

Varying Coefficients in R

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¹Unemployed in 27 days

May 10, 2018

A Simple Equation

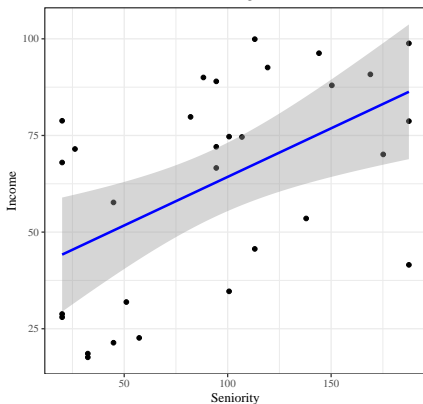
$$Y_i = f(X_i, Z_i) + \sigma(X_i, Z_i)\varepsilon_i \quad E[\varepsilon] = 0 \quad V[\varepsilon] = 1$$

- 1 Assume $Y \Leftrightarrow (X, Z)$ can be summarized by a finite number of parameters.
- 2 Assume $Y \Leftrightarrow (X, Z)$ cannot be summarized by a finite number of parameters.
- 3 Assume $Y \Leftrightarrow X$ can be summarized by a finite number of parameters but $Y \Leftrightarrow Z$ cannot.

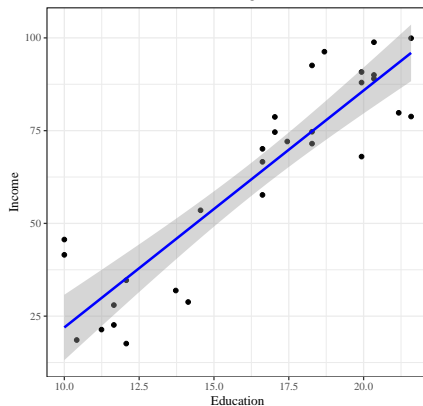
Parametric

$$Income_i = \beta_0 + \beta_1 Seniority_i + \beta_2 Education_i + \varepsilon_i$$

Univariate Regression 1



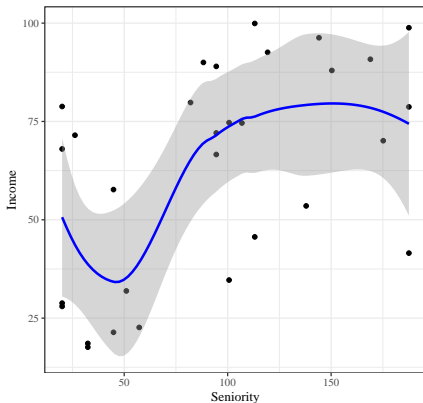
Univariate Regression 2



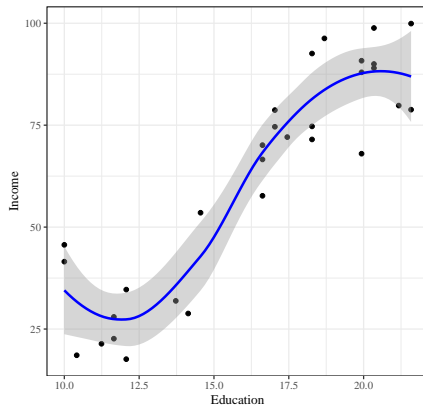
Nonparametric

$$Income_i = \beta_0 + \textcolor{red}{f}(Seniority_i, Education_i) + \varepsilon_i$$

Univariate Regression 1



Univariate NP Regression 2



Heterogeneity in the Data

In all the previous cases the impact of the explanatory variable(s) on Y is constant!

Cameron and Trivedi, Microeconometrics

As the data become more disaggregated the importance of controlling for inter-individual heterogeneity increases...ignoring persistent inter-individual differences leads to a **confounding** with other factors that are also sources of persistent inter-individual differences.

Varying Coefficient Model

$$\left. \begin{array}{l} Y_i = \beta_0 + \beta_{1i}Z_i + \varepsilon_i \\ \beta_{1i} = g(X_i) \end{array} \right\} \mapsto Y_i = \beta_0 + g(X_i)Z_i + \varepsilon_i$$

Impact of Z on Y is function of the magnitude of X

Heterogenous Marginal Returns to Experience

Card, 2001: Marginal returns to education vary over for different levels of working experience. If the income equation is expressed in linear form the returns to education could be systematically underestimated.

$$Income_i = \beta_0 + g(Seniority_i) Education_i + \varepsilon_i$$

Varying Outcome

