

PLSC 503 – Spring 2022

Regression, Conceptually

January 19, 2022

“Multivariate Analysis for Political Research”

- “Regression” course
- Texts: Weisberg (2013) plus some other readings
- Class materials: <https://github.com/PrisonRodeo/PLSC503-2022-git>
- Preceptor: Ilayda Onder
- Software: R > Stata > others
- Grading: Ten homework assignments (@ 50 points), plus a final project (500 points)

Things We Will And Won't Do

Will: "Regression":

$$Y = f(\mathbf{X})$$

Won't: Multivariate regression:

$$\mathbf{Y} = f(\mathbf{X})$$

Won't: Measurement (e.g. PCA, factor analysis, etc.):

$$\mathbf{Y} = \mathbf{W}^T \mathbf{X}$$

Won't: Classification:

- Cluster Analysis
- Classification and Regression Trees \rightarrow Random Forests, etc.
- Pattern Recognition
- Machine Learning, Support Vector Machines, etc.

“Regression,” conceptually:

$$\Pr(Y|\mathbf{X}) = f(\mathbf{X})$$

Two important things:

- The distribution of Y is *conditional on all variables in \mathbf{X}* , and
- The conditional distribution of Y is conditional on the *joint distribution* of the elements of \mathbf{X} .

→ Regression is hard...

Figure: Infant Mortality and Life Expectancy (data from 2000)

