STAT 151A Lecture 2

Henry Liev

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Example 0.1 (Judicial behavior in Israel)

- In Israel, defendants appealing a criminal sentence face a panel of three judges
- There are two dominant ethnic groups in Israel, Jewish (majority) and Arab (minority)
- How does the number of Arab judges on the panel affect the length of sentences given?
- Data from Israeli court records.
- Design: judges are assigned to panels by a court clerk without specific knowledge of cases.
- Separate linear models for Jewish and Arab defendants. No strong relationship for Jewish defendants, but large downward slope for Arab defendants.

Can we use these models to:

1. Summarize an association?
2. Do prediction?
3. Evaluate causal claims

Solution.

1. Arab defendents have a negative correlation between criminal sentences
2. If we have more Arab defendents, we expect a more lenient sentence
3. If we need a more lenient sentence, we should put more Arab defendents on our panel.

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Remark 0.2 (Transforming Data)

Kleiber: rate $\rightarrow$ log(rate)
mass $\rightarrow$ log(mass)
Why transform? What transformation?

1. "Symmetrize" a distribution (get rid of skewneess)

2. "Linearize" a relationship

Why symmetrize?

- Means and SD are good descriptive tools $\Leftrightarrow$ Normal distributions, know a lot use them regularly

- More insight, two peaks then harder to make sense of the data

Why linearize?

- Familiar tools: Linear models, linear algebra

- Interpretation: easier to interpret a linear model

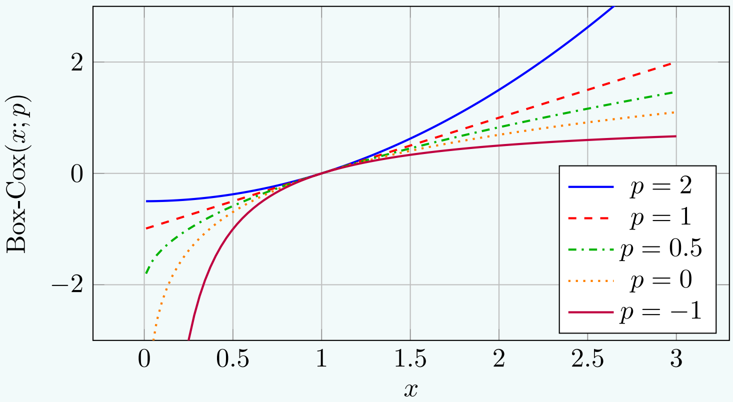
- Visualization $\rightarrow$ spreads out the data

Remark 0.3 (What transformations?)

$x \to f(x)$

- $x \to \log(x)$ multiplicative interpretation: $\log(y) = a + b\log(x) \to y \propto x^b$
- $x \to x^p$ $p = 2, 3, \frac{1}{2}, -1$, more flexibility, generalization of p

  Generalization of power transform (Box Cox Transform) $x \to \begin{cases} \frac{x^p - 1}{p} & p \neq 0 \\ \log(p) & p = 0 \end{cases}$

  Here are some examples of the Box-Cox transformation for different values of p:

  - $p = 2$: $\dfrac{x^2 - 1}{2}$
  - $p = 1$: $x - 1$
  - $p = 0.5$: $\dfrac{x^{0.5} - 1}{0.5}$
  - $p = 0$: $\log(x)$
  - $p = -1$: $\dfrac{x^{-1} - 1}{-1}$