ECON3140HW6

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library(haven)  
  
data <- read\_dta("C:/Users/Nick/Downloads/JEC.dta")  
  
# 3.1  
# This model is created to estimate the overall elasticity of demand in the market. Elasticity is represented in the form of percent change, and since this model is likely skewed and not entirely linear, a log-log model would best respresent this model by regressing a percent change in y (Qi) on a percent change in x (Pi). ICE is included because it will clearly have an effect on quantity shipped, as icy roads will lower quntity. However, this regressor is not logged because it is binary.

# 3.2  
  
lm.fit <- lm(data$quantity ~ log(data$price) + data$ice + data$seas1 + data$seas2 + data$seas3 + data$seas4 + data$seas5 + data$seas6 + data$seas7 + data$seas8 + data$seas9 + data$seas10 + data$seas11 + data$seas12)  
  
summary(lm.fit)

##   
## Call:  
## lm(formula = data$quantity ~ log(data$price) + data$ice + data$seas1 +   
## data$seas2 + data$seas3 + data$seas4 + data$seas5 + data$seas6 +   
## data$seas7 + data$seas8 + data$seas9 + data$seas10 + data$seas11 +   
## data$seas12)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -28520 -6705 -164 5565 33087   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -8049.3 4174.5 -1.928 0.05474 .   
## log(data$price) -16233.3 2007.1 -8.088 1.35e-14 \*\*\*  
## data$ice 13326.4 2913.7 4.574 6.91e-06 \*\*\*  
## data$seas1 -2768.0 2703.1 -1.024 0.30662   
## data$seas2 2479.8 2711.3 0.915 0.36109   
## data$seas3 3284.8 2711.6 1.211 0.22665   
## data$seas4 8581.9 2697.8 3.181 0.00161 \*\*   
## data$seas5 7356.7 3164.9 2.324 0.02074 \*   
## data$seas6 5391.2 3887.9 1.387 0.16653   
## data$seas7 8190.2 3898.8 2.101 0.03647 \*   
## data$seas8 -461.2 3894.3 -0.118 0.90580   
## data$seas9 3251.9 3898.3 0.834 0.40482   
## data$seas10 6984.2 3929.3 1.777 0.07646 .   
## data$seas11 7912.3 3900.1 2.029 0.04333 \*   
## data$seas12 7599.3 3876.7 1.960 0.05085 .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 9678 on 313 degrees of freedom  
## Multiple R-squared: 0.3375, Adjusted R-squared: 0.3079   
## F-statistic: 11.39 on 14 and 313 DF, p-value: < 2.2e-16

# 3.3  
  
# This estimate is not entirely credible because some of the covariates may be correlated with the error term. log(price) likely has a nonzero corrleation with other regressors and the error term as many factors effect price, including the navigatibility of the Great Lakes and the season. Cartel would be a plausible IV as it is not correlated with the other terms.

# 3.4  
  
firststage = lm(log(data$price) ~ data$cartel)  
summary(firststage)

##   
## Call:  
## lm(formula = log(data$price) ~ data$cartel)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.59597 -0.23180 -0.08515 0.09717 0.61550   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -1.66532 0.02047 -81.37 <2e-16 \*\*\*  
## data$cartel 0.36418 0.02601 14.00 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2288 on 326 degrees of freedom  
## Multiple R-squared: 0.3755, Adjusted R-squared: 0.3735   
## F-statistic: 196 on 1 and 326 DF, p-value: < 2.2e-16

firststage = lm((data$ice) ~ data$cartel)  
summary(firststage)

##   
## Call:  
## lm(formula = (data$ice) ~ data$cartel)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.4384 -0.4384 -0.4080 0.5616 0.5920   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.40800 0.04436 9.198 <2e-16 \*\*\*  
## data$cartel 0.03042 0.05638 0.540 0.59   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.4959 on 326 degrees of freedom  
## Multiple R-squared: 0.0008924, Adjusted R-squared: -0.002172   
## F-statistic: 0.2912 on 1 and 326 DF, p-value: 0.5898

# Based on the P values and F statistics, cartel appears to be a weak instrumental variable for ice, however a strong instrumental variable for price. Cartel could instead be an instrumental variable for price as price will likely go up if the great lakes are not navigable. Price is also likely correlated with the error term as many factors effect the price. Carteli is not correlated witht the other covariates like price is.

# 3.5  
  
second = lm( data$quantity ~ firststage$fitted.values + data$ice + data$seas1 + data$seas2 + data$seas3 + data$seas4 + data$seas5 + data$seas6 + data$seas7 + data$seas8 + data$seas9 + data$seas10 + data$seas11 + data$seas12 )  
summary(second)

##   
## Call:  
## lm(formula = data$quantity ~ firststage$fitted.values + data$ice +   
## data$seas1 + data$seas2 + data$seas3 + data$seas4 + data$seas5 +   
## data$seas6 + data$seas7 + data$seas8 + data$seas9 + data$seas10 +   
## data$seas11 + data$seas12)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -25009 -6334 -1752 6347 36365   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 117529.43 17636.33 6.664 1.20e-10 \*\*\*  
## firststage$fitted.values -236334.28 38904.42 -6.075 3.60e-09 \*\*\*  
## data$ice 12202.81 3058.82 3.989 8.25e-05 \*\*\*  
## data$seas1 -3514.65 2812.82 -1.250 0.2124   
## data$seas2 149.39 2812.82 0.053 0.9577   
## data$seas3 -99.27 2823.96 -0.035 0.9720   
## data$seas4 6734.06 2825.80 2.383 0.0178 \*   
## data$seas5 6386.45 3326.25 1.920 0.0558 .   
## data$seas6 5012.46 4071.77 1.231 0.2192   
## data$seas7 8483.21 4071.77 2.083 0.0380 \*   
## data$seas8 -733.63 4080.34 -0.180 0.8574   
## data$seas9 2318.94 4109.47 0.564 0.5730   
## data$seas10 7584.27 4109.47 1.846 0.0659 .   
## data$seas11 8581.47 4063.79 2.112 0.0355 \*   
## data$seas12 6670.39 4063.79 1.641 0.1017   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 10060 on 313 degrees of freedom  
## Multiple R-squared: 0.2835, Adjusted R-squared: 0.2514   
## F-statistic: 8.846 on 14 and 313 DF, p-value: 2.934e-16

EstimatedElasticity = second$coefficients[2]  
EstimatedElasticity

## firststage$fitted.values   
## -236334.3

# Price Elasticity of Demand is very negative, suggesting a heavily elastic demand

# 3.6  
  
# This IV regression shows that the elasticity of demand is significantly less than negative 1, suggesting heavy elasticity. This means that the firm is not operating at a profit maximizing price.