R Review Session

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1 Setup

This example file uses data from Dominick's, a now defunct grocery store chain in Chicago. First, I read in the data and print out a quick summary of the variables.

```
#  run line 42 - df table created
df <- read_excel("dominicks_oj.xlsx")
str(df) # compactly displaying the internal structure of a R object
```

```
tibble [12,512 x 10] (S3: tbl_df/tbl/data.frame)
 $ zone      : chr [1:12512] "CubFighter" "CubFighter" "CubFighter" "CubFighter" ...
 $ week      : num [1:12512] 1 2 3 4 5 6 7 8 9 10 ...
 $ holiday   : num [1:12512] 0 0 0 0 0 0 1 0 0 0 ...
 $ brand     : chr [1:12512] "STORE" "STORE" "STORE" "STORE" ...
 $ size      : num [1:12512] 16 16 16 16 16 16 16 16 16 16 ...
 $ brand_size: chr [1:12512] "STORE_16" "STORE_16" "STORE_16" "STORE_16" ...
 $ units     : num [1:12512] 892 1035 1139 690 898 ...
 $ price     : num [1:12512] 1.54 1.54 1.54 1.54 1.54 ...
 $ cost      : num [1:12512] 1.21 1.21 1.21 1.21 1.21 ...
 $ merch     : num [1:12512] 0 0 0 0 0 0 0 0 0 0 ...
```

```
head(df) # print first few lines of the data
```

```
# A tibble: 6 x 10
  zone        week holiday brand  size brand_size units price  cost merch
  <chr>      <dbl>   <dbl> <chr> <dbl> <chr>      <dbl> <dbl> <dbl> <dbl>
1 CubFighter     1       0 STORE    16 STORE_16     892  1.54  1.21     0
2 CubFighter     2       0 STORE    16 STORE_16    1035  1.54  1.21     0
3 CubFighter     3       0 STORE    16 STORE_16    1139  1.54  1.21     0
4 CubFighter     4       0 STORE    16 STORE_16     690  1.54  1.21     0
5 CubFighter     5       0 STORE    16 STORE_16     898  1.54  1.21     0
6 CubFighter     6       0 STORE    16 STORE_16     584  1.54  1.21     0
```

2 Manipulating the data

Let's create some new variables.

```
df <- df %>%
  mutate(lnp = log(price),
         lnq = log(units),
         Dmerch = factor(merch),
         Dholiday = factor(holiday),
         Dsize = factor(size),
         Dzone = factor(zone))
head(df) #append these new variables back to df
```

```
# A tibble: 6 x 16
  zone   week holiday brand  size brand_size units price  cost merch   lnp   lnq
  <chr> <dbl>   <dbl> <chr> <dbl> <chr>      <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
1 CubF~     1       0 STORE    16 STORE_16     892  1.54  1.21     0 0.432  6.79
2 CubF~     2       0 STORE    16 STORE_16    1035  1.54  1.21     0 0.432  6.94
3 CubF~     3       0 STORE    16 STORE_16    1139  1.54  1.21     0 0.432  7.04
4 CubF~     4       0 STORE    16 STORE_16     690  1.54  1.21     0 0.432  6.54
5 CubF~     5       0 STORE    16 STORE_16     898  1.54  1.21     0 0.432  6.80
6 CubF~     6       0 STORE    16 STORE_16     584  1.54  1.21     0 0.432  6.37
# ... with 4 more variables: Dmerch <fct>, Dholiday <fct>, Dsize <fct>,
#   Dzone <fct>
```

Quick tabulations by zone, brand, and brand-size.

```
table(df$zone) #dollar sign to indicate data frame
```

```
CubFighter       High        Low     Medium 
      3129       3129       3125       3129 
```

```
table(df$brand)
```

```
CITHI MMAID STORE TROPI 
  767  4443  4443  2859 
```

```
table(df$brand, df$size)
```

```
          6   12   16
  CITHI    0  767    0
  MMAID 1584 1279 1580
  STORE 1584 1279 1580
  TROPI    0 1279 1580
```

