Ace Hardware

Case #1: Ace Hardware

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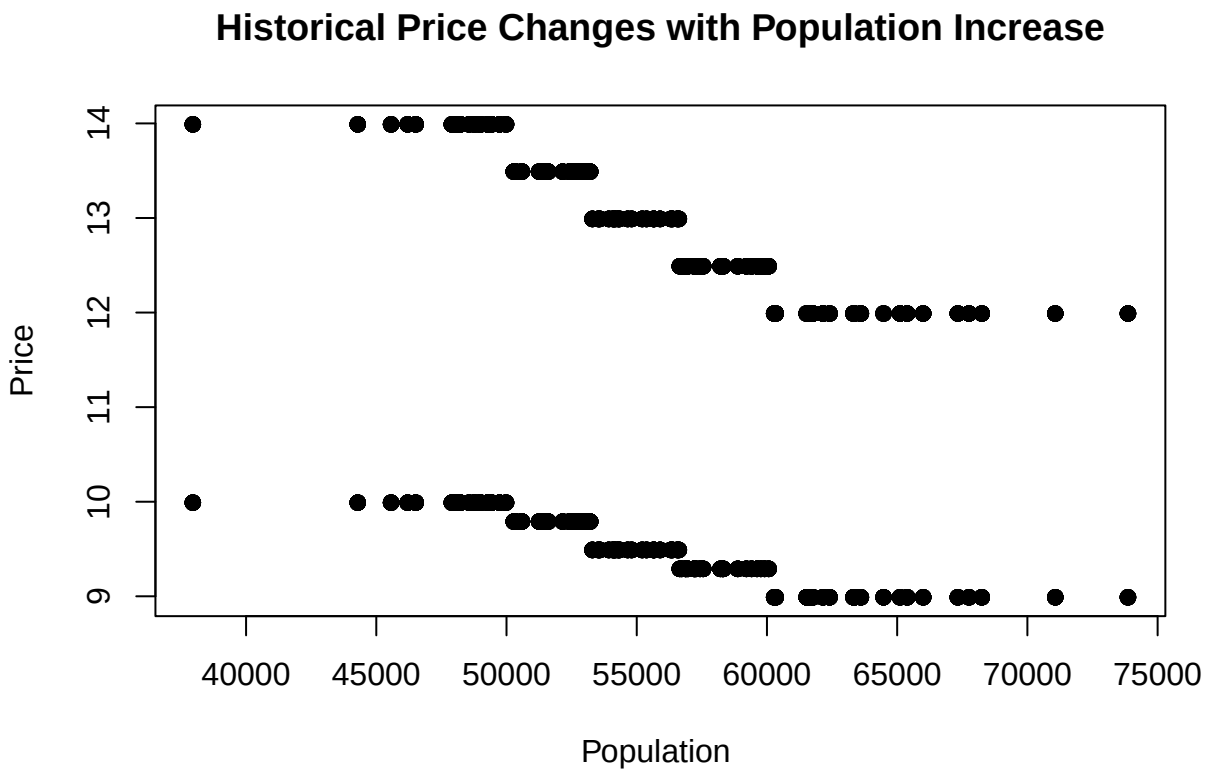
1 Technical Section

```
# Read in the data
# NOTE: This assumes the current working directory contains these files
df.hist <- read_excel("ace_historical.xlsx")
df.test <- read_excel("ace_testlearn.xlsx")
```

1.1 Data Exploration

```
#plot population to historical price
plot(df.hist$population, df.hist$regprice, main="Historical Price Changes with Populatio
   xlab="Population ", ylab="Price", pch=19)
```



