Making Policy with Data

An Introductory Course on Policy Evaluation

Policy Briefing

Instructor: Prof Yiqing Xu

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What Should Central Banker Do during A Financial Crisis?

- One view: Injecting money helps. A bank-run is usually a crisis of confidence. “Easy money may allow banks to meet increasingly urgent withdrawal demands, staaving off depositor panic” (Friedman and Schwartz).

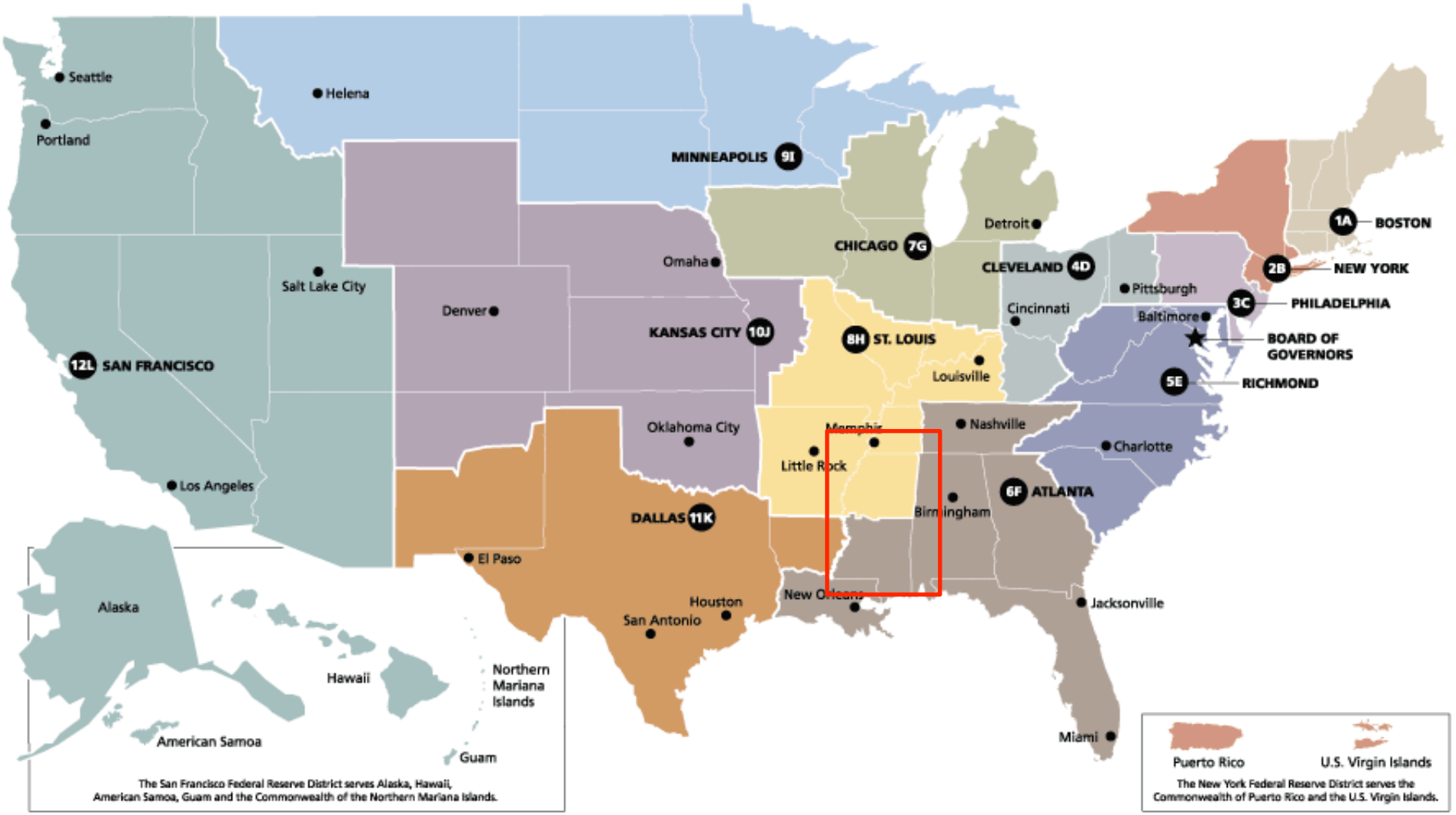
- Another view: Let bad banks go bankrupt. (1) When crisis are real, injecting money is throwing away good money after bad. (2) Banks who have made bad decision should be responsible for their behavior.

- Can we run an experiment?

