HW10

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4/25/2024

Question One

1) Question: What question are you trying to answer?

- The question I am trying to answer is if there was an instance of redlining, or a discriminatory denial of service with no grounds, within the insurance industry in 1970 Chicago. In other words, I am investigating if there is a relationship between the number of FAIR policies distributed and racial / ethnic composition of a zip code (percentage of people identifying as a minority within a ZIP code).

2) Approach: What approach/statistical tool did you use to answer the question?

- To answer this question, I constructed a linear regression model that models FAIR policies as a function of minority composition, additionally accounting for other possible predictor variables such as fire rate, age, and income of housing units in each ZIP code. I will use the model to investigate and interpret the intercept and variable-level coefficients, meaning examining each predictor variable while keeping the others constant.

```
##
## Call:
## lm(formula = policies ~ minority + fire + age + income, data = redlining)
##
## Coefficients:
## (Intercept)     minority         fire          age       income
##   -0.124873     0.008359     0.021739     0.005623    -0.015965
```

```
##                    2.5 %     97.5 %
## (Intercept) -1.410125111 1.16037900
## minority     0.002544164 0.01417293
## fire         0.003904606 0.03957406
## age         -0.002000042 0.01324683
## income      -0.093533129 0.06160356
```

3) Results: What evidence/results did your approach provide to answer the question? (E.g. any numbers, tables, figures as appropriate.)

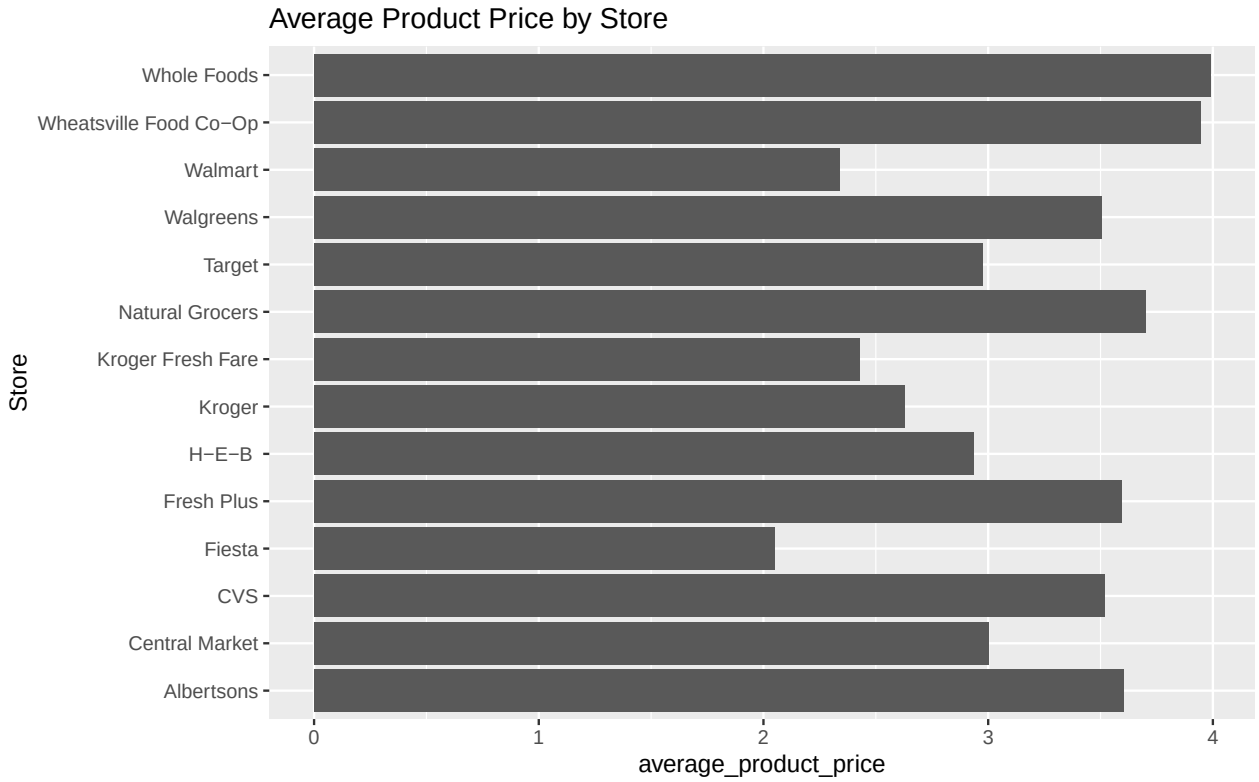
- The above tables are the results of the regression model. The first table are the actual coefficients of the model, which represent each predictor variables respective effect on policy distribution, holding the other variables constant. The second table represents a confidence each interval for these coefficients and intercept.

