

Quantile Regression: An Introduction

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Abstract

There is more to econometric life than is dreamt of in the philosophies of Gaussian regression and least squares estimation.

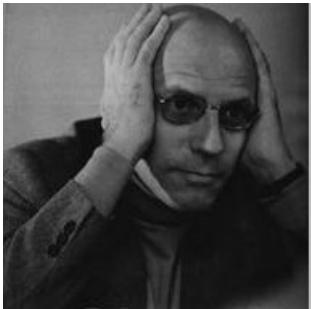
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Regression is Demeaning



'De mean is 'de meaning.



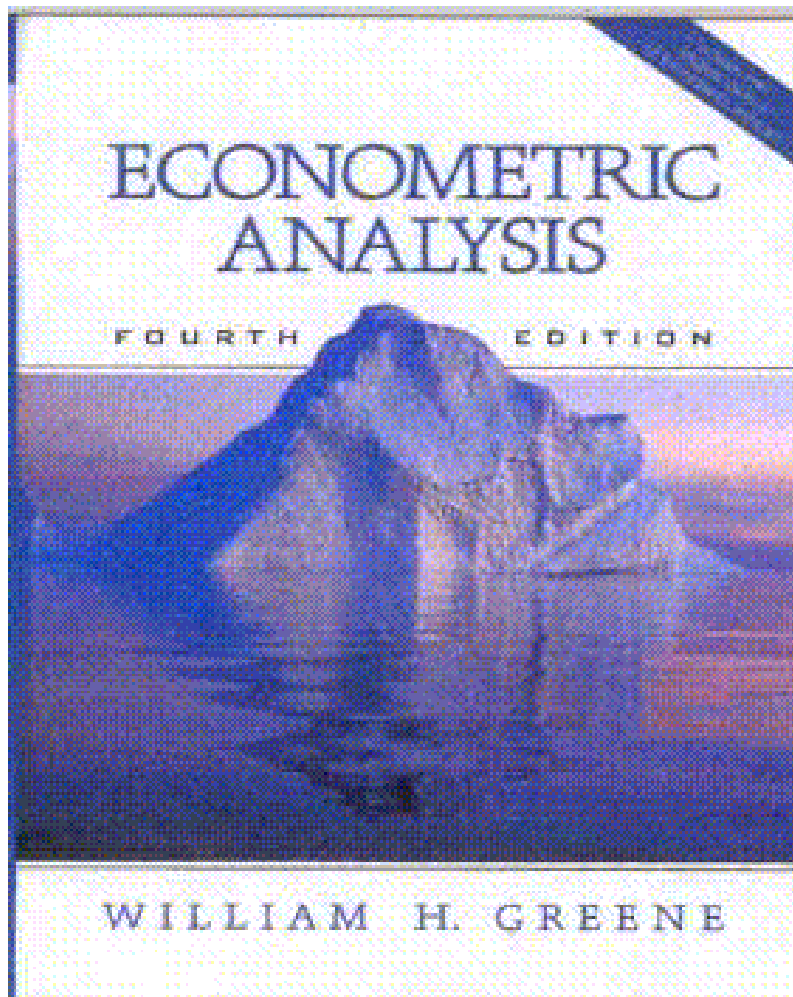
Regression is demeaning.



Regression is de-meaning

Quantile Regression

Just Enough to be Dangerous

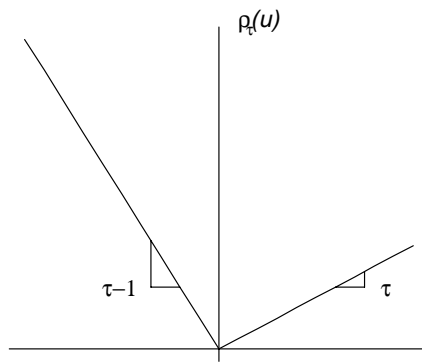


Quantile Regression

Univariate τ th Quantile

$$\hat{\alpha}(\tau) = \operatorname{argmin}_{a \in \mathfrak{R}} \sum_{i=1}^n \rho_{\tau}(y_i - a)$$