Research Design: One Mississippi, Two Mississippi

- One Mississippi, two federal reserve districts
  - Policy of the 8th District: **NOT** lending to troubled banks
  - Policy of the 6th District: lending to troubled banks
- Two periods
  - Before the 1930 crisis
  - After the 1930 crisis

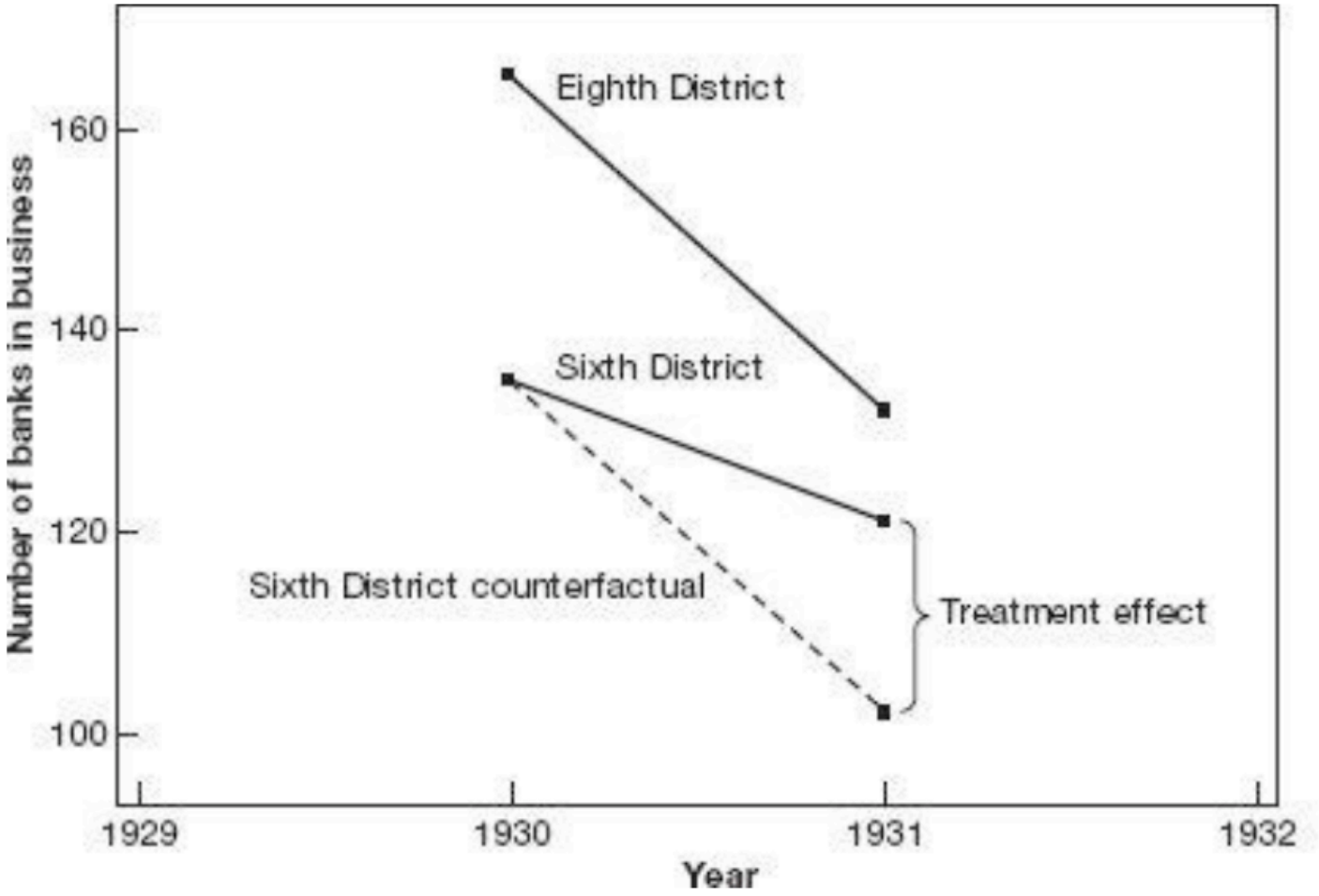
Research Design: One Mississippi, Two Mississippi