Summary statistics by brand.

```
# Total sales, mean price, number of observations *for each* brand
df %>%
  group_by(brand) %>%
  summarize(sum_sales = sum(units),
            mean_price = mean(price),
            num_obs = n())
```

```
# A tibble: 4 x 4
  brand sum_sales mean_price num_obs
  <chr>     <dbl>      <dbl>   <int>
1 CITHI    832635       1.51     767
2 MMAID   4831259       1.49    4443
3 STORE   9864500       1.18    4443
4 TROPI   3101784       1.70    2859
```

Summary statistics for a subset of the data.

```
df %>%
  filter(size==12) %>%
  group_by(brand) %>%
  summarize(sum_sales = sum(units),
            mean_price = mean(price),
            num_obs = n())
```

```
# A tibble: 4 x 4
  brand sum_sales mean_price num_obs
  <chr>     <dbl>      <dbl>   <int>
1 CITHI    832635       1.51     767
2 MMAID   3641990       1.46    1279
3 STORE   6301080       1.20    1279
4 TROPI   2615389       1.42    1279
```

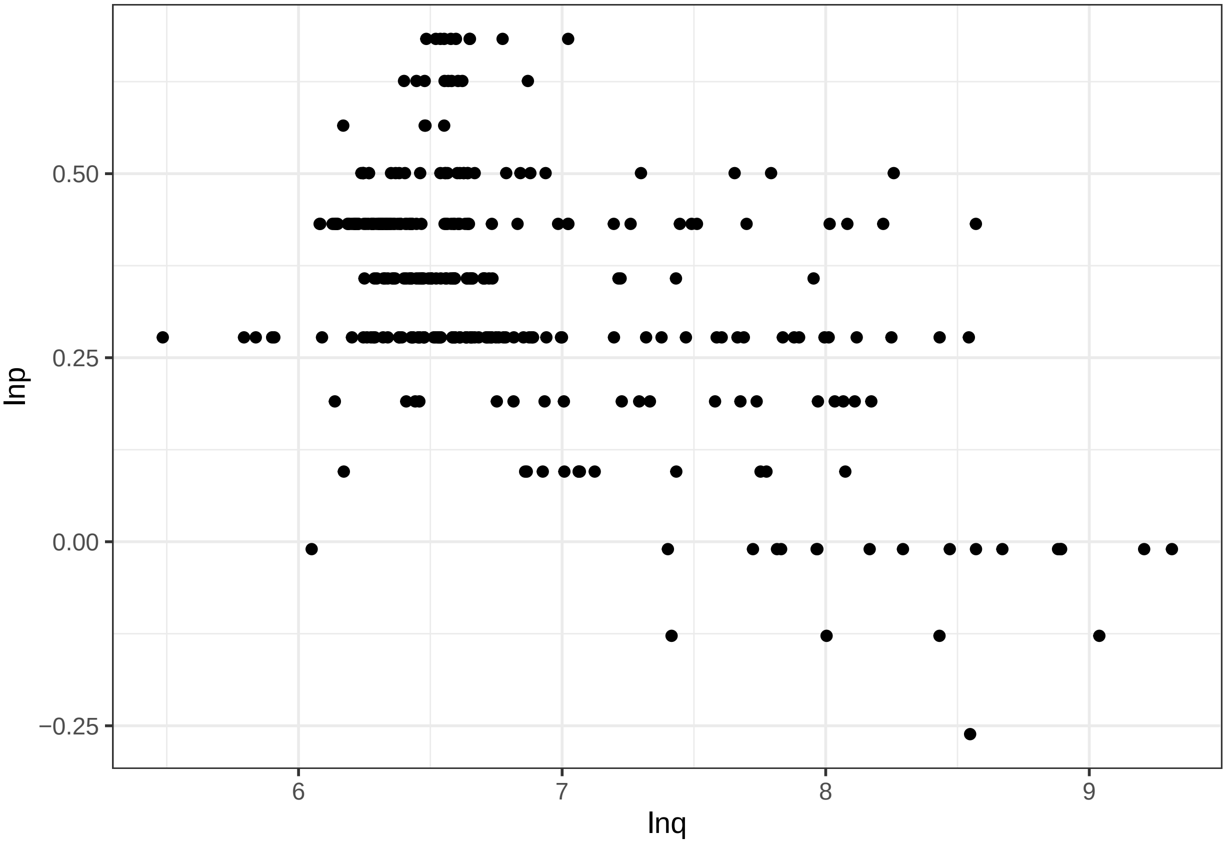
Let me create some handy subsets of the data (and note my variable naming scheme).

```
df.low <- df %>% filter(zone=="Low")
df.mmaid12 <- df %>% filter(brand=="MMAID" & size==12)
df.low.mmaid12 <- df.mmaid12 %>% filter(zone=="Low")
```

