EDS 230 Assignment 3: Informal Sensitivity Analysis

Erika Egg and Jared Petry

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This is an informal sensitivity analysis for the two parameters in our profit model: selling_price and production_cost.

Load libraries

```
library(here)
library(tidyverse)
library(purrr)
library(ggplot2)
library(ggpubr)
```

Source necessary functions

```
# source necessary functions
source("calc_almond_yield_anomaly_for_profit_func.R")
source("calc_almond_profit.R")
```

Run both models to make sure sourcing worked:

```
calc_almond_yield_anomaly_for_profit_func()
```

```
## # A tibble: 22 x 2
##     year yield_anomaly
##    <int>         <dbl>
##  1  1989        0.0432
##  2  1990        9.67
##  3  1991       69.3
##  4  1992       15.8
##  5  1993       20.5
##  6  1994        2.86
##  7  1995     1920.
##  8  1996        4.19
##  9  1997      330.
## 10  1998       28.2
## # i 12 more rows
```

```
calc_almond_profit()
```

```
## $annual
## # A tibble: 22 x 2
##     year profit_w_anom
##    <int>         <dbl>
##  1  1989       208643.
##  2  1990      2134955.
##  3  1991     14063283.
##  4  1992      3364692.
##  5  1993      4298904.
##  6  1994       771975.
##  7  1995    384261681.
##  8  1996      1037104.
##  9  1997     66196108.
## 10  1998      5839985.
## # i 12 more rows
##
## $mean
## [1] 36551791
```

Sensitivity analysis with parameters: "selling_price" and "production_cost"

```
# Create a sampling distribution for both parameters
# Assume a uniform distribution - we don't know anything about variation
nsamples = 300
deviation = 0.15


base_sellprice = 5000 # default in profit function
selling_price = runif(min = base_sellprice-deviation*base_sellprice,
                      max = base_sellprice+deviation*base_sellprice,
                      n = nsamples) # get a sampling distribution length 300

base_prodcost = 4000 # default in profit function
production_cost = runif(min = base_prodcost-deviation*base_prodcost,
                        max = base_prodcost+deviation*base_prodcost,
                        n = nsamples) # get a sampling distribution length 300


params = cbind.data.frame(selling_price, production_cost) # combine into one df

# Use pmap to acquire results: takes function name and then names of all
# parameters that don't change
results = params %>% pmap(calc_almond_profit,
                          acres = 200,
                          expected_yield = 1)

# Check results
results[[1]]
```

```
## $annual
## # A tibble: 22 x 2
##     year profit_w_anom
##    <int>         <dbl>
##  1  1989        50307.
##  2  1990       514768.
##  3  1991      3390858.
##  4  1992       811275.
##  5  1993      1036527.
##  6  1994       186134.
##  7  1995     92650980.
##  8  1996       250061.
##  9  1997     15960827.
## 10  1998      1408104.
## # i 12 more rows
##
## $mean
## [1] 8813159
```

```
length(results)
```

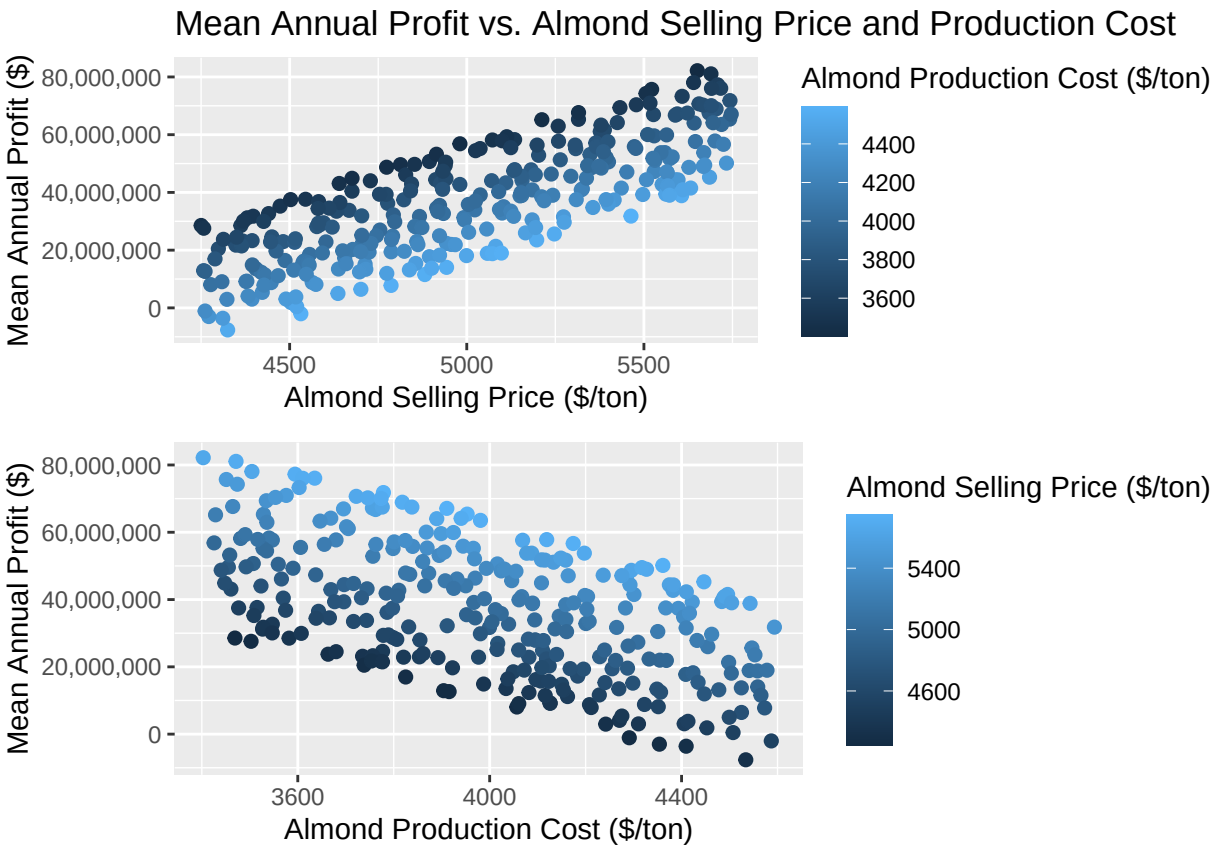
```
## [1] 300
```

```
# Extract results from the list as above
mean_profit = map_df(results,`[`, c("mean"))

# Add the parameter values for each run
mean_profit = cbind.data.frame(mean_profit, params)

# Plots for means - two versions of same thing
p1 = ggplot(mean_profit, aes(selling_price, mean, col = production_cost)) +
  geom_point(cex = 2) +
  labs(title = "Mean Annual Profit vs. Almond Selling Price and Production Cost",
       y = "Mean Annual Profit ($)",
       x = "Almond Selling Price ($/ton)",
       col = "Almond Production Cost ($/ton)") +
  scale_y_continuous(labels = scales::comma)
p2 = ggplot(mean_profit, aes(production_cost, mean, col = selling_price)) +
  geom_point(cex = 2) +
  labs(y = "Mean Annual Profit ($)",
       x = "Almond Production Cost ($/ton)",
       col = "Almond Selling Price ($/ton)") +
  scale_y_continuous(labels = scales::comma)

ggarrange(p1, p2, ncol = 1)
```