Research Design: One Mississippi, Two Mississippi

A Difference-in-Differences Design

Bank failures in the Sixth and Eighth Federal Reserve Districts



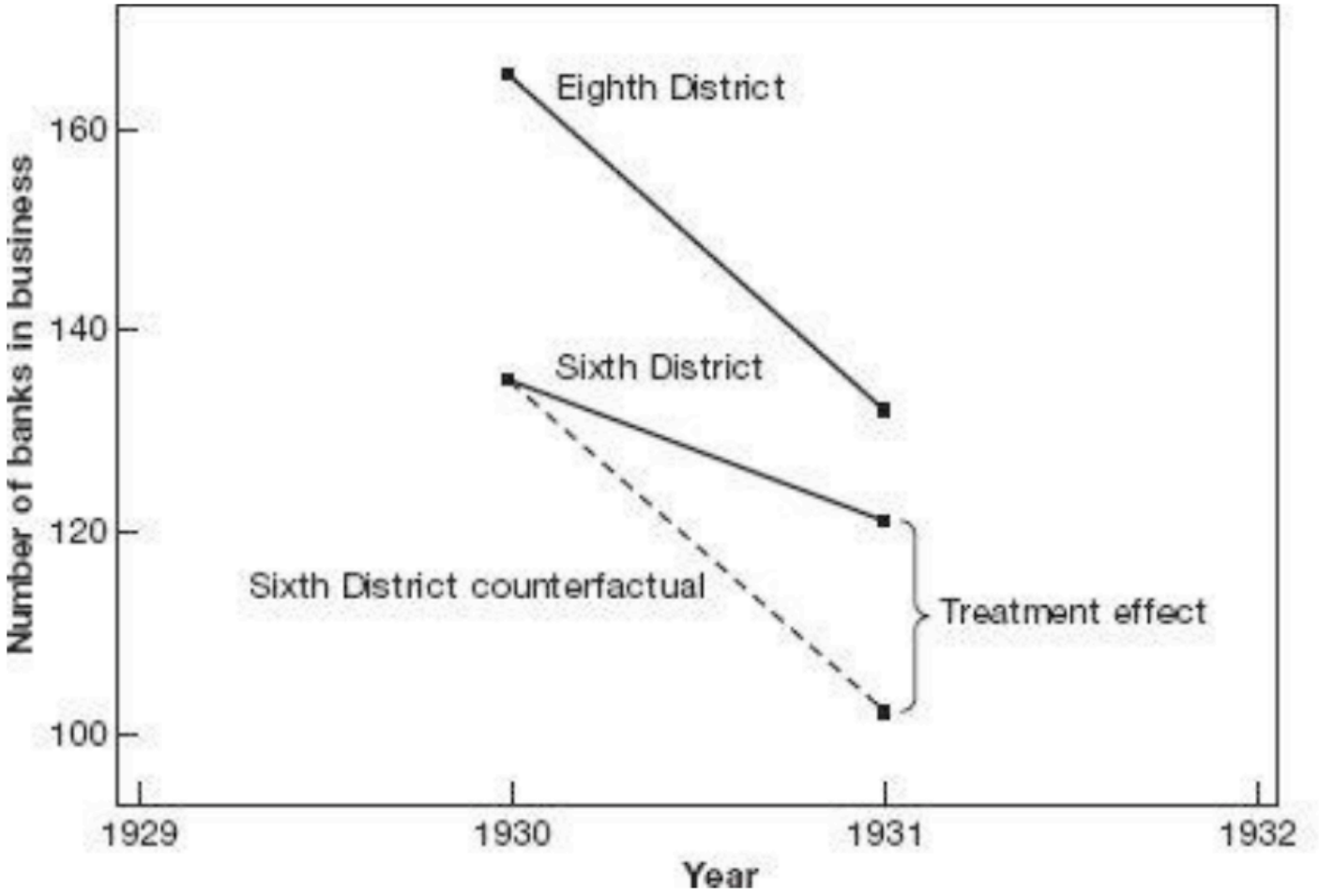
A Difference-in-Differences Design

	The 8th District (No easy money) *Control*	The 6th District (Easy money) *Treated*	6th - 8th
1930 (before crisis)	165	135	-30
1931 (after crisis)	132	121	-11
1931-1930	-33	-14	**19**

- Less reduction in the number of banks in the 6th district (with easy lending) than in the 8th district (with strict lending).
- First view is supported by data!

