# Lecture 5
# The Shape of the regression function

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# The Appropriate Shape of a regression line

- The shape of a relationship may not always be linear
- For example:
  - Wages may not grow with age at the same rate for all ages
  - The Marginal propensity to consume food out of income may not be constant for all levels of income.
- We can control this by fitting more elaborate models that allow the shape to be nonlinear.
- The techniques for doing this will be taught under the multiple regression model.
- Here we will consider some examples
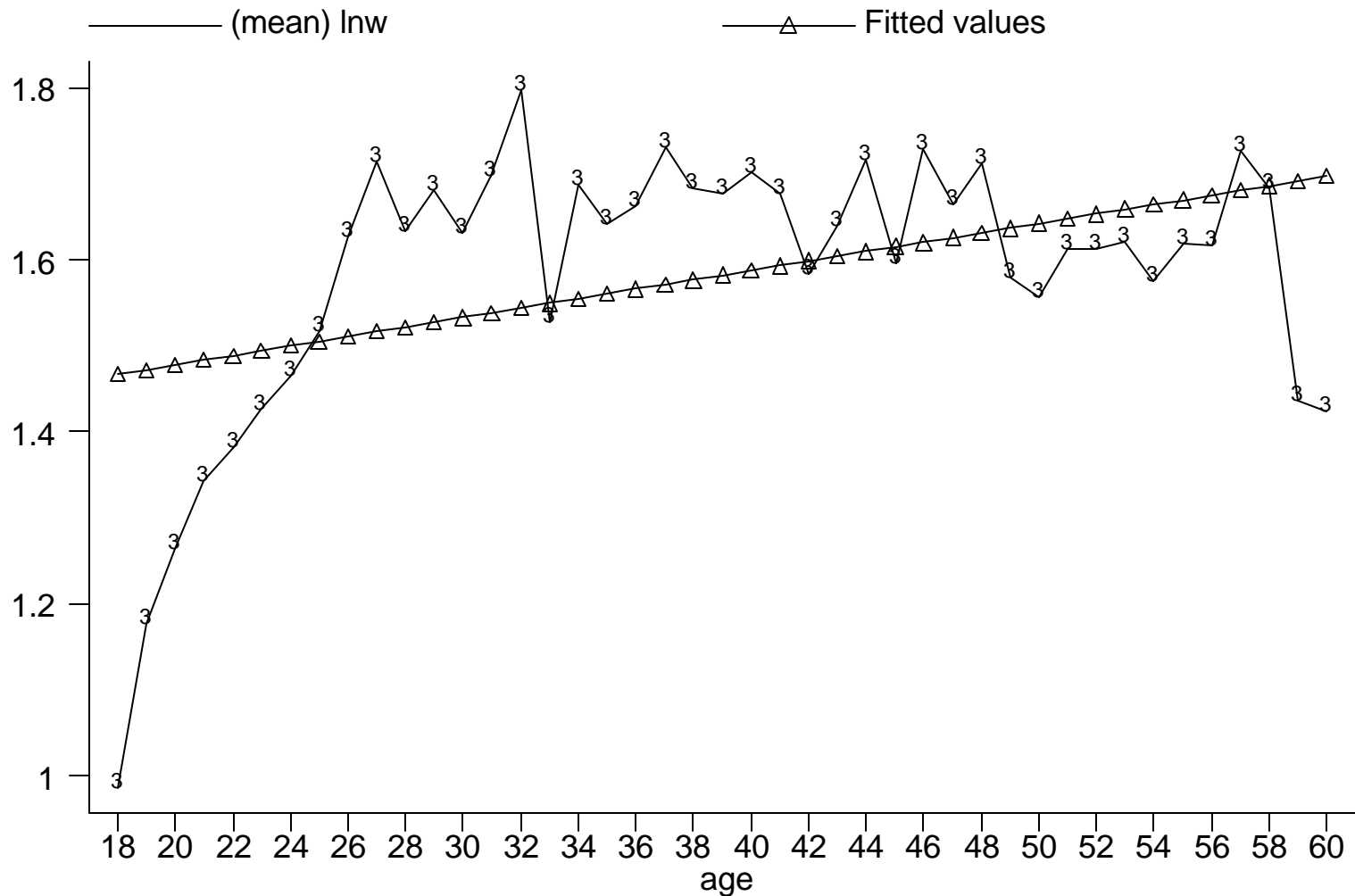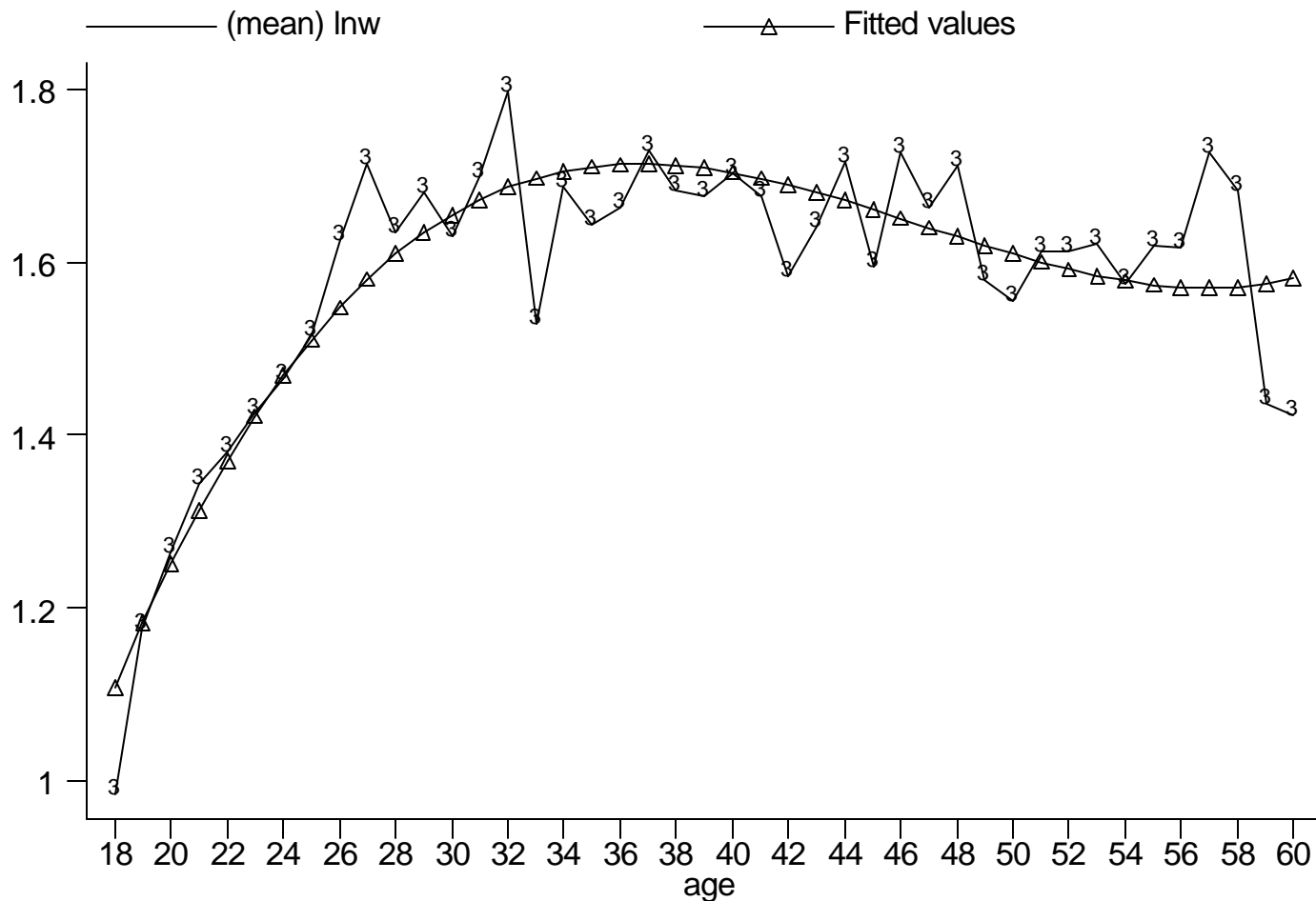
Wages and Age - UK: Linear model