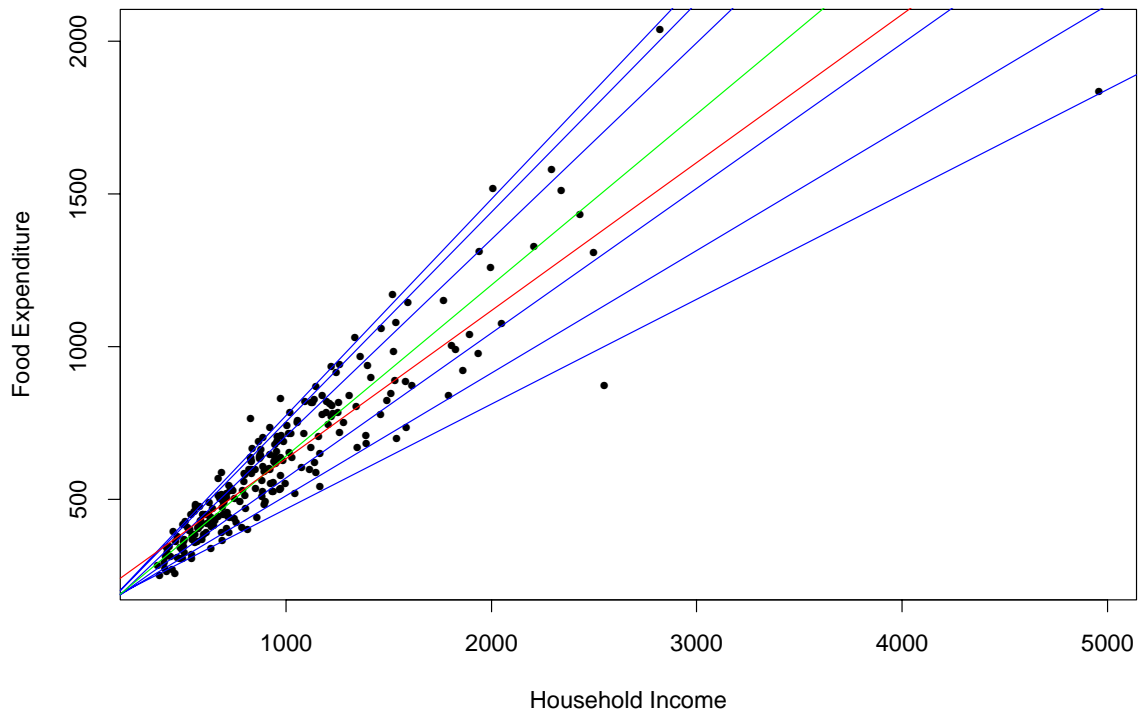
where $\rho_{\tau}(u) = (\tau - I(u < 0))u$



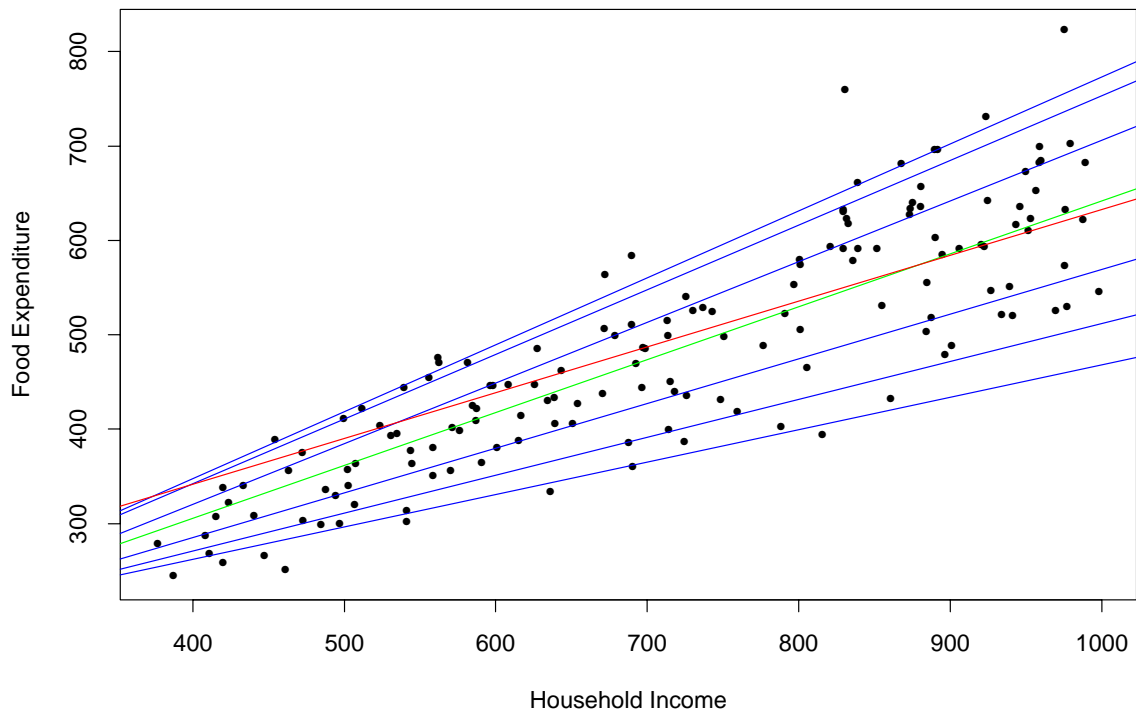
Regression τ th Quantile

$$\hat{\beta}(\tau) = \operatorname{argmin}_{b \in \mathfrak{R}^p} \sum_{i=1}^n \rho_{\tau}(y_i - x_i^{\top} b)$$