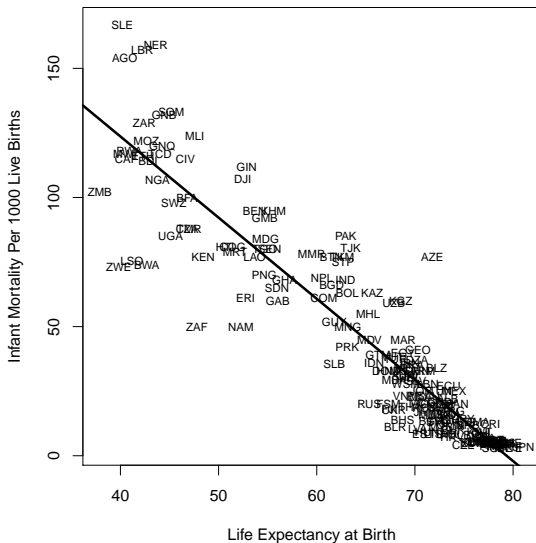


Figure: Infant Mortality and Fertility

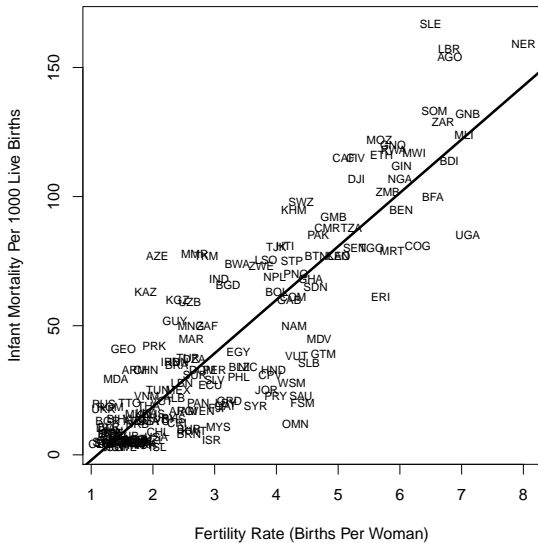


Figure: Infant Mortality and Wealth

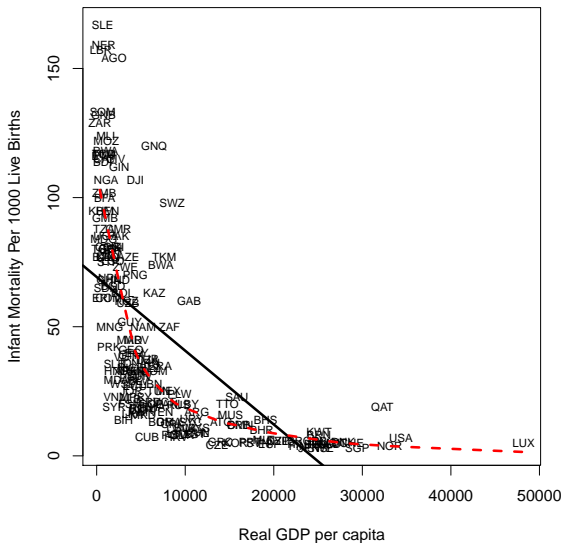


Figure: (Logged) Infant Mortality and (Logged) Wealth

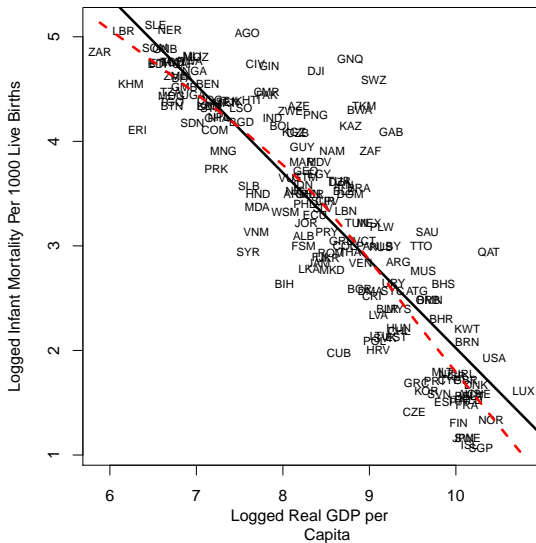


Figure: Infant Mortality and Democracy

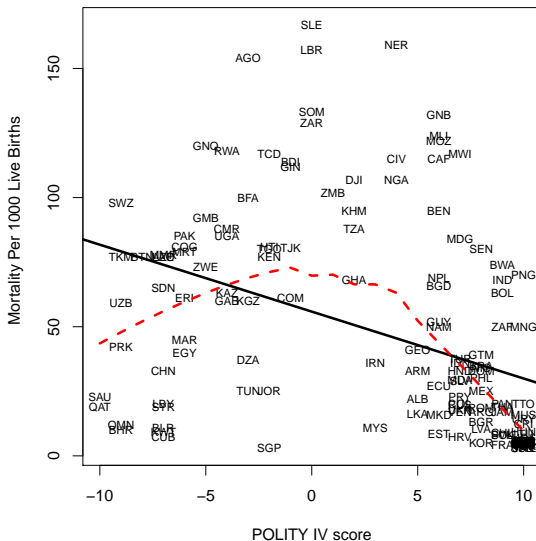


Figure: Infant Mortality, (Dichotomized) Wealth, and Democracy

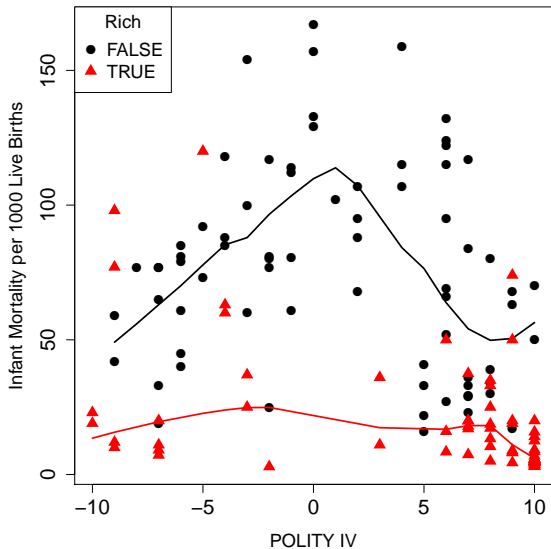


Figure: Measurement: National Health Indicators

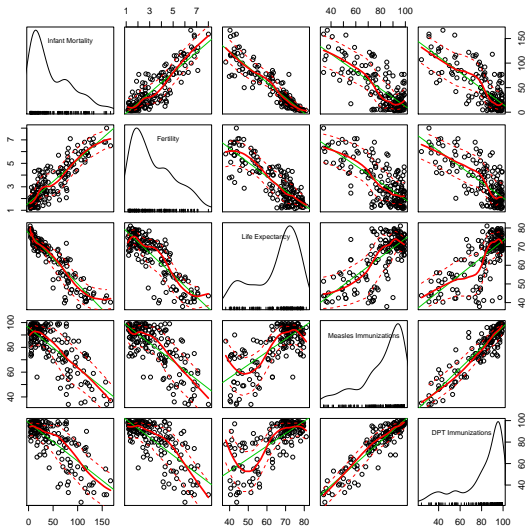
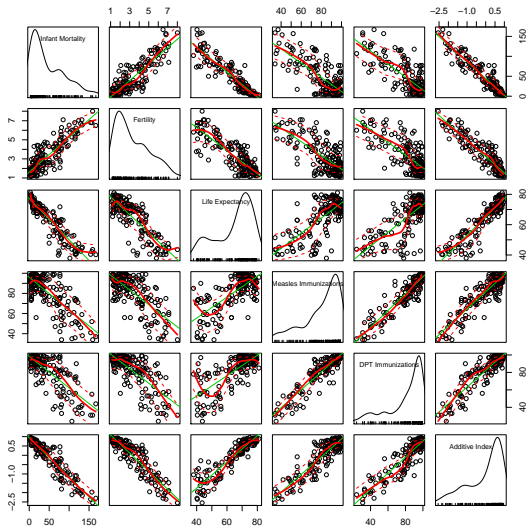


Figure: Measurement: National Health Indicators, Plus Additive Index



Why regression?

	Description	Explanation	Prediction
Task	Summarize data	Correlation/causation	Forecast OOS / future data
Emphasis	Data	Theory / Hypotheses	Outcomes
Focus	Univariate	Multivariate	Multivariate
Typical Application	Summarize / "reduce" data	Discuss marginal associations between predictors and an outcome of interest	Optimize out-of-sample predictive power / minimize prediction error