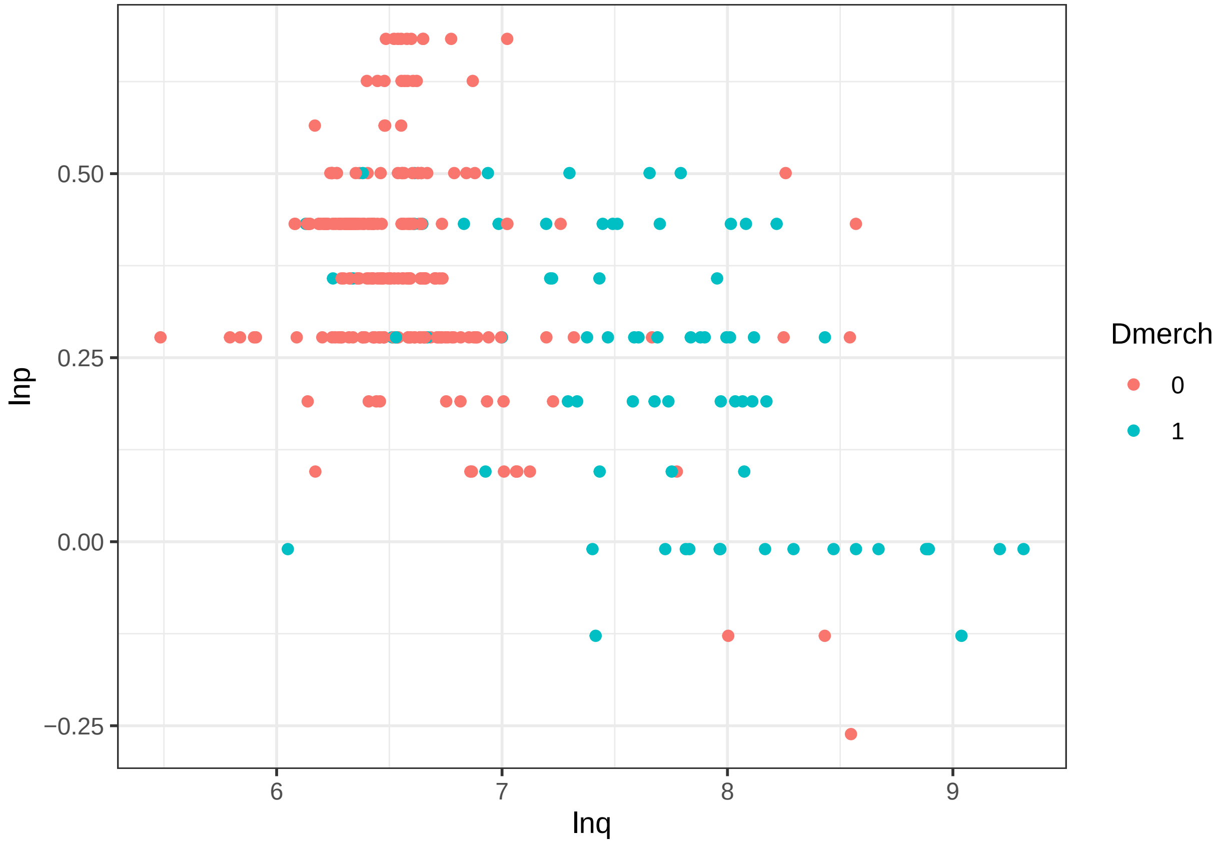
3 Plots

3.1 Scatter plots

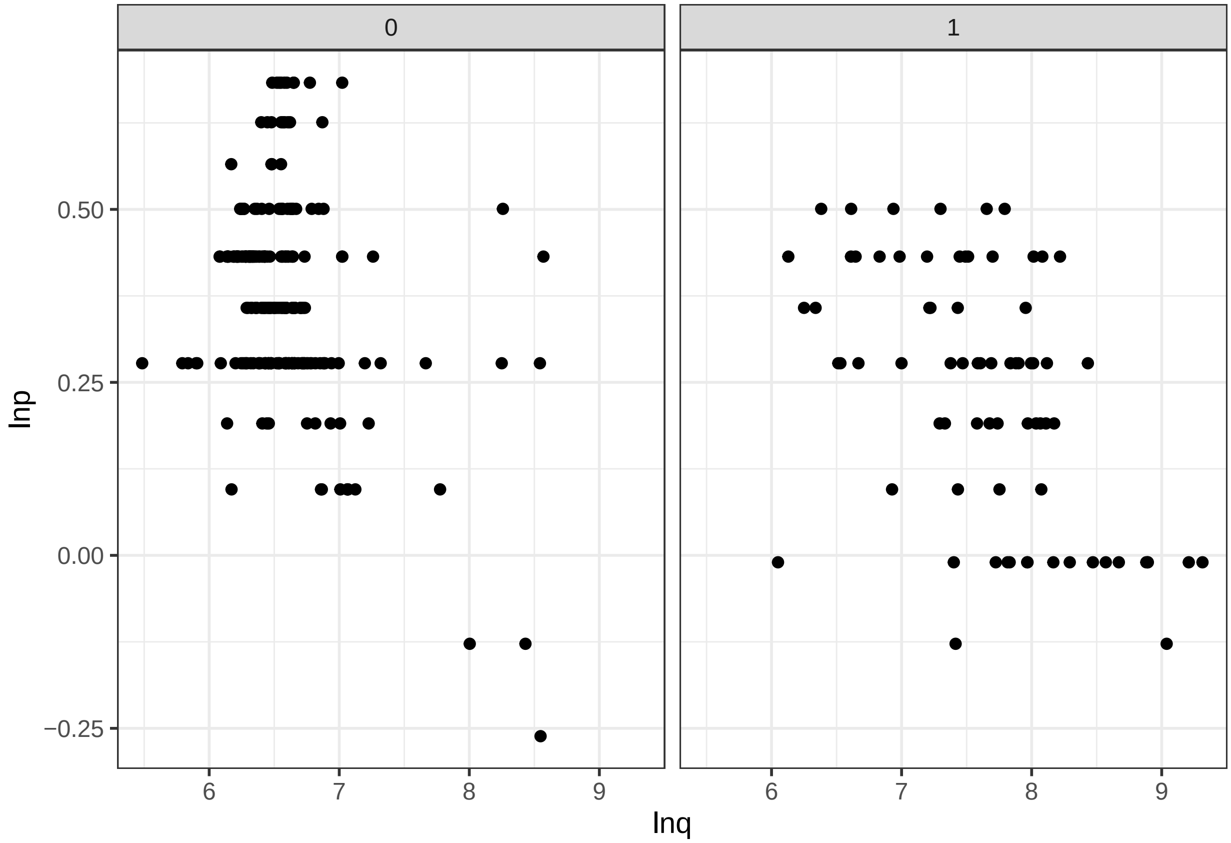
```
ggplot(df.low.mmaid12, aes(x=lnq, y=lnp)) +
  geom_point()
```



