

# Homework Assignment

## Week 6 & 7

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### Problem 1: The Shock Absorber Data

The data comes from a company which supplies a major automobile manufacturer with shock absorbers. An important characteristic is the “force transferred through the shock absorber when the shank is forced out of the cylinder”. If you don’t know what that really means, don’t worry, neither do I.

What we do need to understand is that the manufacturer only considers the shock to be an acceptable part if the force measurement is between 485 and 585.

The shock manufacturer and the auto manufacturer are arguing over the following issue. Before the shock is finally shipped, it is filled with gas. After it is filled with gas, it becomes very difficult to measure the force characteristic we are interested in. The shock manufacturers would like to make the measurement before the shock is filled with gas. The auto maker is concerned that there may be a difference in the force before and after the shock is filled with gas and so would like to make the measurement after it is filled.

The shock maker claims that there is little difference between the before and after measurement so that the before measurement can be used.

To investigate this we have the before (column 1, reboundb) and the after (column 2, rebounda) measurements on 35 shocks. The data for this problem is in **shock.xls** available in the class website.

- (a) Plot the before measurement vs. the after measurement. Does this look like the kind of data we can use the simple linear regression model to think about? Why does it make sense to choose the after measurement as “Y” and the before measurement as “X”?
- (b) What are 95% confidence intervals for both the slope and the intercept?
- (c) Test the null hypothesis  $H_0 : \beta_0 = 0$ .
- (d) From the shock maker’s point of view, what hypotheses would be of interest to test for the slope and intercept. That is, what would the shock maker like the true intercept and slope to be?

Test whether the intercept is equal to the value proposed by the shock maker.

Test whether the slope is equal to the value proposed by the shock maker.

- (f) Suppose the before measurement is 550.  
What is the plug-in predictive interval given  $x\text{-before}=550$ .  
What does this interval suggest about the acceptability of the shock absorber?

## Problem 2

The data file for this question is available in the course website.

Consider the regression model

$$Apple_t = \alpha + \beta SP500_t + \epsilon_t \quad \epsilon_t \sim N(0, \sigma^2)$$

where  $Apple_t$  represents the return on Apple Computers in month  $t$  and  $SP500_t$  represents the return on the S&P 500 in month  $t$ .

- What is the interpretation of  $\beta$  in terms of a measure of risk of the stock?
- What is the interpretation of  $\alpha$ ?
- Plot  $Apple$  against  $SP500$ . What graphical evidence is there of a relationship between  $Apple$  and  $SP500$ ? Does the relationship appear to be linear? Why or why not?
- Estimate  $\beta$ . What does this estimate tell you about the risk of Apple?
- Is the estimate of  $\beta$  obtained in part (c) the actual value of  $\beta$ ? Why or why not?
- Now consider the regression models

$$Intel_t = \alpha + \beta SP500_t + \epsilon_t \quad \epsilon_t \sim N(0, \sigma^2)$$

where  $Intel_t$  represents the return on Intel in month  $t$ , and

$$Safeway_t = \alpha + \beta SP500_t + \epsilon_t \quad \epsilon_t \sim N(0, \sigma^2)$$

where  $Safeway_t$  represents the return on Safeway in month  $t$ . How does the beta risk of the three companies compare? What do their  $\alpha$ 's tell you?