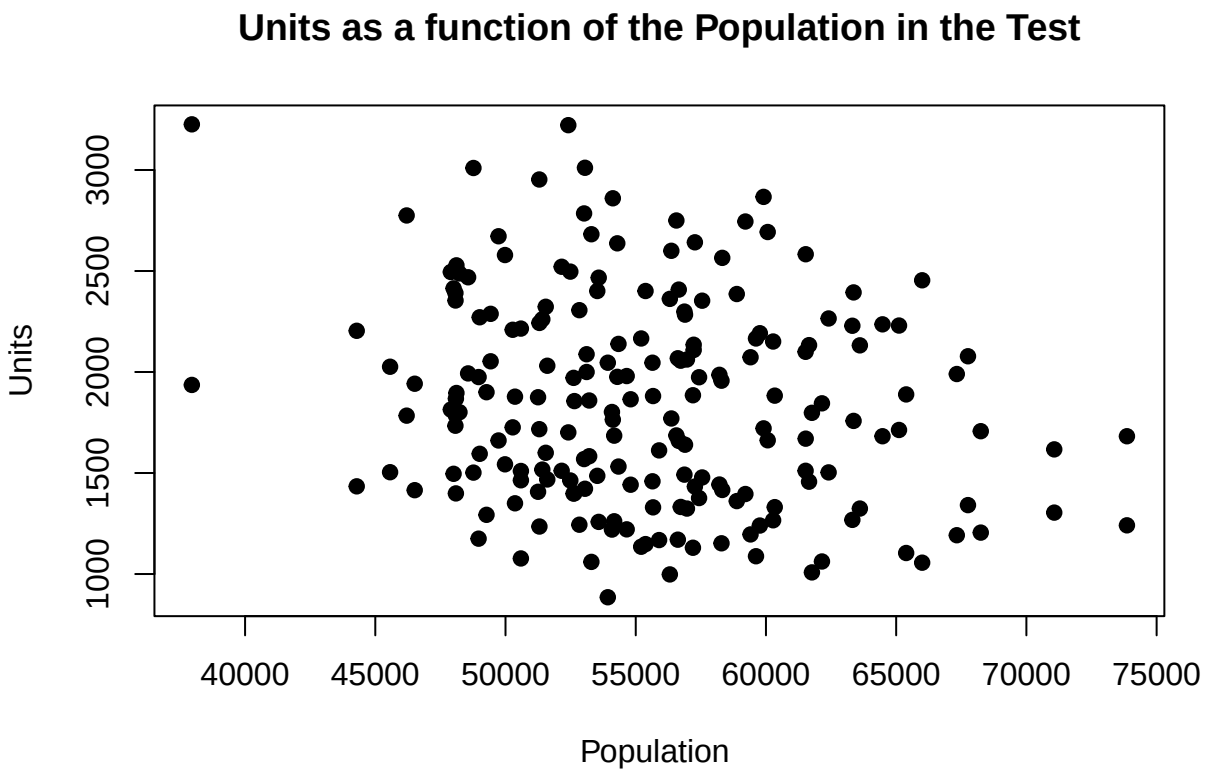

```
#plot population to test price
plot(df.test$population, df.test$regprice, main="Test Price Changes with Population Incr
   xlab="Population ", ylab="Price", pch=19)
```

1.1.1 Data Exploration: Part A

Based on the the first of the two previous graphs, historically, price decreased as the population in the area increased.

However, in the tests, which is displayed in the second of the two graphs, price is not related to the population. The price is set independent of the population of the area. Areas with the same population have prices all over the board, from $9 - $10 for the bottom product and from $12 to $14 for the top product.

```
# Part 1 Data Exploration
#plot population to units
plot(df.test$population, df.test$units, main="Units as a function of the Population in t
   xlab="Population ", ylab="Units", pch=19)
```



1.1.2 Data Exploration: Part B

Based on the above graph, the units sold reaches its peak at the lowest population level. The maximum at the highest population is almost half of this peak. The maximums at each population size trends down as population increases. Therefore, Ace does not sell more in areas with larger population.