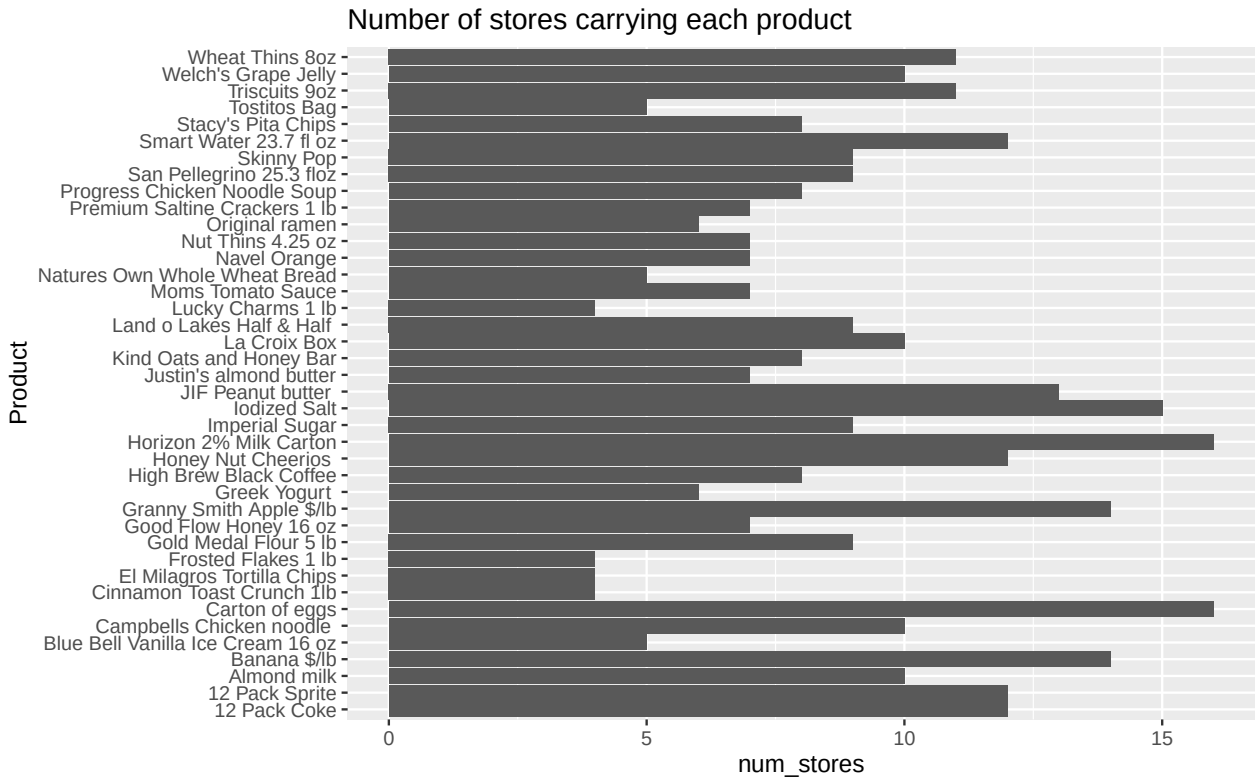
4) Conclusion: What is your conclusion about your question? Provide a written interpretation of your results, understandable to stakeholders who might plausibly take an interest in this data set.

- For this model, the intercept represents the expected number of FAIR policies when the predictor variables, minority composition, fire rate, age, and median income are all zero. The 0.0084 value for the minority coefficient means that holding other variables constant, for every percentage increase in

self-identifying minorities, FAIR policies are expected to increase by 0.0084 per 100 housing units. The 0.0217 value for the fire coefficient means that holding other variables constant, for every increase in house fires per 100 housing units, FAIR policies are expected to increase by 0.0217. The 0.0056 value for the age coefficient means that holding other variables constant, for every percentage increase in houses built before WW2, FAIR policies are expected to increase by 0.0056. The -0.0159 value for the income coefficient means that holding other variables constant, for every thousand increase in median household income, FAIR policies are expected to decrease by 0.0159. According to the confidence intervals (containing zero or not), the only statistically significant predictor variables on FAIR policies are minority composition and fire rate. My conclusion is that to some non-trivial degree, the composition of self-identifying minorities and fire rate of housing units within a zip code are related to more reliance on FAIR policys and therefore less access to private insurance. It should be noted the further analyses of other possible predictor variables should be considered get more accurate results.

