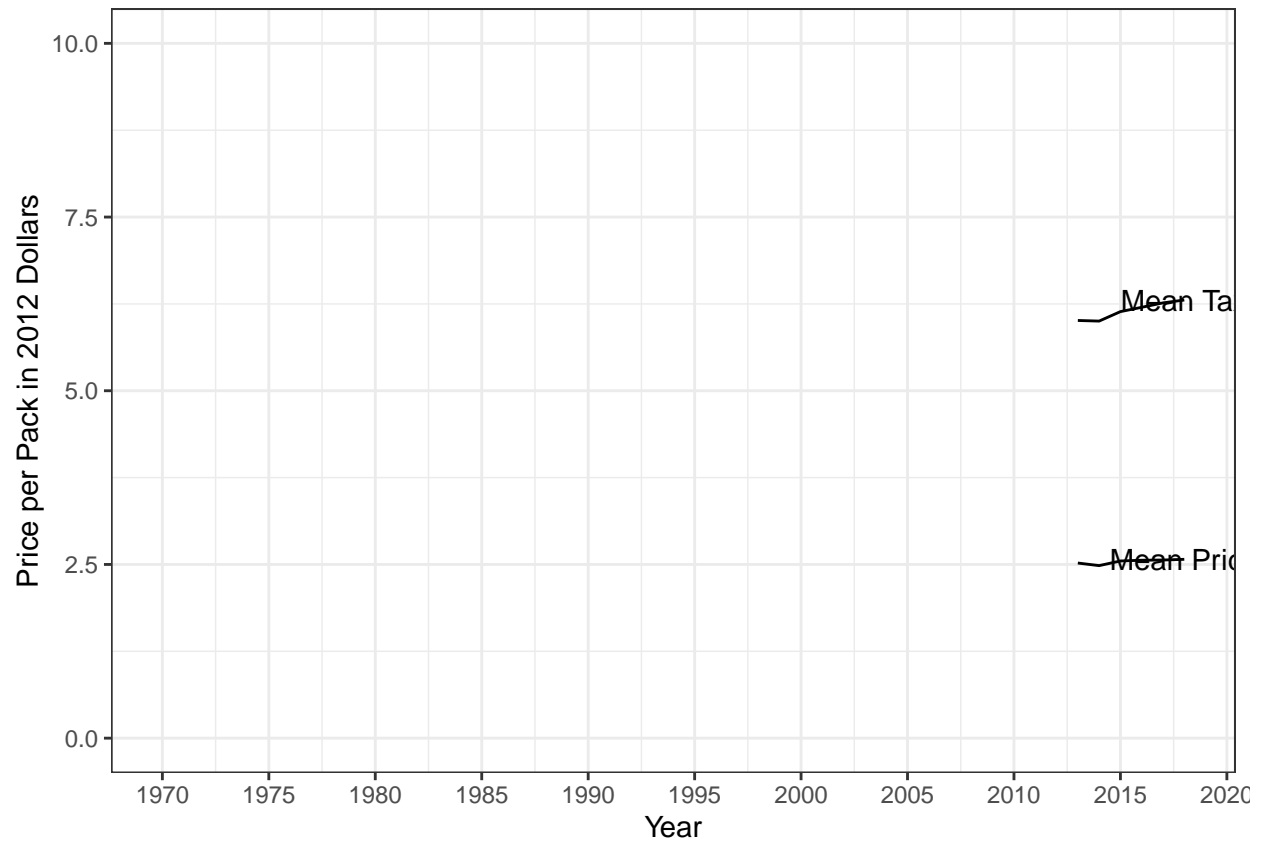
12 March 2023

Part 1 Question 1

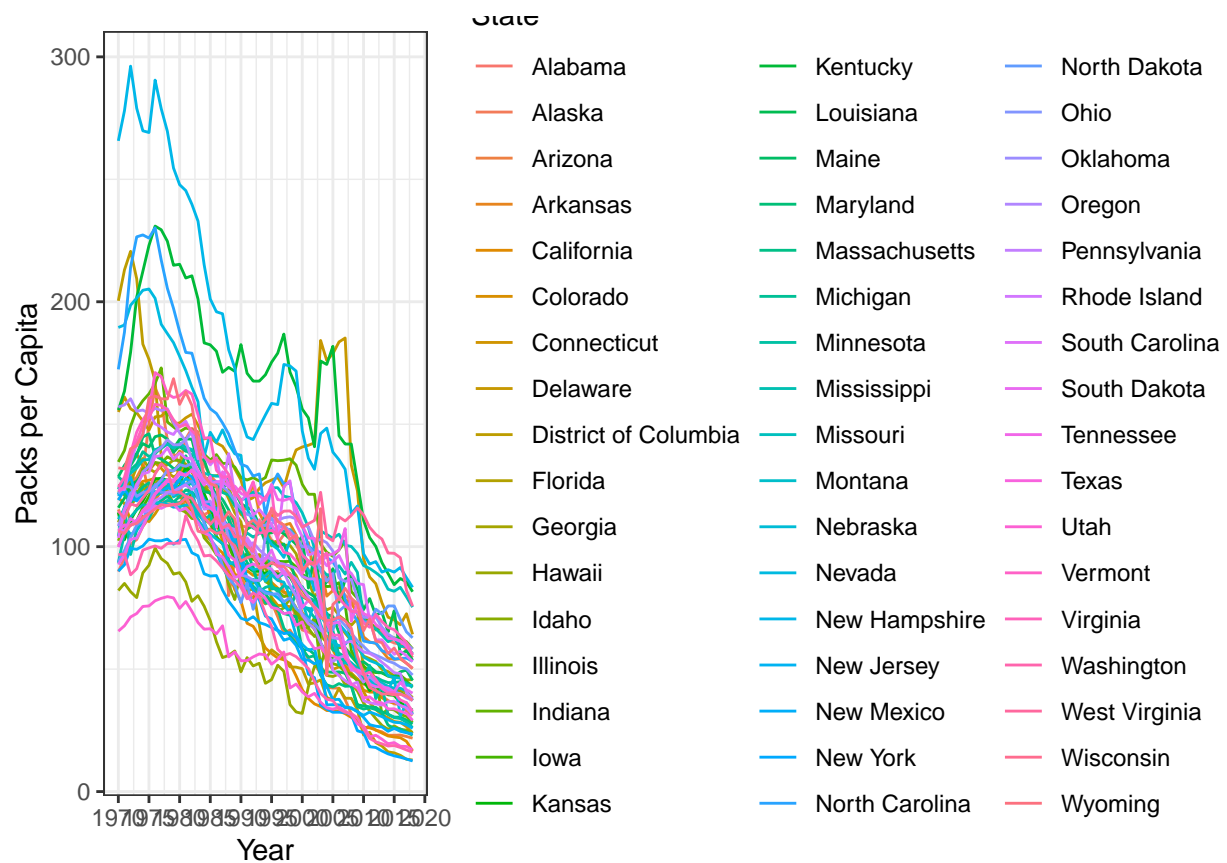