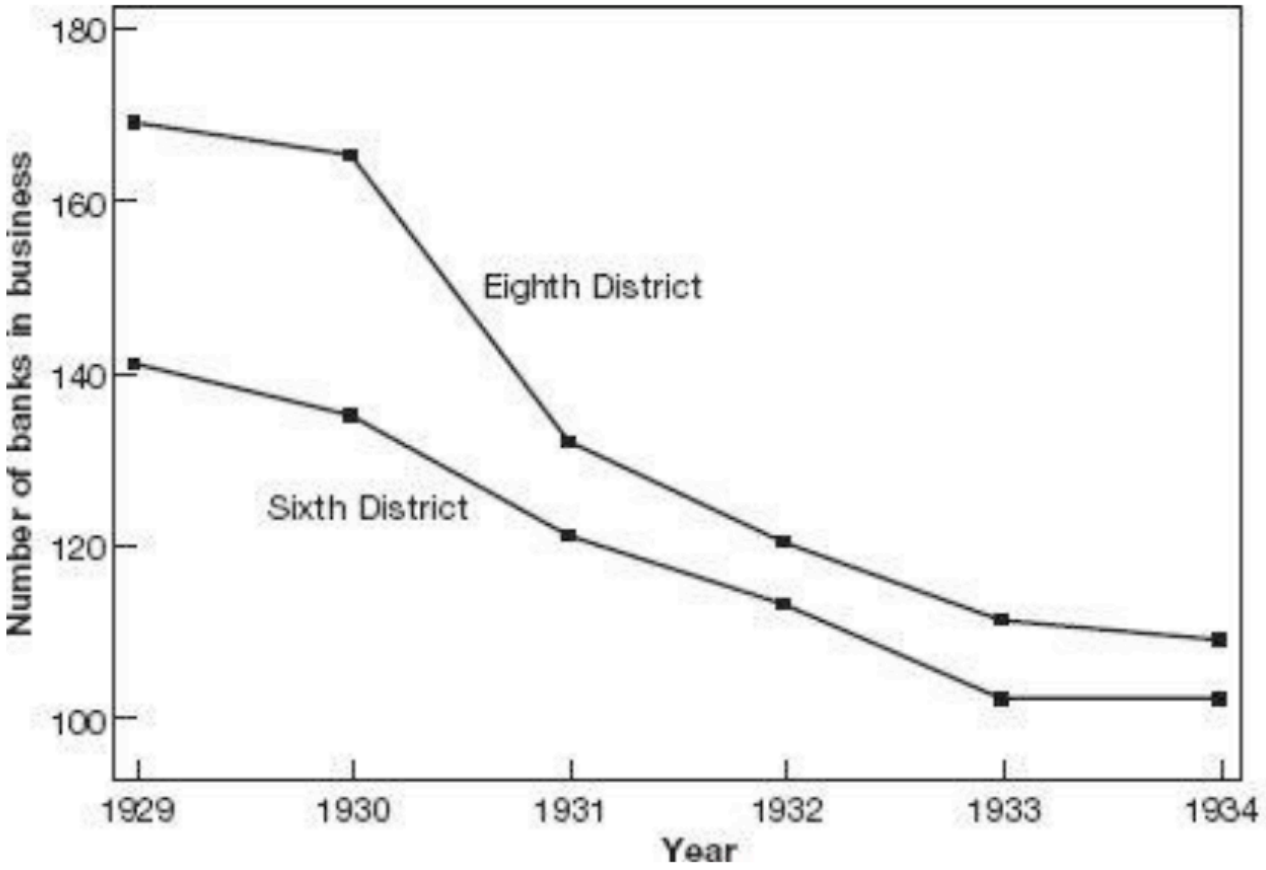
A Difference-in-Differences Design

Bank failures in the Sixth and Eighth Federal Reserve Districts

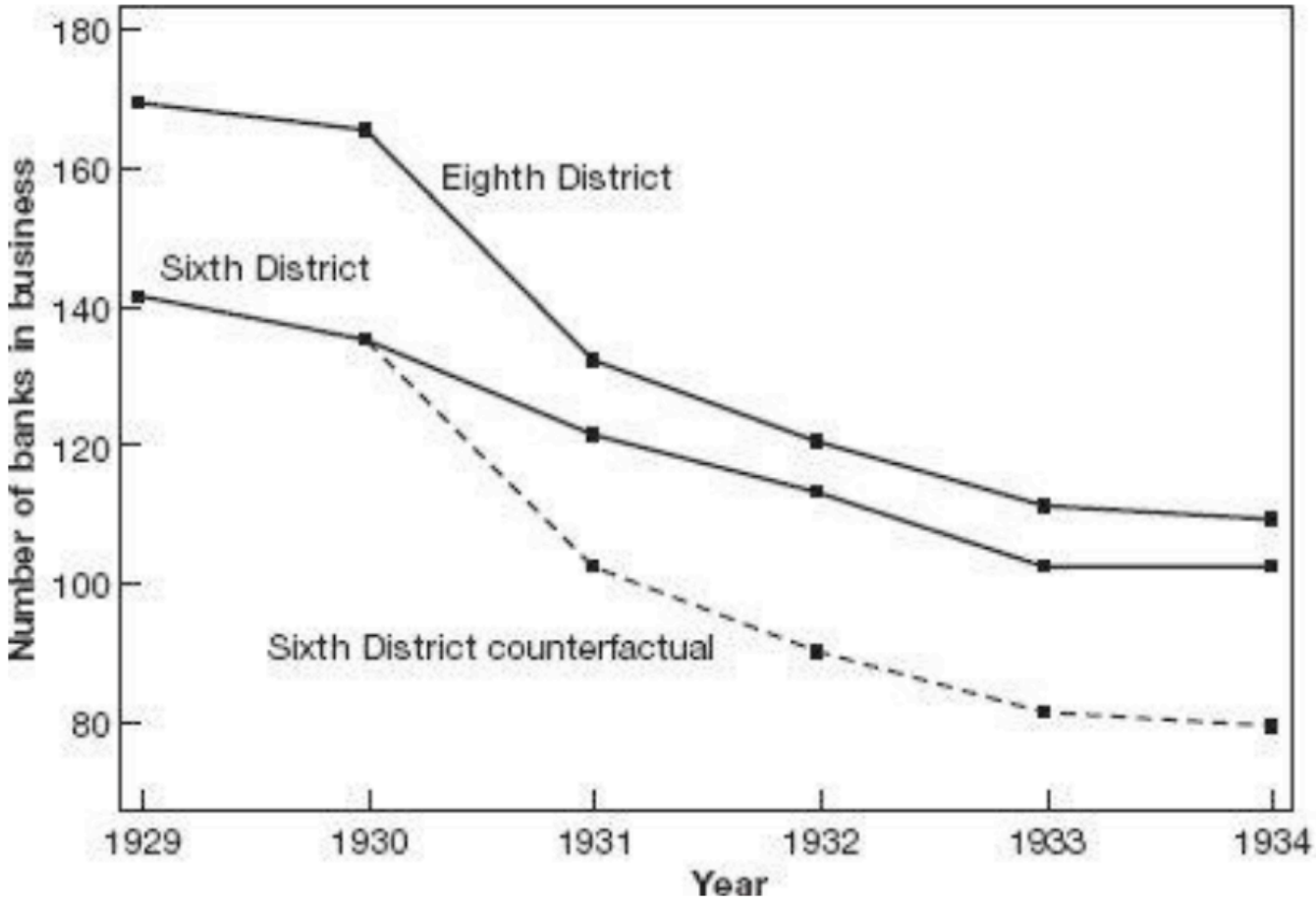


Is the Parallel Trend Assumption Plausible?

Trends in bank failures in the Sixth and Eighth Federal Reserve Districts



All About **Counterfactuals**



Buzzword:

Bias-Variance Trade-off

Bias-Variance Trade-off

- In reality, we usually do not know the true data generating process
- When constructing a predictive model, we often face a trade-off between **model complexity** (to have better fit with existing data) and **uncertainty of estimated parameters** (limited ability to generalize beyond existing data)
- **Solution:** reserve some data for out-of-sample testing and use prediction error as criterion of model selection
- Examples from *An Introduction o Statistical Learning with Application in R*