Question Two






```
##                                           2.5 % 97.5 %
## (Intercept)                                5.45   6.40
## Product12 Pack Sprite                     -0.63   0.60
## ProductAlmond milk                        -2.85  -1.56
## ProductBanana $/lb                        -5.48  -4.29
## ProductBlue Bell Vanilla Ice Cream 16 oz -3.75  -2.14
## ProductCampbells Chicken noodle           -4.11  -2.82
## ProductCarton of eggs                     -3.58  -2.42
## ProductCinnamon Toast Crunch 1lb          -1.87  -0.12
## ProductEl Milagros Tortilla Chips         -2.91  -1.17
## ProductFrosted Flakes 1 lb                -2.12  -0.38
## ProductGold Medal Flour 5 lb              -2.84  -1.50
## ProductGood Flow Honey 16 oz               0.28   1.72
## ProductGranny Smith Apple $/lb            -4.32  -3.13
## ProductGreek Yogurt                       -4.61  -3.10
## ProductHigh Brew Black Coffee             -3.61  -2.23
## ProductHoney Nut Cheerios                 -2.34  -1.11
## ProductHorizon 2% Milk Carton             -1.68  -0.52
## ProductImperial Sugar                     -3.15  -1.82
## ProductIodized Salt                       -4.45  -3.28
## ProductJIF Peanut butter                  -3.32  -2.12
## ProductJustin's almond butter              6.08   7.53
## ProductKind Oats and Honey Bar            -2.56  -1.17
## ProductLa Croix Box                       -1.72  -0.42
## ProductLand o Lakes Half & Half           -3.96  -2.63
## ProductLucky Charms 1 lb                  -2.37  -0.63
## ProductMoms Tomato Sauce                   0.72   2.17
## ProductNatures Own Whole Wheat Bread      -3.22  -1.62
## ProductNavel Orange                       -4.68  -3.24
```

```
## ProductNut Thins 4.25 oz                -3.20  -1.75
## ProductOriginal ramen                   -5.81  -4.30
## ProductPremium Saltine Crackers 1 lb    -3.05  -1.61
## ProductProgress Chicken Noodle Soup     -3.76  -2.38
## ProductSan Pellegrino 25.3 floz         -4.32  -2.98
## ProductSkinny Pop                       -2.70  -1.37
## ProductSmart Water 23.7 fl oz           -4.31  -3.08
## ProductStacy's Pita Chips               -2.50  -1.12
## ProductTostitos Bag                     -2.49  -0.88
## ProductTriscuits 9oz                    -2.89  -1.63
## ProductWelch's Grape Jelly              -3.58  -2.29
## ProductWheat Thins 8oz                  -2.90  -1.64
## TypeGrocery                             -0.92  -0.41
## TypeHigh-end Grocery                    -0.59   0.00
## TypeNatural                             -0.40   0.22
## TypeSmall Format                        -0.75  -0.14
```

- Compared with ordinary grocery stores (like Albertsons, HEB, or Krogers), convenience stores charge somewhere between .41 and .92 dollars more for the same product.

Stores that charge the lowest and highest, holding product constant:

When comparing the same product, the two stores that charge the lowest prices are Walmart and Kroger Fresh Fare which have coefficients of -0.99 and -0.90, respectively. In contrast, when comparing the same product, the two stores that charge the highest prices are Whole Foods and Wheatsville Food Co-Op which have coefficients of 0.36 and 0.29, respectively.

Two Possibilities -

1. Central Market charges more than HEB for the same product.
2. Central Market charges a similar amount to HEB for the same product.

