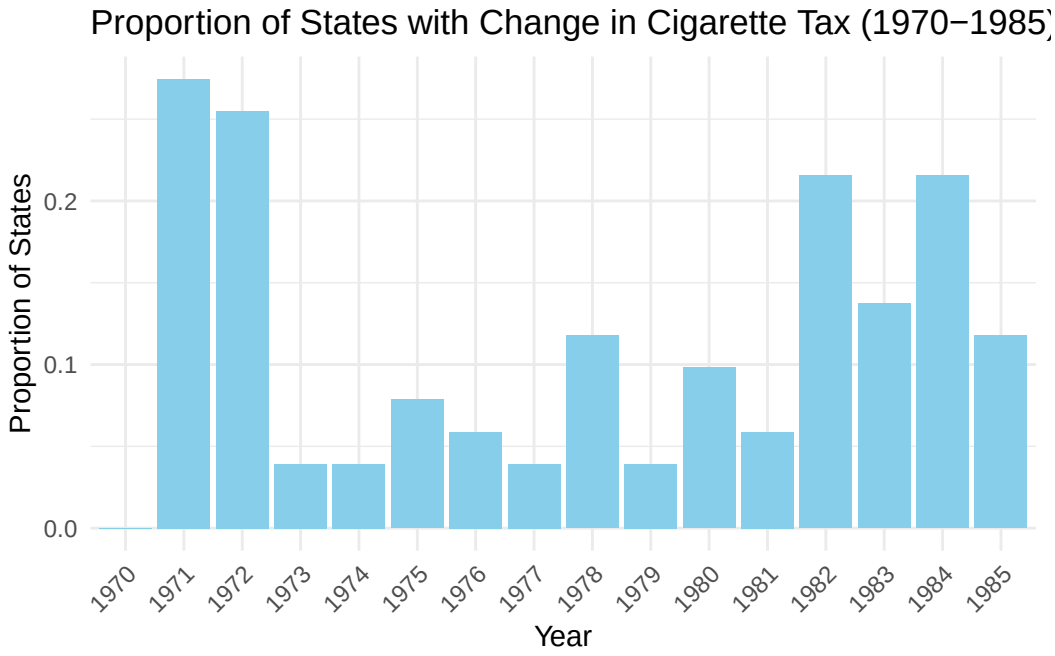
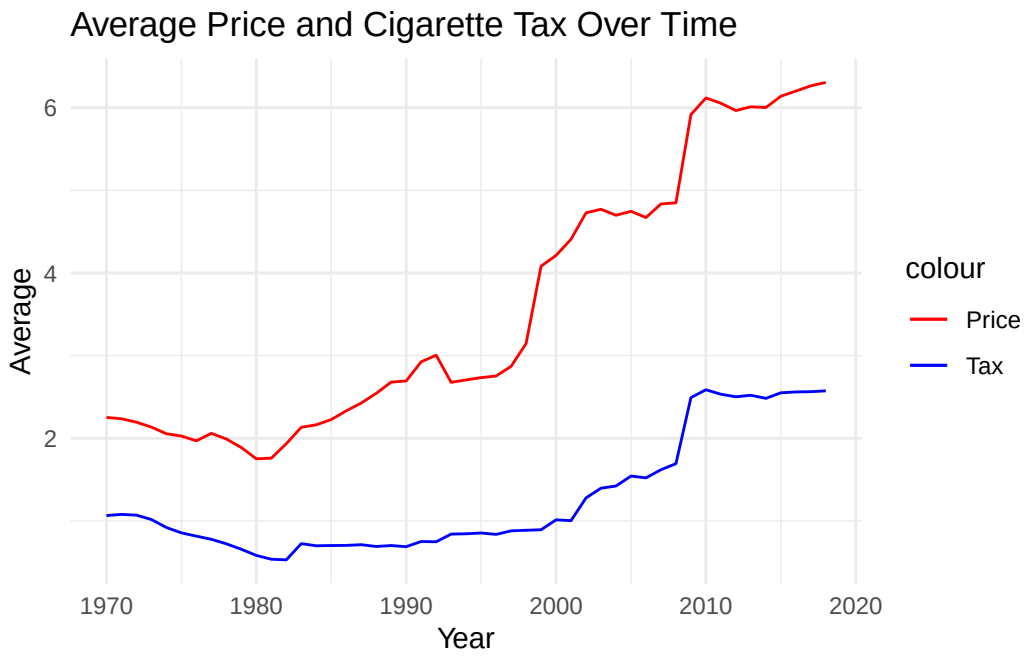
Git Repository: https://github.com/AlekhyaPidugu/Homework3