Engel's Food Expenditure Data

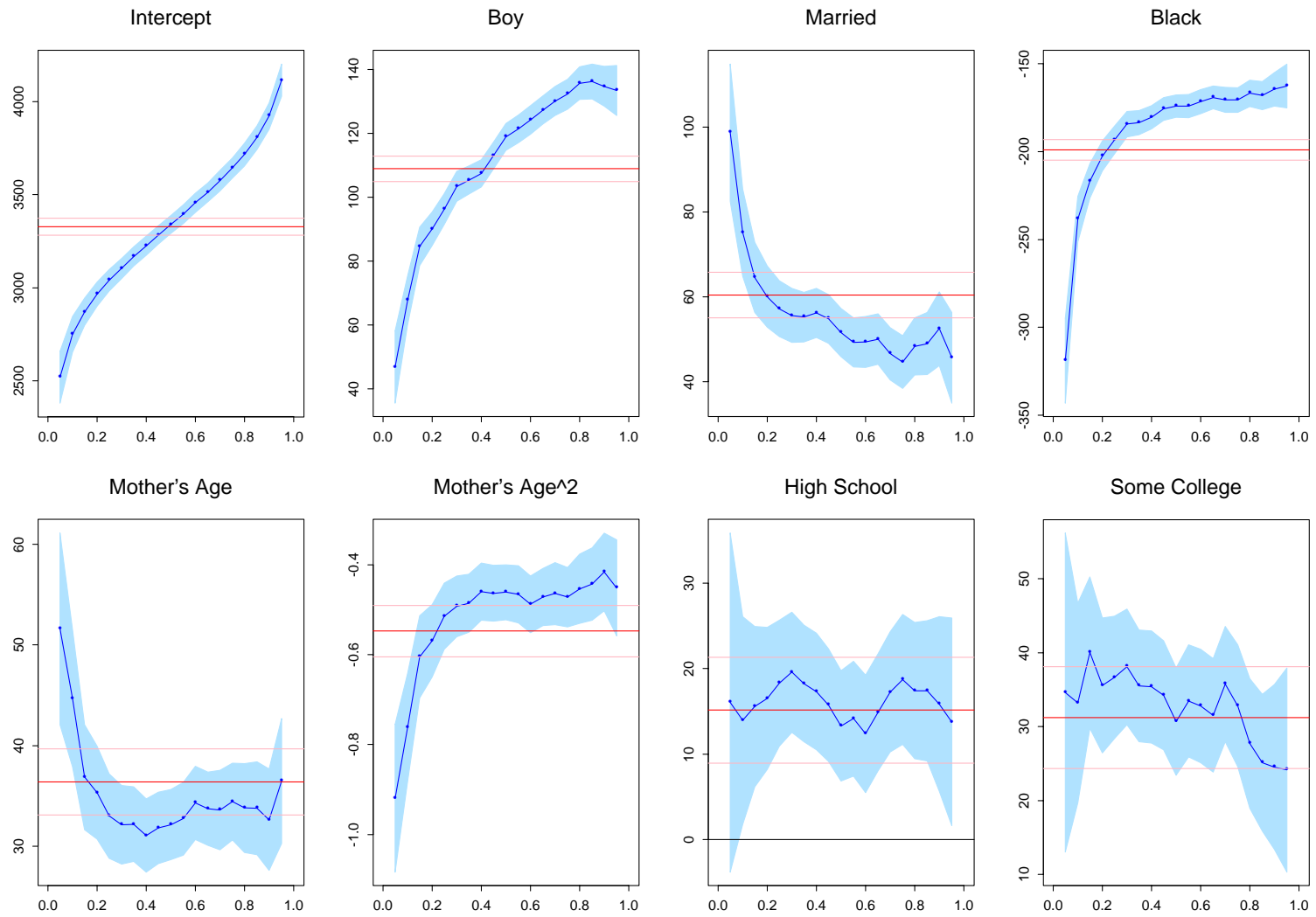


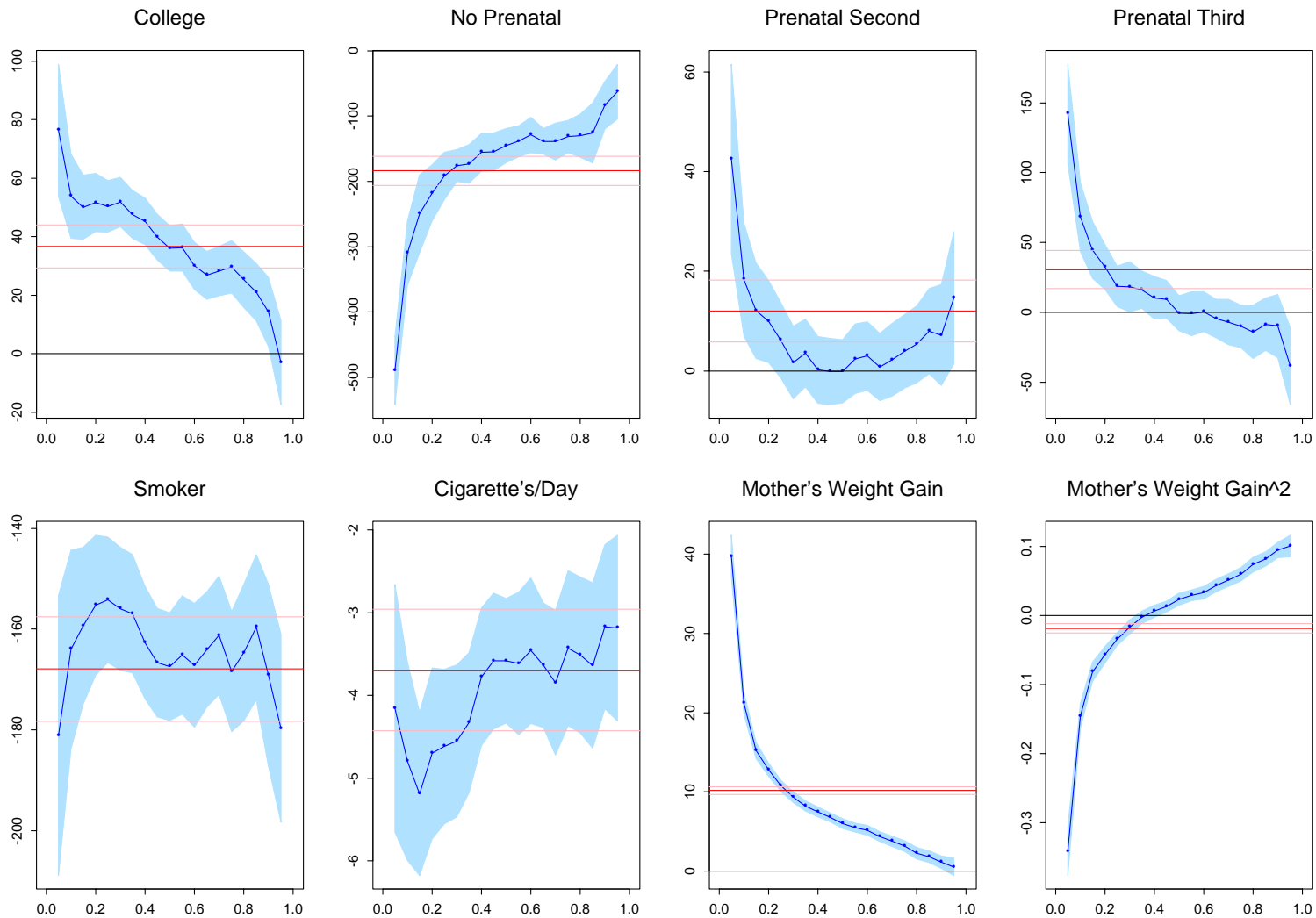
Engel's Food Expenditure Data



A Model of Infant Birthweight

- Reference: Abreveya (2001)
- Data: June, 1997, Detailed Natality Data of the US. Live, singleton births, with mother's recorded as either black or white, between 18-45, and residing in the U.S. Sample size: 198,377.
- Response: Infant Birthweight (in grams)
- Covariates:
 - Mother's Education
 - Mother's Prenatal Care
 - Mother's Smoking
 - Mother's Age
 - Mother's Weight Gain





Conclusions

- Quantile regression methods complement established mean regression (least-squares) methods.
- By focusing on local slices of the conditional distribution, they offer a useful deconstruction of conditional mean models.
- They provide a more flexible role for covariate effects allowing them to influence location, scale *and shape* of the response distribution.
- In applications a variety of unobserved heterogeneity phenomena are rendered observable.