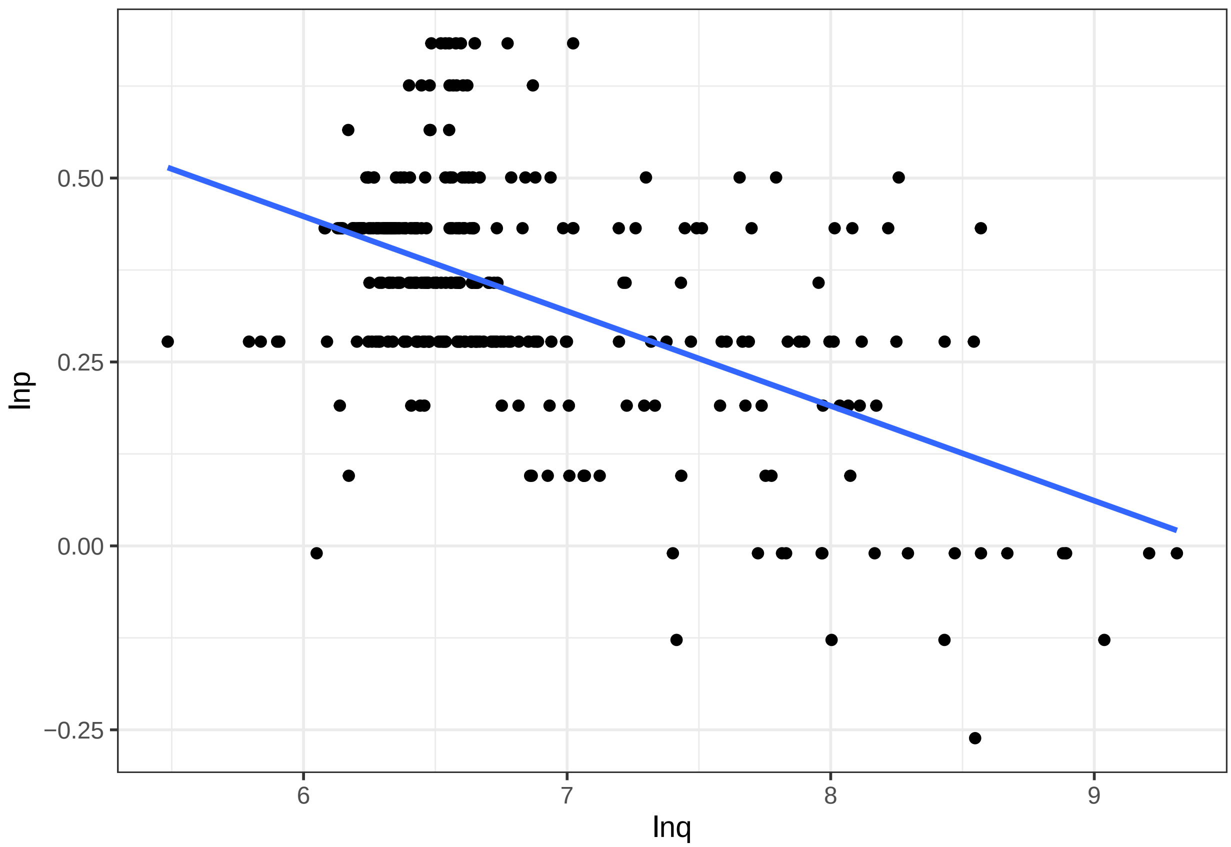
```
ggplot(df.low.mmaid12, aes(x=lnq, y=lnp, color=Dmerch)) +
  geom_point()
```



```
ggplot(df.low.mmaid12, aes(x=lnq, y=lnp)) +
  geom_point() +
  facet_wrap(~ Dmerch)
```

