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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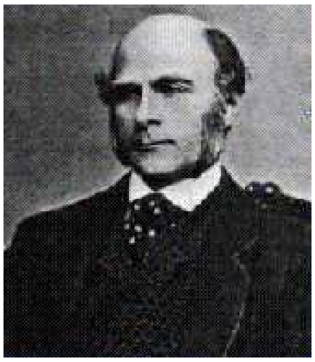
Regression is Demeaning

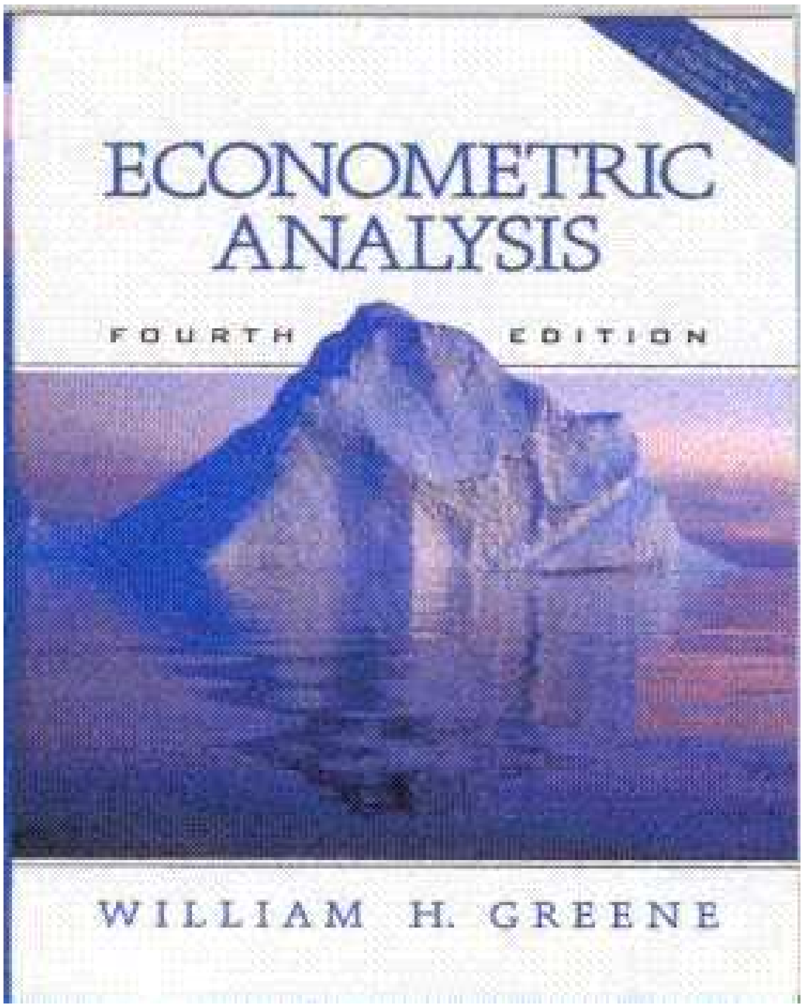
 'De mean is 'de meaning.

 Regression is demeaning.