**Problem 3: Presidential Election**  
(Imagine this is October 2012!)

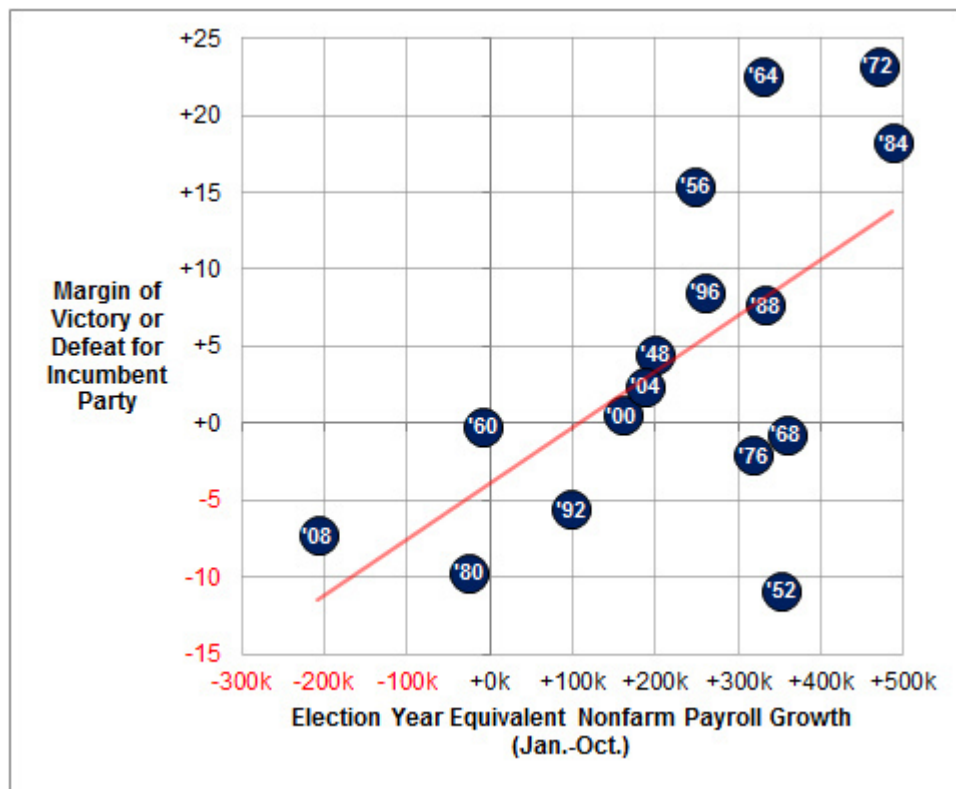
# FiveThirtyEight

Nate Silver's Political Calculus



This question is based on an analysis presented in the New York Times blog FiveThirtyEight by Nate Silver...

According to the blog post, the most accurate economic indicator to predict the results of the election for an incumbent president is the election year “equivalent non-farm payroll growth” (in number of jobs from Jan to Oct). In the blog they provided a picture summarizing the relationship between this economic indicator and the election results. The analysis was based on the last 16 elections where a sitting president was seeking re-election. The picture is displayed below:



This week, The Department of Labor released the most recent employment numbers which says that the economy has added, on average, 100,000 non-farm jobs since January 2012.

Now, I am a gambling person and I need your help... Currently, on intrade.com, I can buy or sell a future contract on Obama's re-election for \$64.7. This contract pays \$100 if Obama wins (see below).

The screenshot shows the intrade.com website interface. At the top, there is a search bar with the text "Search Markets" and a placeholder "e.g. Obama". Below the search bar, the site's logo "intrade" is displayed with the tagline "The World's Leading Prediction Market". Navigation tabs include "US Election 2012", "Home", "How it Works", and "Mar". A breadcrumb trail shows the path: "Markets" > "Politics" > "2012 US Elections" > "2012 Presidential Election Winner (Individual)" > "Barack Obama to". The main content area features a profile picture of Barack Obama and the title "Barack Obama to be re-elected President in 2012". Below the title, it states "Last prediction was: \$6.47 / share", "Today's Change: ▼ -\$0.01 (-0.2%)", and "Contract Type: 0-100". A large "64.7% CHANCE" is prominently displayed, along with social media sharing icons for Facebook, Twitter, and a plus sign. At the bottom, it lists the "Event: 2012 Presidential Election Winner (Individual)".

1. Based on the model presented in the New York Times blog and the numbers released by the Department of Labor how should I bet on the Intrade website (i.e., should I buy or sell the future contract)? Why?

2. Do you think the answer in the question above is a good idea? Why or why not?