Question 2

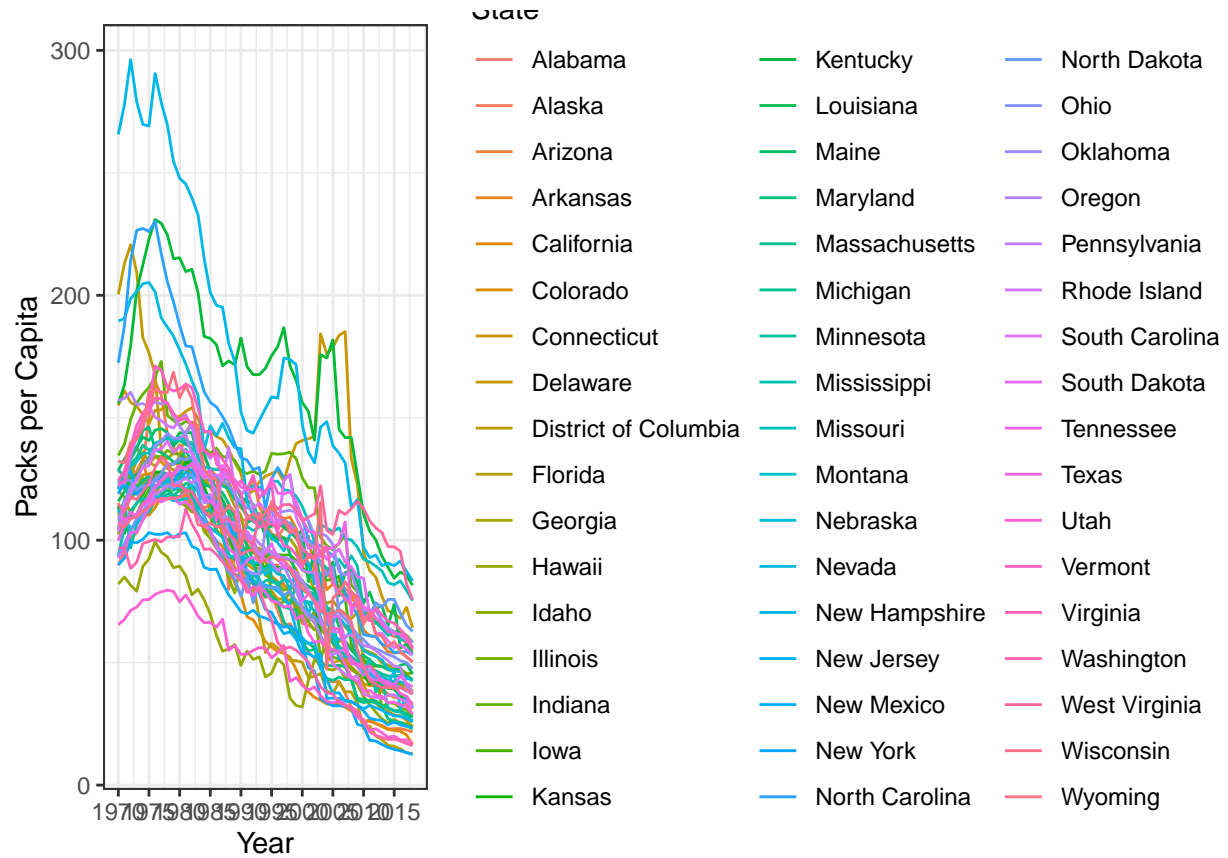




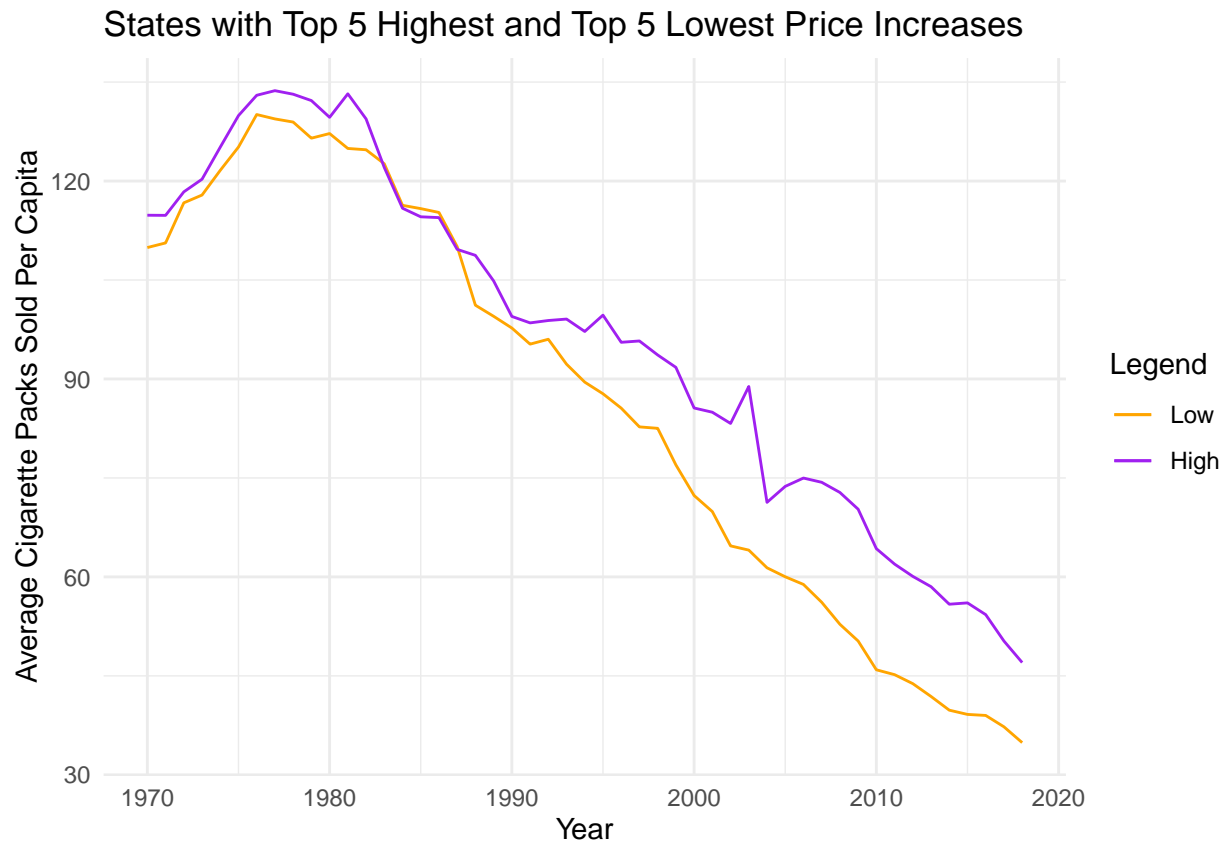
Question 3 Trying to fix errors with ungroup() function. Please let me know if you can think of a fix!