 Regression is de-meaning

Quantile Regression

Just Enough to be Dangerous

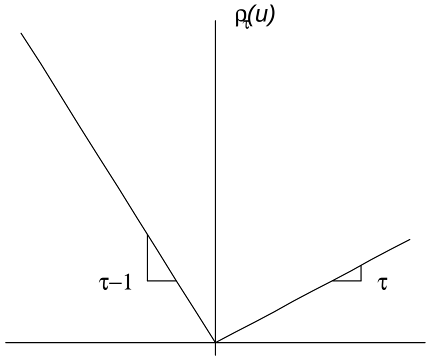


Quantile Regression

Univariate τth Quantile

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

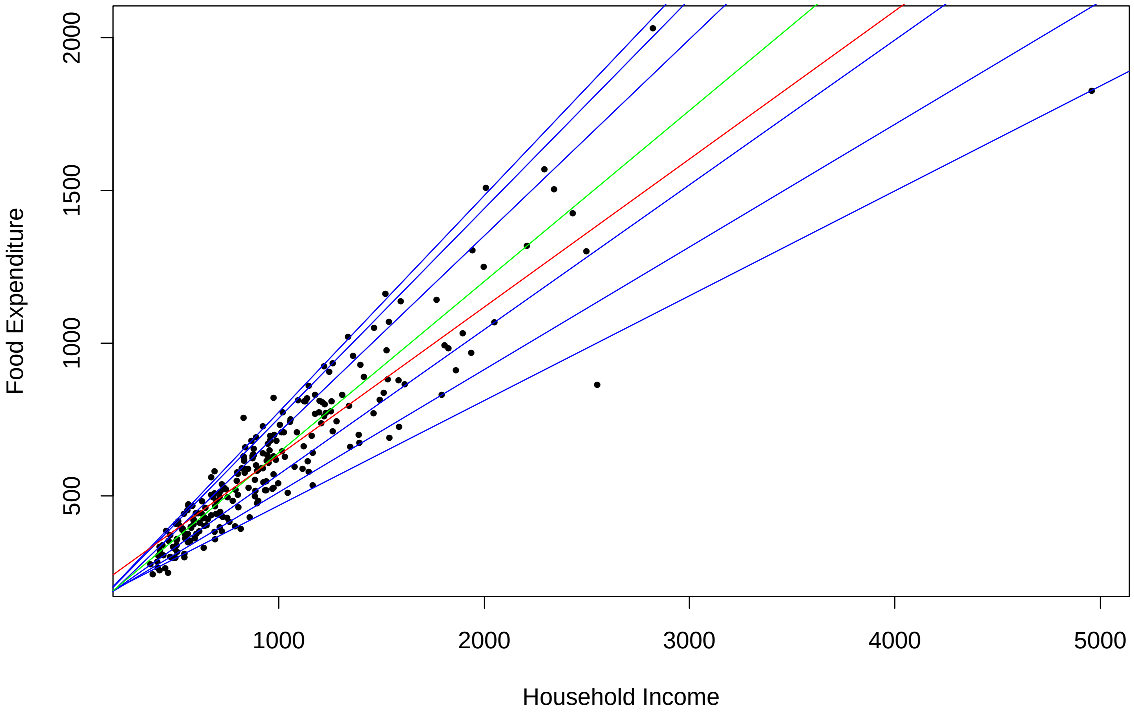
$$\text{where} \qquad \rho_\tau(u) = (\tau - I(u < 0))u$$