$$\log(\ wage\ ) = \underset{(0.074)}{1.37} + \underset{(0.0018)}{0.0055}\ Age$$
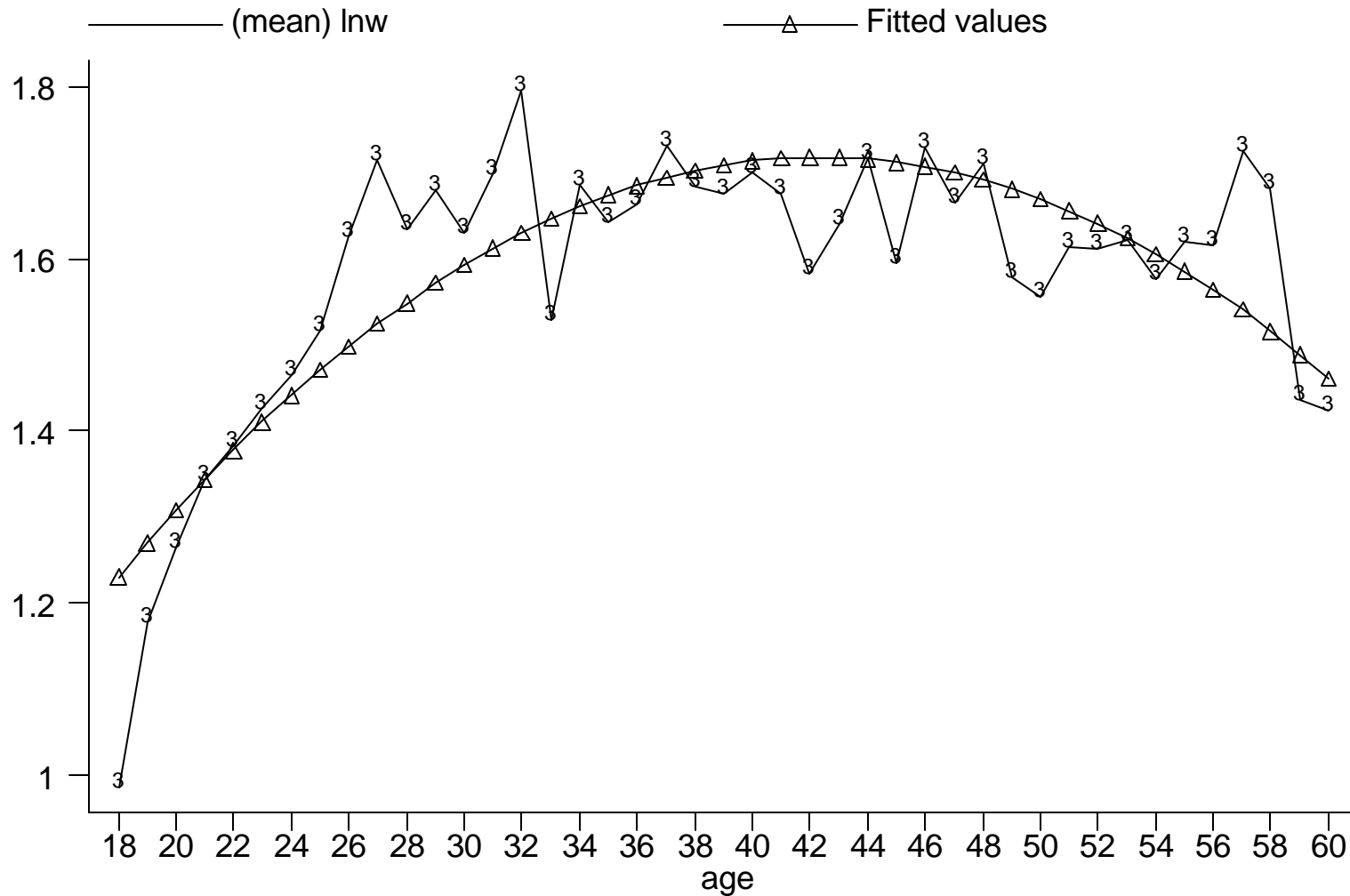
Wages and Age - UK: Quadratic model

