# Variance Regression

- $\sigma^2(x)$ called "volatility function". (or $\sigma(x)$)
- residual-based does regression on $(y_i - m(x_i))^2$, difference-based does $E(Y|X=x)^* - m(x)^2$, but might be $< 0$ and has serious bias problems.
- 2.1 of "Efficient Estimation of Conditional Variance Functions in Stochastic Regression" has...

... the method that I teach.

- The bias in the direct method occurs because it turns out that, if you write it like a residual-based method, it subtracts a constant for $m(x)$ instead of multiplies.

$$\frac{1}{n_B}\sum_{x_i \in B}\left(y_i - m(x_i)\right)$$

Put the direct estimator back in

$$\bar{y}_B = \frac{1}{n_B}\sum_{x_i \in B} y_i$$