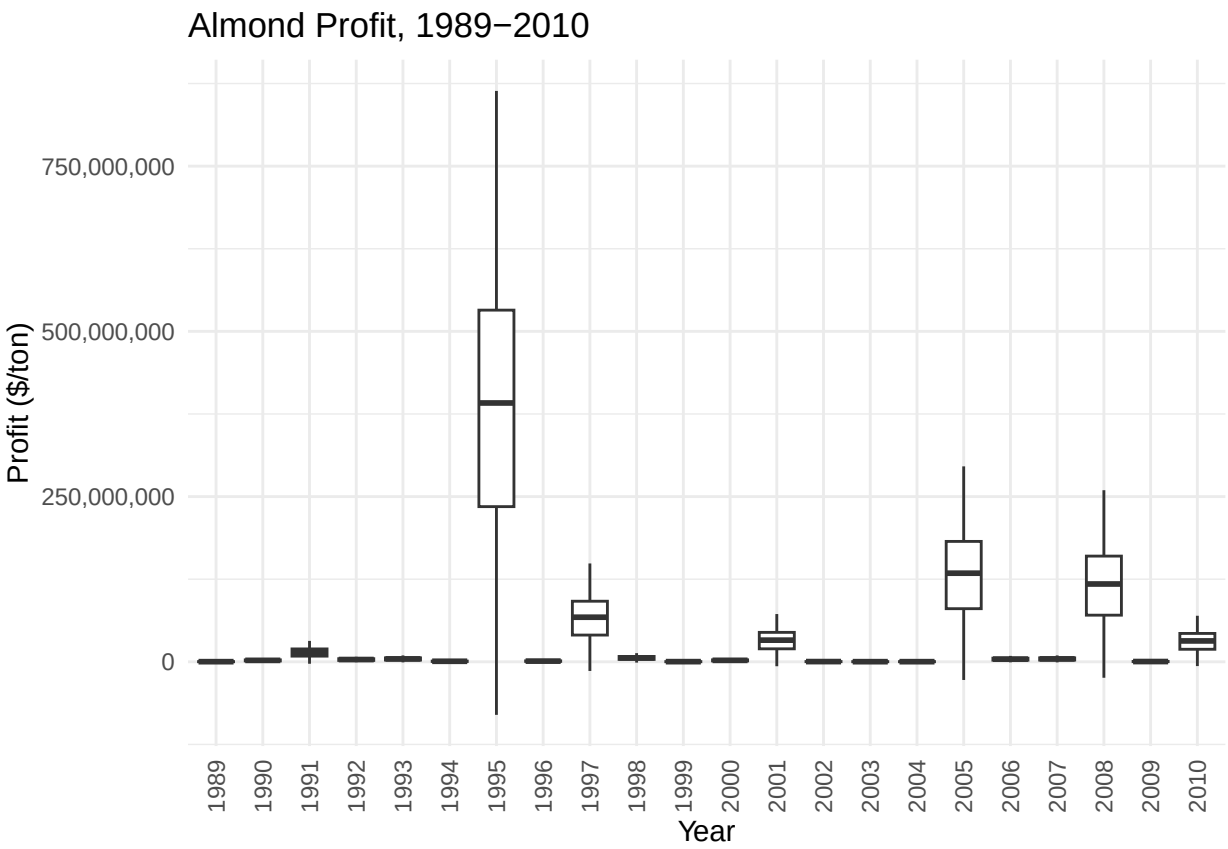



```
ggsave(here("almond_profit_scatterplot.png"))

# Extract annual information too and plot
annual_df = map_df(results,`[`, c("annual"))
annual_profit = as.data.frame(annual_df$annual$year)
colnames(annual_profit)="year"
annual_profit$profit_w_anom = annual_df$annual$profit_w_anom

p3 = ggplot(annual_profit, aes(as.factor(year), profit_w_anom)) +
  geom_boxplot() +
  labs(title = "Almond Profit, 1989-2010",
       x = "Year",
       y = "Profit ($/ton)") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  scale_y_continuous(labels = scales::comma)

p3
```




```
ggsave(here("almond_profit_boxplot.png"))
```