$$\log(\ wage\ ) = \underset{(0.147)}{0.241} + \underset{(0.008)}{0.0698}\ Age\ - \underset{(0.0001)}{0.00082}\ Age^{2}$$

Wages and Age - UK: Cubic model

$$\log(wage) = \underset{(0.39)}{-1.46} + \underset{(0.033)}{0.22} Age - \underset{(0.0009)}{0.0049} Age^2 + \underset{(0.000008)}{0.000035} Age^3$$

- The basic features of the age profile is rapid wage growth for the young, flattenning out at about 40with a small decline thereafter.

- The cubic model seems to fit the data best, in that it captures tha basic features of the age profile.

- In all cases the extra coefficients attached to powers of age are all highly significant.

- Thus everything points to a **<u>rejection of the linear model</u>**

Share of Expenditure on Alcohol
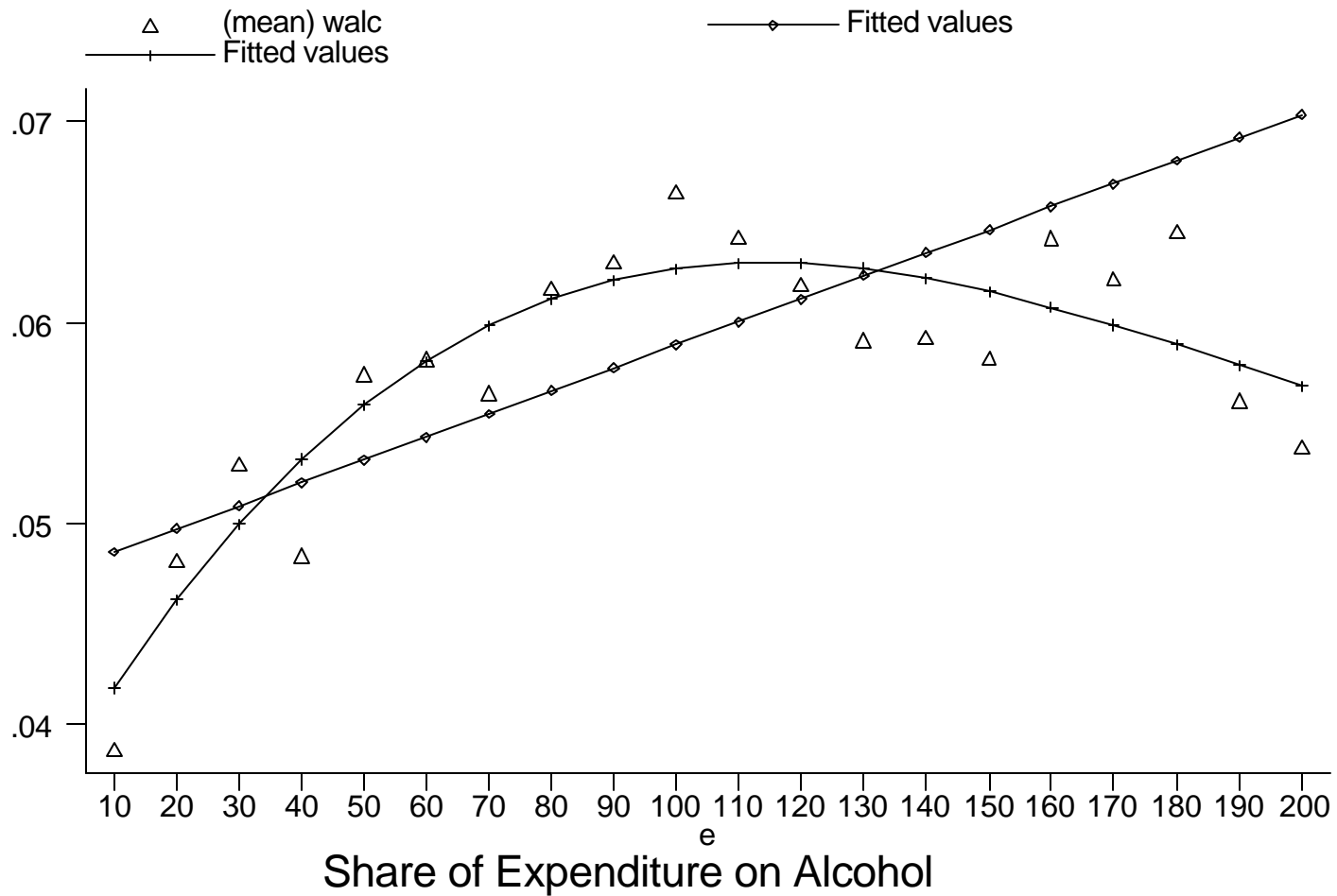
$$(Share\ of\ alcohol) = 0.037 + 0.0053\ E - (3.31e\ \text{-}\ 06)\ E^2 + (5.78e\ \text{-}\ 09)\ E^3$$
$$\phantom{(Share\ of\ alcohol) =} (0.0029) \quad (0.00013) \qquad (1.66e\ \text{-}06) \qquad\qquad (5.74e\ \text{-}09)$$

$E$ denotes total household Expenditure

# Features of the Data and results

- The share of the budget spent on Alcohol Consumption increases with the total budget
- This means that alcohol is a luxury
- The rate of increase seems to decrease with the budget
- Quadratic term is just about significant
- Cubic termis not significant

# The Sequel

- Introduce Multiple Regression Model
- Deal with issues such as ommitted variable bias
- Broaden our inference to cover many variables
- Relax some of the assumptions of the classical regression model