Question 1

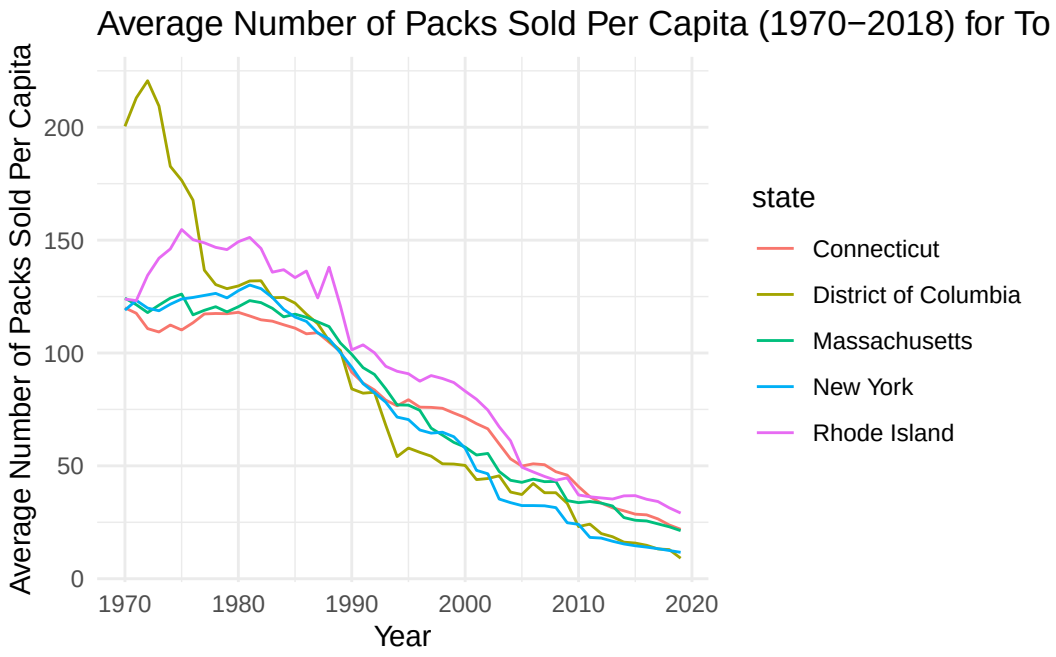

Proportion of States with Change in Cigarette Tax (1970−1985)
Proportion of States
0.0
0.1
0.2
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
Year

Question 2


Average Price and Cigarette Tax Over Time
Average
6
4
2
1970
1980
1990
2000
2010
2020
Year
colour
Price
Tax