Bias-Variance Trade-off

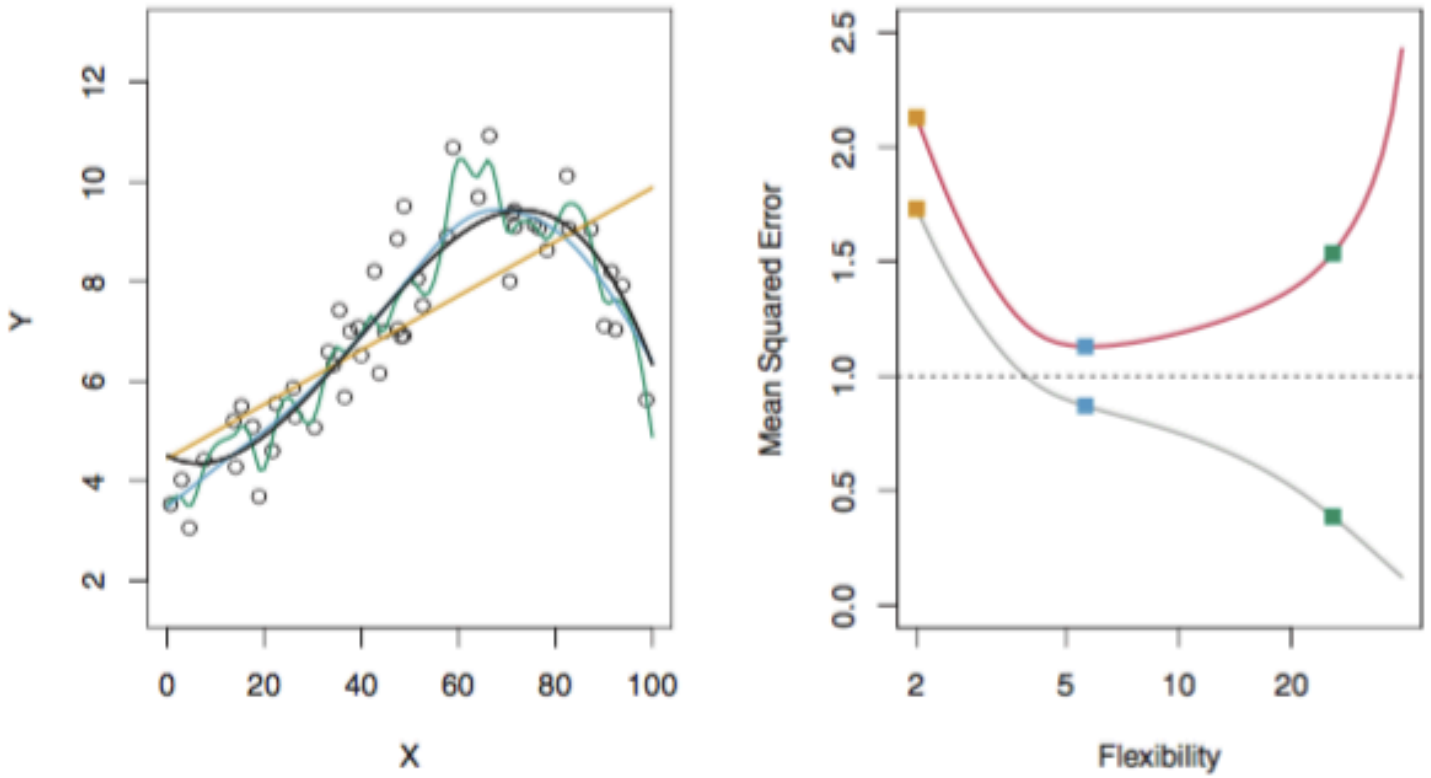


FIGURE 2.9. Left: *Data simulated from f, shown in black. Three estimates of f are shown: the linear regression line (orange curve), and two smoothing spline fits (blue and green curves).* Right: *Training MSE (grey curve), test MSE (red curve), and minimum possible test MSE over all methods (dashed line). Squares represent the training and test MSEs for the three fits shown in the left-hand panel.*