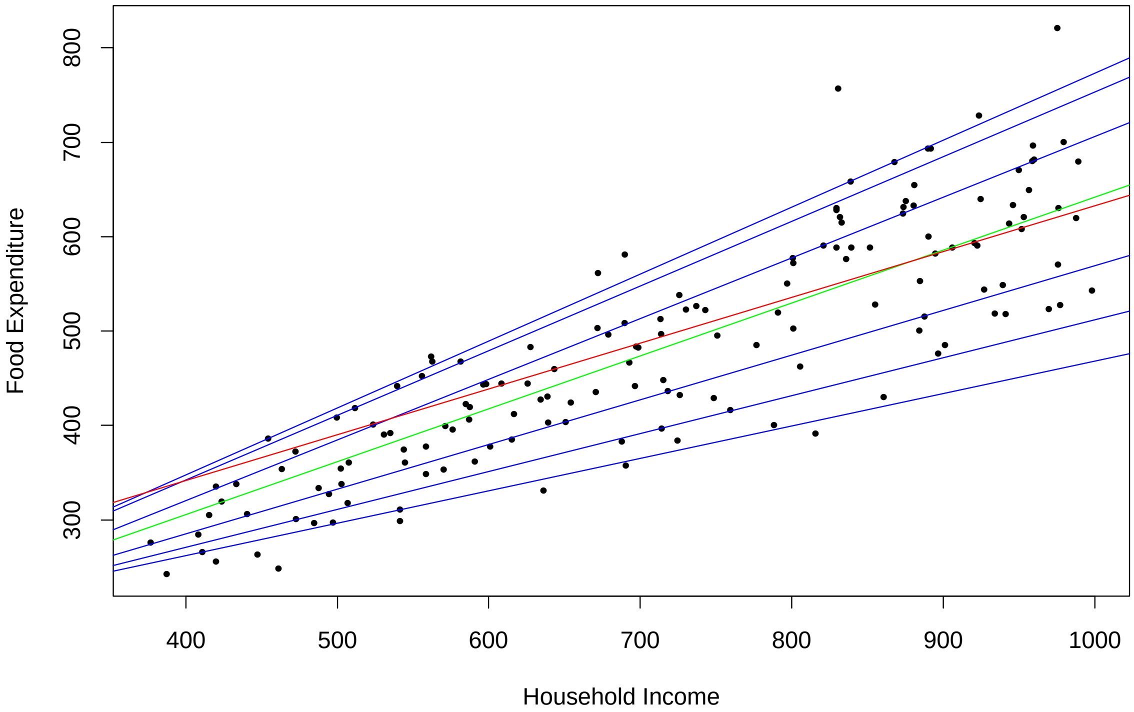
Regression τth Quantile

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

Engel's Food Expenditure Data

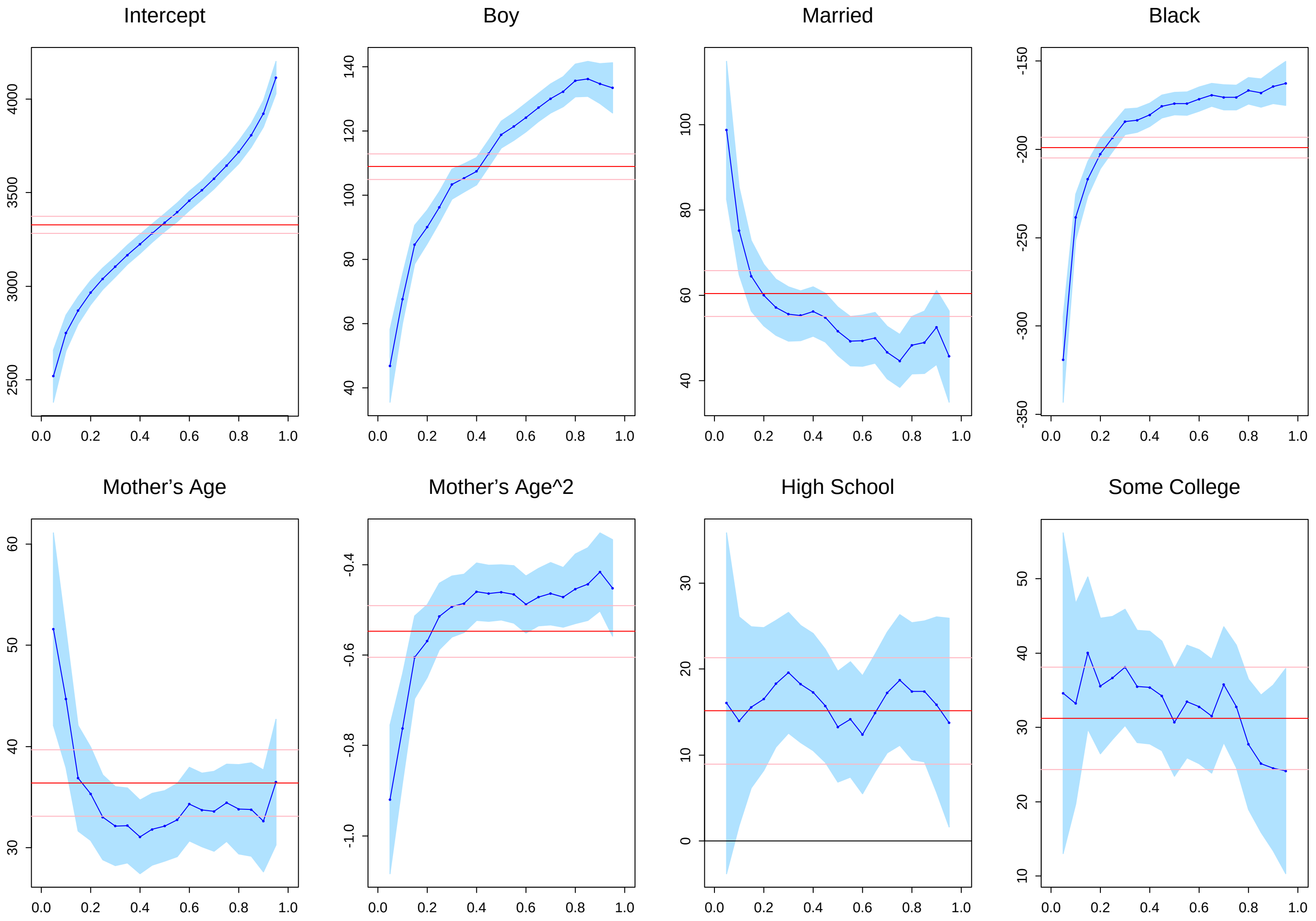


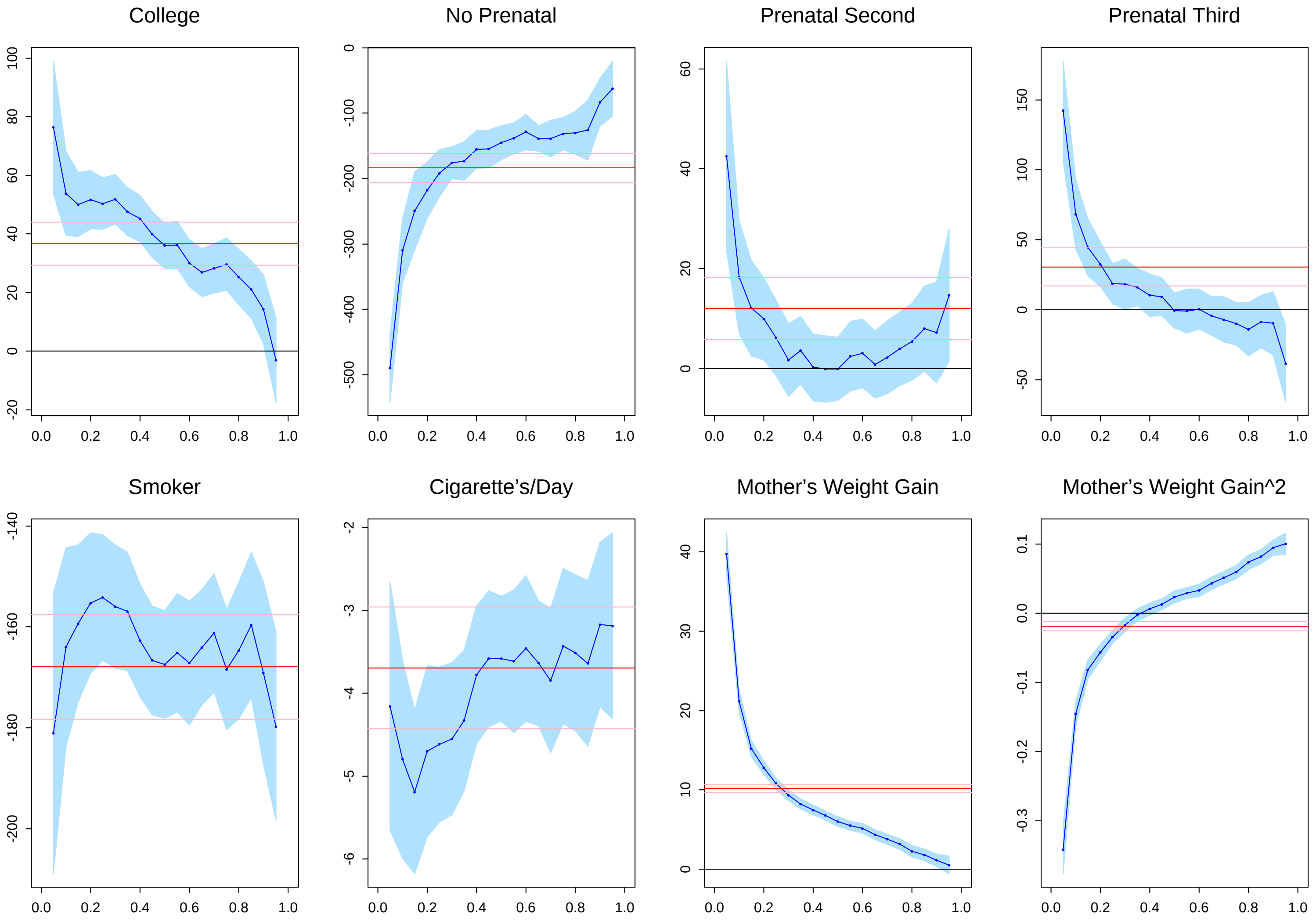
Engel's Food Expenditure Data



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


Intercept
Boy
Married
Black
Mother's Age
Mother's Age^2
High School
Some College
2500
3000
3500
4000
40
60
80
100
120
140
40
60
80
100
-350
-300
-250
-200
-150
30
40
50
60
-1.0
-0.8
-0.6
-0.4
0
10
20
30
10
20
30
40
50
0.0
0.2
0.4
0.6
0.8
1.0


College
No Prenatal
Prenatal Second
Prenatal Third
Smoker
Cigarette's/Day
Mother's Weight Gain
Mother's Weight Gain^2

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.