Question 4 Same error occurring here.



Question 5



## Part 2 Question 1

A 1% increase in cost per cigarette pack is estimated to decrease the sales per capita by 0.17% (on average).

```
##  
## Call:  
## lm(formula = log(sales_per_capita) ~ log(cost_per_pack), data = subset_data)  
##  
## Coefficients:  
##      (Intercept)  log(cost_per_pack)  
##           4.7504           -0.1715
```



## Question 2

A 1% increase in cost per cigarette pack is estimated to decrease the sales per capita by 0.28% (on average). The instrumental variables changed the estimates in that a change in cost has a greater effect on sales than before, as we are now including total federal and state tax on the cost of cigarettes. Cigarettes seem more of an elastic good.

```
##  
## Call:  
## ivreg(formula = LogSales ~ LogPrices | TotalCigaretteTax, data = subset_data)  
##  
## Coefficients:  
## (Intercept)      LogPrices  
##      4.7101      -0.2843
```

### Question 3

```
##
## Call:
## lm(formula = log(cost_per_pack) ~ log(tax_dollar), data = subset_data)
##
## Coefficients:
##      (Intercept)    log(tax_dollar)
##           1.179           1.080

##
## Call:
## lm(formula = log(sales_per_capita) ~ cost_hat, data = subset_data)
##
## Coefficients:
##      (Intercept)    cost_hat
##           4.7101    -0.2843
```

### Question 4a

A 1% increase in cost per cigarette pack is estimated to decrease the sales per capita by 0.17% (on average).

```
##
## Call:
## lm(formula = log(sales_per_capita) ~ log(cost_per_pack), data = subset_data)
##
## Coefficients:
##      (Intercept)    log(cost_per_pack)
##           4.7504           -0.1715
```

### Question 4b

A 1% increase in cost per cigarette pack is estimated to decrease the sales per capita by 0.76% (on average). The change in cost has an even greater effect on sales in this time period, which suggests cigarettes are an extremely elastic good. This can be explained by increasing evidence by the CDC suggesting the ill health effects cigarettes have, which makes people more sensitive to increased taxes/price.

```
##
## Call:
## ivreg(formula = LogSales ~ LogPrices | TotalCigaretteTax, data = subset_data2)
##
## Coefficients:
##      (Intercept)    LogPrices
##           5.1575    -0.7626
```

### Question 4c

```
##
## Call:
```

```
## lm(formula = log(cost_per_pack) ~ log(tax_dollar), data = subset_data2)
##
## Coefficients:
##      (Intercept)  log(tax_dollar)
##           1.207           0.630

##
## Call:
## lm(formula = log(sales_per_capita) ~ pricehat, data = subset_data2)
##
## Coefficients:
## (Intercept)      pricehat
##  1.114e-14      1.000e+00
```

#### Question 5

The elasticity estimations were higher in 1991-2015 versus 1970-1990. Taxes on cigarette packs increased, and coupled with information about the detrimental health effects about smoking cigarettes beginning in 1990, led to increased sensitivity from people about purchasing cigarettes.