Bias-Variance Trade-off

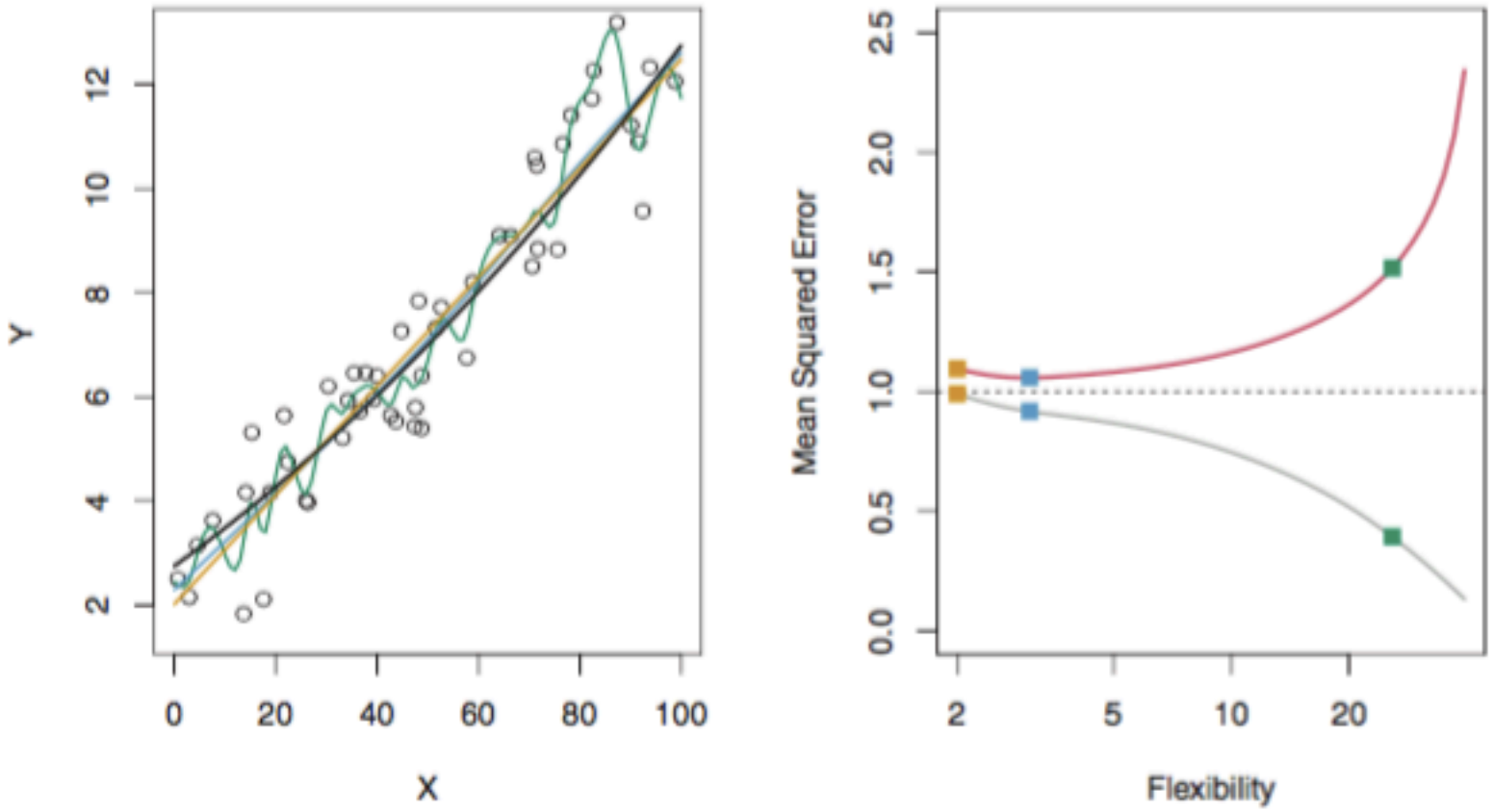


FIGURE 2.10. *Details are as in Figure 2.9, using a different true f that is much closer to linear. In this setting, linear regression provides a very good fit to the data.*

Bias-Variance Trade-off

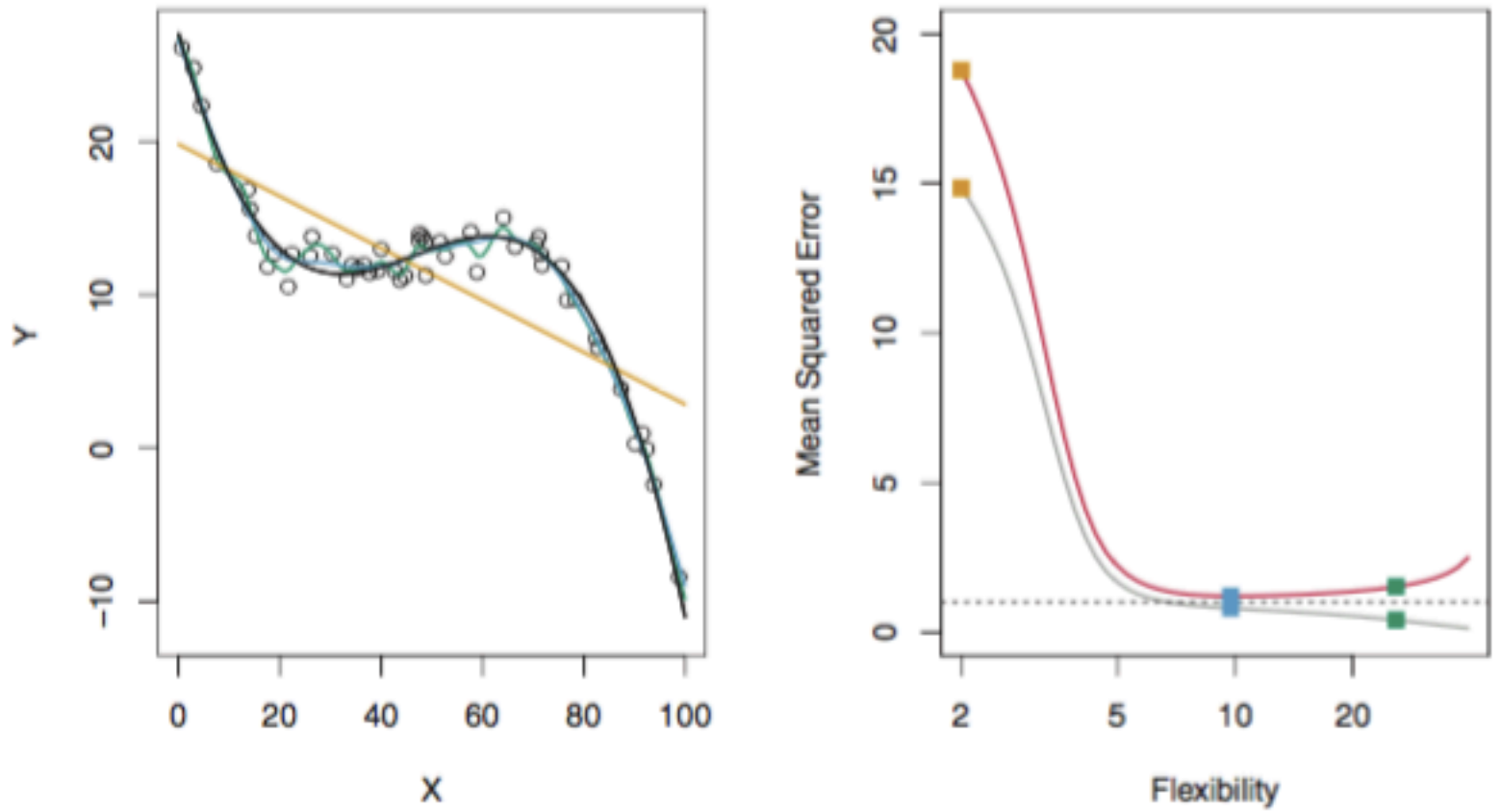


FIGURE 2.11. *Details are as in Figure 2.9, using a different f that is far from linear. In this setting, linear regression provides a very poor fit to the data.*