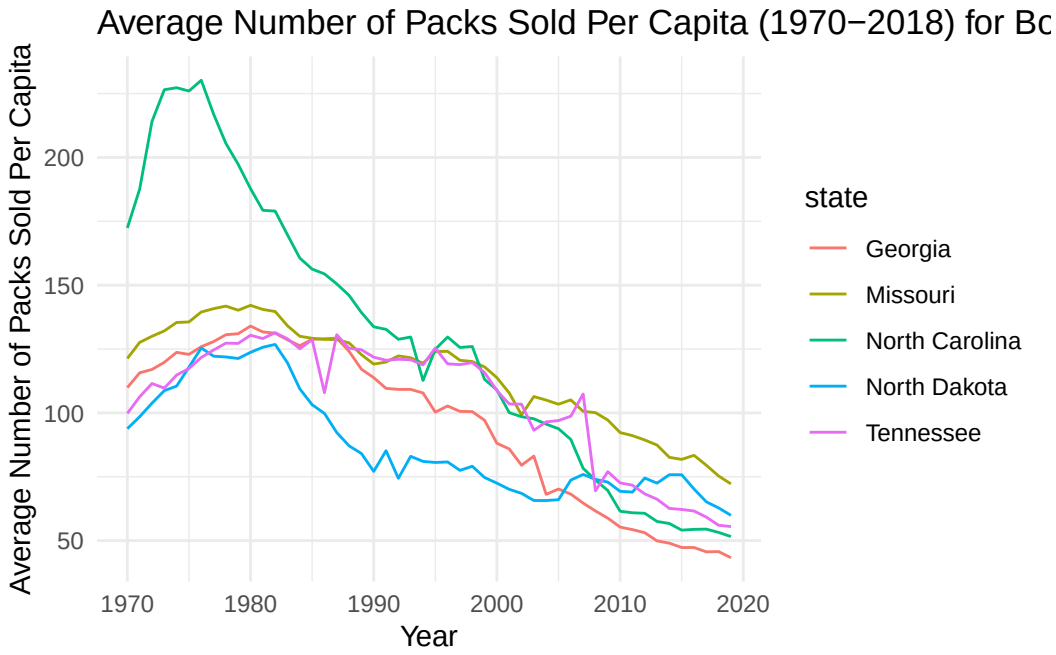
Question 3

Connecticut
D.C
Massachusetts
New York
Rhode Island



Question 4

Georgia Missouri
North Carolina
North Dakota
Tennessee



Question 5

One significant trend to observe is that the bottom five states cigarette prices is not as substantial as the magnitude of the increase in cigarette prices for the 5 states with the highest price raises. The bottom 5 states with the lowest price increases generally demonstrated more stable trends in sales per capita. Although there were fluctuations, the overall trend tended to be less pronounced compared to states with higher price increases.

Question 6

The estimated price elasticity of demand for cigarettes from 1970 to 1990 is approximately -0.81. The demand for cigarettes during this period is relatively inelastic, suggesting that changes in price have a limited impact on quantity demanded.

Question 7

```
TSLS estimation, Dep. Var.: log(sales_per_capita), Endo.: log(price_cpi), Instr.: log(total_t
Second stage: Dep. Var.: log(sales_per_capita)
Observations: 1,071
Standard-errors: IID
                    Estimate Std. Error  t value  Pr(>|t|)
(Intercept)         5.375575   0.050825 105.7659 < 2.2e-16 ***
fit_log(price_cpi) -0.795524   0.071235 -11.1676 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
RMSE: 0.189226   Adj. R2: 0.293235
F-test (1st stage), log(price_cpi): stat = 436.8     , p < 2.2e-16 , on 1 and 1,069 DoF.
                        Wu-Hausman: stat =   0.053709, p = 0.816775, on 1 and 1,068 DoF.
```

The estimated price elasticity of demand for cigarettes from 1970 to 1990 using an instrument (total cigarette tax) for log prices is approximately -0.79. The estimate is not signficantly different from the estimate in question 6. But as you can see from the table, the R2 is low so this may indicate that the IV is not strongly correlated with the endogenous variable.