StoreCentral Market -0.57339

StoreH-E-B -0.64596

Upon inspecting the coefficients, H-E-B seems to be charging slightly less than Central Market for the same product, by around 7 cents. However, when this difference is compared to the differences between other stores it is relatively small. For example the difference between Walmart and Walgreens is almost $1.20. With that said, I conclude that the possibility that Central Market charges a similar amount to HEB for the same product is most plausible, albeit the small difference.

```
## # Standardization method: refit
##
## Parameter                                | Std. Coef. |         95% CI
## ------------------------------------------------------------------------
## (Intercept)                              |       1.08 | [ 0.86,  1.31]
## Product12 Pack Sprite                    |  -9.03e-03 | [-0.33,  0.31]
## ProductAlmond milk                       |      -1.04 | [-1.37, -0.71]
## ProductBanana $/lb                       |      -2.42 | [-2.72, -2.11]
## ProductBlue Bell Vanilla Ice Cream 16 oz |      -1.43 | [-1.85, -1.02]
## ProductCampbells Chicken noodle          |      -1.66 | [-1.99, -1.33]
## ProductCarton of eggs                    |      -1.46 | [-1.76, -1.17]
## ProductCinnamon Toast Crunch 1lb         |      -0.59 | [-1.04, -0.14]
## ProductEl Milagros Tortilla Chips        |      -0.98 | [-1.43, -0.53]
## ProductFrosted Flakes 1 lb               |      -0.71 | [-1.16, -0.26]
## ProductGold Medal Flour 5 lb             |      -1.03 | [-1.38, -0.69]
## ProductGood Flow Honey 16 oz             |       0.52 | [ 0.15,  0.89]
```

```
## ProductGranny Smith Apple $/lb          |      -1.85 | [-2.15, -1.54]
## ProductGreek Yogurt                     |      -1.93 | [-2.32, -1.54]
## ProductHigh Brew Black Coffee           |      -1.39 | [-1.75, -1.03]
## ProductHoney Nut Cheerios               |      -0.83 | [-1.15, -0.52]
## ProductHorizon 2% Milk Carton           |      -0.53 | [-0.83, -0.23]
## ProductImperial Sugar                   |      -1.19 | [-1.53, -0.85]
## ProductIodized Salt                     |      -1.89 | [-2.19, -1.59]
## ProductJIF Peanut butter                |      -1.35 | [-1.67, -1.04]
## ProductJustin's almond butter           |       3.38 | [ 3.01,  3.75]
## ProductKind Oats and Honey Bar          |      -0.83 | [-1.19, -0.47]
## ProductLa Croix Box                     |      -0.48 | [-0.82, -0.15]
## ProductLand o Lakes Half & Half         |      -1.56 | [-1.91, -1.22]
## ProductLucky Charms 1 lb                |      -0.84 | [-1.29, -0.39]
## ProductMoms Tomato Sauce                |       0.74 | [ 0.37,  1.11]
## ProductNatures Own Whole Wheat Bread    |      -1.22 | [-1.63, -0.80]
## ProductNavel Orange                     |      -1.92 | [-2.29, -1.55]
## ProductNut Thins 4.25 oz                |      -1.19 | [-1.56, -0.82]
## ProductOriginal ramen                   |      -2.45 | [-2.84, -2.06]
## ProductPremium Saltine Crackers 1 lb    |      -1.11 | [-1.48, -0.74]
## ProductProgress Chicken Noodle Soup     |      -1.49 | [-1.85, -1.13]
## ProductSan Pellegrino 25.3 floz         |      -1.74 | [-2.08, -1.39]
## ProductSkinny Pop                       |      -0.96 | [-1.31, -0.62]
## ProductSmart Water 23.7 fl oz           |      -1.84 | [-2.16, -1.52]
## ProductStacy's Pita Chips               |      -0.83 | [-1.18, -0.47]
## ProductTostitos Bag                     |      -0.81 | [-1.22, -0.39]
## ProductTriscuits 9oz                    |      -1.13 | [-1.45, -0.80]
## ProductWelch's Grape Jelly              |      -1.48 | [-1.82, -1.15]
## ProductWheat Thins 8oz                  |      -1.13 | [-1.46, -0.81]
## Income10K                               |      -0.03 | [-0.07,  0.01]
```

- Based on the negative sign of the Income10K coefficient, consumers in poorer ZIP codes seem to pay more for the same product on average. We see that a $10,000 increase in average income of a zip code is expected to decrease price for the same product by 0.01, or CI(-0.03, 0). This difference does not seem to hold that much weight in terms of practical significance, although it does exist.
- A one-standard deviation increase in the income of a ZIP code seems to be associated with a -0.03 standard-deviation change in the price that consumers in that ZIP code expect to pay for the same product.