Bias-Variance Trade-off

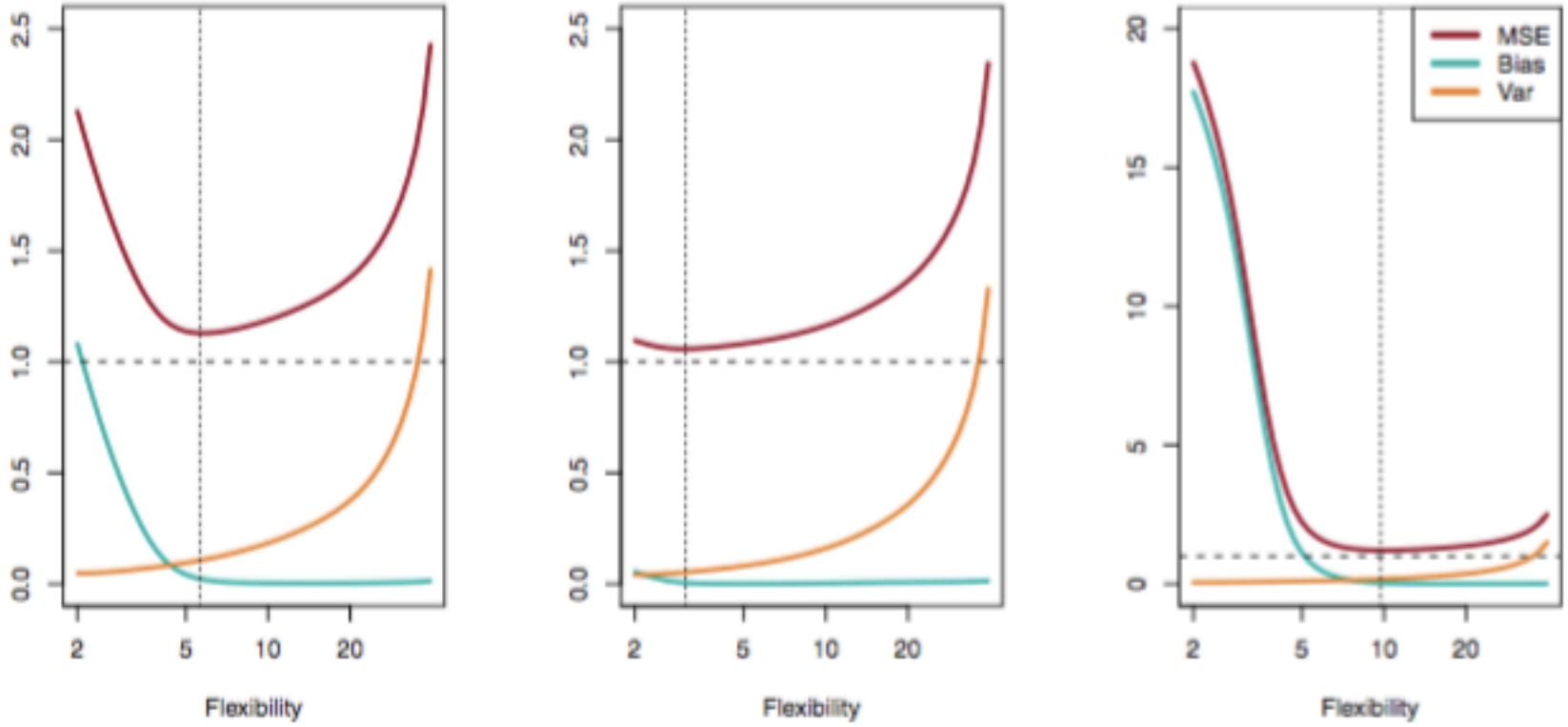


FIGURE 2.12. *Squared bias (blue curve), variance (orange curve), Var(ϵ) (dashed line), and test MSE (red curve) for the three data sets in Figures 2.9–2.11. The vertical dotted line indicates the flexibility level corresponding to the smallest test MSE.*

Bias-Variance Trade-off

$$E\left(y_0 - \hat{f}(x_0)\right)^2 = \mathrm{Var}(\hat{f}(x_0)) + [\mathrm{Bias}(\hat{f}(x_0))]^2 + \mathrm{Var}(\epsilon). \qquad (2.7)$$

- Test error can be decomposed into three components:

(1) the variance of the estimated model

(2) square of the bias of the estimated model

(3) sampling error