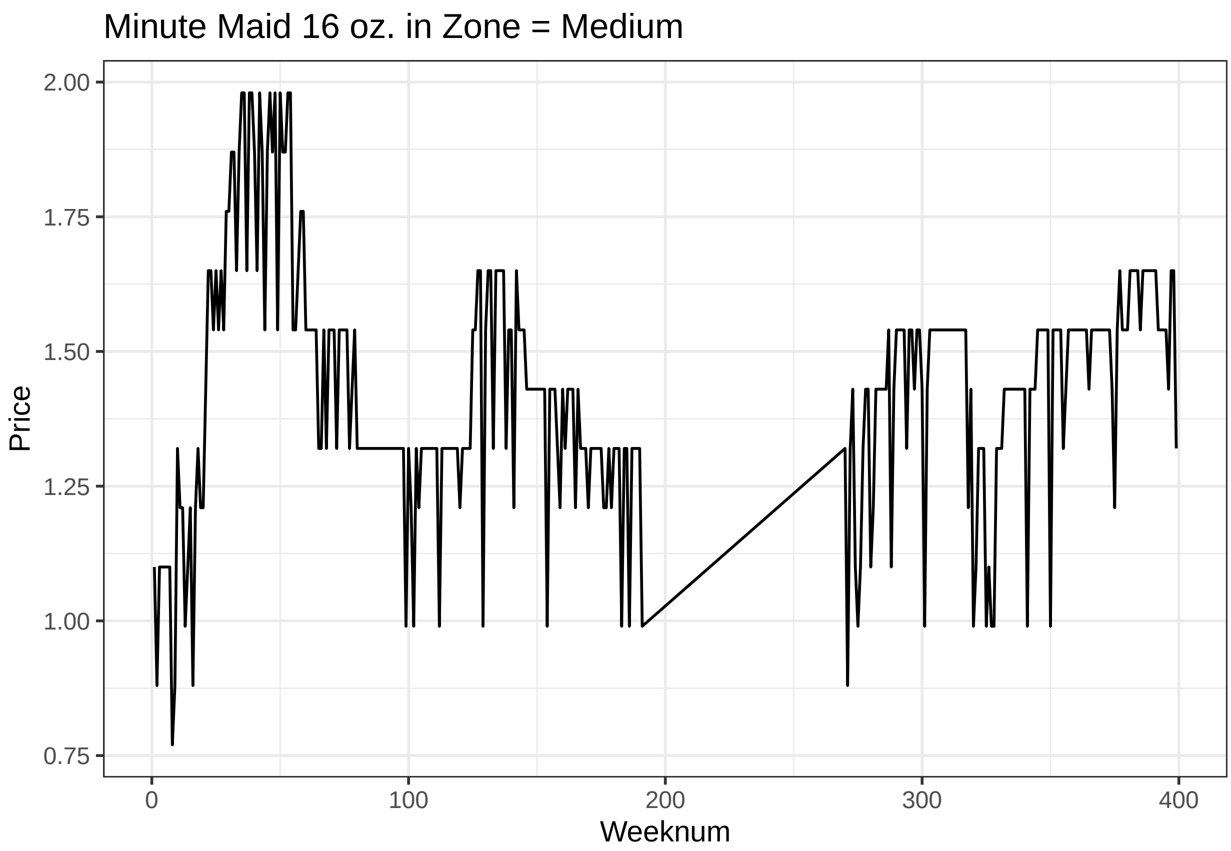


```
ggplot(df.low.mmaid12, aes(x=lnq, y=lnp)) +
  geom_point() +
  geom_smooth(method='lm', se=FALSE)
```



3.2 Line plots

```
ggplot(df.low.mmaid12, aes(x=week, y=price)) +
  geom_line() +
  labs(x="Weeknum", y="Price", title="Minute Maid 16 oz. in Zone = Medium")
```



4 Regression

```
reg1 <- lm(lnq ~ lnp, data=df.low.mmaid12)
summary(reg1)
```

```
Call:
lm(formula = lnq ~ lnp, data = df.low.mmaid12)

Residuals:
    Min      1Q  Median      3Q     Max
-1.5579 -0.3608 -0.1922  0.3593  1.9544

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  7.58509    0.07504  101.08   <2e-16 ***
lnp         -2.24576    0.19768  -11.36   <2e-16 ***
---
Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
```

```
Residual standard error: 0.5747 on 317 degrees of freedom
Multiple R-squared:  0.2893,    Adjusted R-squared:  0.2871
F-statistic: 129.1 on 1 and 317 DF,  p-value: < 2.2e-16
```

The regression indicates that the price elasticity is -2.246. Now I will add zone dummies and an interaction between `lnp` and `Dmerch`.

```
reg2 <- lm(lnq ~ lnp + Dzone + lnp:Dmerch, data=df.mmaid12)
summary(reg2)
```

```

Call:
lm(formula = lnq ~ lnp + Dzone + lnp:Dmerch, data = df.mmaid12)

Residuals:
    Min      1Q  Median      3Q     Max 
-3.8673 -0.2420 -0.0562  0.2439  2.4228 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)  7.68063    0.04651 165.153  < 2e-16 ***
lnp         -2.34245    0.09992 -23.443  < 2e-16 ***
DzoneHigh    1.02904    0.04722  21.794  < 2e-16 ***
DzoneLow    -0.15736    0.04637  -3.394 0.000711 ***
DzoneMedium  1.26856    0.04665  27.193  < 2e-16 ***
lnp:Dmerch1  1.77531    0.12187  14.568  < 2e-16 ***
---
Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1

Residual standard error: 0.5857 on 1273 degrees of freedom
Multiple R-squared:  0.5974,    Adjusted R-squared:  0.5958
F-statistic: 377.8 on 5 and 1273 DF,  p-value: < 2.2e-16
```

Now the price elasticity is -2.342, which is pretty similar to the first regression. Both estimates are within the reasonable range for a price elasticity.