Question 8

```
Call:
lm(formula = log(price_cpi) ~ log(total_tax_cpi_2022), data = subset_data)

Residuals:
     Min       1Q   Median       3Q      Max
-0.23046 -0.09207 -0.02919  0.08019  0.48675

Coefficients:
                        Estimate Std. Error t value Pr(>|t|)
(Intercept)             0.787829   0.005421   145.3   <2e-16 ***
log(total_tax_cpi_2022) 0.260060   0.012443    20.9   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1272 on 1069 degrees of freedom
Multiple R-squared:  0.2901,    Adjusted R-squared:  0.2894
F-statistic: 436.8 on 1 and 1069 DF,  p-value: < 2.2e-16



Call:
lm(formula = log(sales_per_capita) ~ pricehat, data = subset_data)

Residuals:
     Min       1Q   Median       3Q      Max
-0.86239 -0.09798  0.00549  0.09359  0.95094

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  5.37557    0.05794  92.779   <2e-16 ***
pricehat    -0.79552    0.08121  -9.796   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2159 on 1069 degrees of freedom
Multiple R-squared:  0.08238,   Adjusted R-squared:  0.08152
F-statistic: 95.97 on 1 and 1069 DF,  p-value: < 2.2e-16
```

Question 9

The estimated price elasticity of demand for cigarettes from 1970 to 1990 is approximately -0.9968

The estimated price elasticity of demand for cigarettes from 1991 to 2015 using an instrument (total cigarette tax) for log prices is approximately -1.15.

```
The estimated price elasticity of demand for cigarettes from 1970 to 1990 is approximately -0
```

```
TSLS estimation, Dep. Var.: log(sales_per_capita), Endo.: log(price_cpi), Instr.: log(total_t
Second stage: Dep. Var.: log(sales_per_capita)
Observations: 1,275
Standard-errors: IID
                  Estimate Std. Error  t value  Pr(>|t|)
(Intercept)        5.82027   0.039371 147.8322 < 2.2e-16 ***
fit_log(price_cpi) -1.15008   0.027811 -41.3536 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
RMSE: 0.300218   Adj. R2: 0.547816
F-test (1st stage), log(price_cpi): stat = 5,503.6, p < 2.2e-16, on 1 and 1,273 DoF.
                       Wu-Hausman: stat =   191.5, p < 2.2e-16, on 1 and 1,272 DoF.
```

```
Call:
lm(formula = log(price_cpi) ~ log(total_tax_cpi_2022), data = subset_data2)

Residuals:
     Min       1Q   Median       3Q      Max
-0.36750 -0.09020  0.00725  0.08241  0.45045

Coefficients:
                        Estimate Std. Error t value Pr(>|t|)
(Intercept)             1.263256   0.004386  288.03   <2e-16 ***
log(total_tax_cpi_2022) 0.513550   0.006922   74.19   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1456 on 1273 degrees of freedom
Multiple R-squared:  0.8121,    Adjusted R-squared:  0.812
F-statistic:  5504 on 1 and 1273 DF,  p-value: < 2.2e-16
```

```
Call:
lm(formula = log(sales_per_capita) ~ pricehat2, data = subset_data2)

Residuals:
     Min       1Q   Median       3Q      Max
-0.90878 -0.15465  0.01119  0.15334  1.16925

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  5.82027    0.03672  158.51   <2e-16 ***
pricehat2   -1.15008    0.02594  -44.34   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2802 on 1273 degrees of freedom
Multiple R-squared:  0.607, Adjusted R-squared:  0.6067
F-statistic:  1966 on 1 and 1273 DF,  p-value: < 2.2e-16
```

Question 10

The elasticity estimate for the period 1970-1990 was approximately -0.81, whereas for the period 1991-2015, it was approximately -0.99.
The difference in elasticity estimates could be attributed to changes in consumer behavior, regulatory policies, and socio-economic conditions. For example, increased awareness of health risks associated with smoking could have made consumers more sensitive to price changes in later years. Please see the table below for the data in the table for easier viewing and comparsion.

	Period	Price_Elasticity	IV_Elasticity	First_Stage_R2	Reduced_Form_R2
log(price_cpi)	1970-1990	-0.9968136	-0.7955235	0.2901006	0.0823776
log(price_cpi)1	1991-2015	-0.9968136	-1.1500837	0.8121467	0.6069778