1.2 Analytics Elasticity

```
df.hist <- df.hist %>%
  mutate(lnpHist = log(regprice),
         lnqHist = log(units))
head(df.hist)
```

```
# A tibble: 6 x 11
   week store product regprice units population  mpop distance  mdist lnpHist
  <dbl> <dbl>   <dbl>    <dbl> <dbl>      <dbl> <dbl>    <dbl>  <dbl>   <dbl>
1     1     1       1       1     12.5   624      59408 0.400     1.26 -0.481    2.52
```

```
2     2     1       1     12.5   557      59408 0.400     1.26 -0.481    2.52
3     3     1       1     12.5   486      59408 0.400     1.26 -0.481    2.52
4     4     1       1     12.5   670      59408 0.400     1.26 -0.481    2.52
5     5     1       1     12.5   449      59408 0.400     1.26 -0.481    2.52
6     6     1       1     12.5   533      59408 0.400     1.26 -0.481    2.52
# ... with 1 more variable: lnqHist <dbl>
```

```
reg1 <- lm(lnqHist ~ lnpHist, data=df.hist)
summary(reg1)
```

```

Call:
lm(formula = lnqHist ~ lnpHist, data = df.hist)

Residuals:
     Min       1Q   Median       3Q      Max
-0.69616 -0.19156 -0.00775  0.17694  0.73301

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.23659    0.07474   29.92   <2e-16 ***
lnpHist      1.58937    0.03098   51.30   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2465 on 2398 degrees of freedom
Multiple R-squared:  0.5233,    Adjusted R-squared:  0.5231
F-statistic:  2632 on 1 and 2398 DF,  p-value: < 2.2e-16
```

The regression indicates that the price elasticity is for the historical data is 1.589.

```
df.test <- df.test %>%
  mutate(lnpTest = log(regprice),
         lnqTest = log(units))
head(df.test)
```

```
# A tibble: 6 x 11
  store product regprice units population   mpop distance   mdist  cost lnpTest
  <dbl>   <dbl>    <dbl> <dbl>      <dbl>  <dbl>    <dbl>   <dbl> <dbl>   <dbl>
1     1       1     12.0  2073      59408  0.400    1.26  -0.481    8.8    2.48
2     2       1     14.0  1510      50591 -0.481    1.65  -0.0915   8.8    2.64
3     3       1     13.0  2243      51302 -0.410    1.98   0.239    8.8    2.56
4     4       1     13.5  1617      71070  1.57     0.290 -1.45     8.8    2.60
5     5       1     13.5  1845      62150  0.674    1.21  -0.531    8.8    2.60
6     6       1     13.5  1859      53213 -0.219    1.95   0.209    8.8    2.60
# ... with 1 more variable: lnqTest <dbl>
```

```
reg2 <- lm(lnqTest ~ lnpTest, data=df.test)
summary(reg2)
```

```
Call:
lm(formula = lnqTest ~ lnpTest, data = df.test)

Residuals:
     Min       1Q   Median       3Q      Max
-0.58092 -0.15553 -0.00424  0.16900  0.50614

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.76403    0.22002   21.65   <2e-16 ***
lnpTest      1.13074    0.09119   12.40   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2094 on 198 degrees of freedom
Multiple R-squared:  0.4371,    Adjusted R-squared:  0.4342
F-statistic: 153.7 on 1 and 198 DF,  p-value: < 2.2e-16
```

For the experiment, the price elasticity is 1.131,

Therefore, the price elasticity decreases in the experiment. For a increase in price by $1, the percentage quantity purchased will decrease by 1.589 - 1.131 = 0.458.

1.3 Pricing Recommendation

Since the Log-Log Model demonstrated a price elasticity for the experiment of NA, the gross margin percentage can be calculated as follows:

-1 / -1.131 = 0.884

Margin: 88%

Therefore, based on this case, each product should earn a margin of 88%

The first is at cost of $8.80. The price should therefore be $16.54.

The second is at cost of $5.43. The price should therefore be $4.78.

2 Managerial Discussion

Managerial discussion goes here.