

Correlated Errors

- 1 Estimated regression coefficients are still unbiased, but they are no longer MLEs.

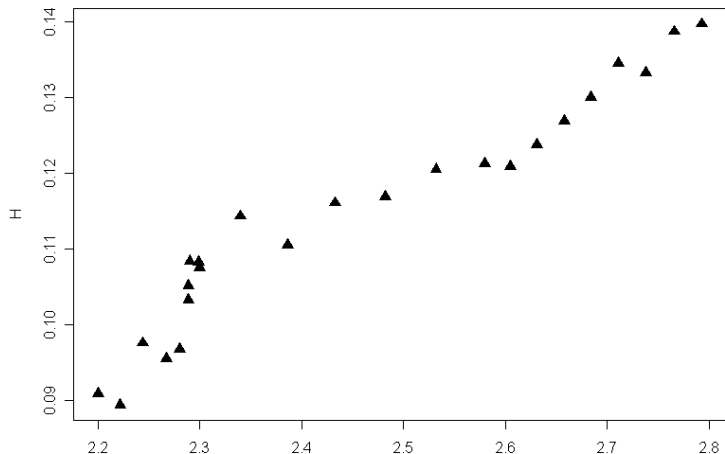
$$E[(X'X)^{-1}X'Y] = (X'X)^{-1}X'E[Y] = \beta.$$

- 2 MSE may seriously underestimated the variance of the error terms.
- 3 Standard errors are too small \rightarrow t -statistics too large \rightarrow false positives.
- 4 Confidence intervals not large enough.

Housing Starts

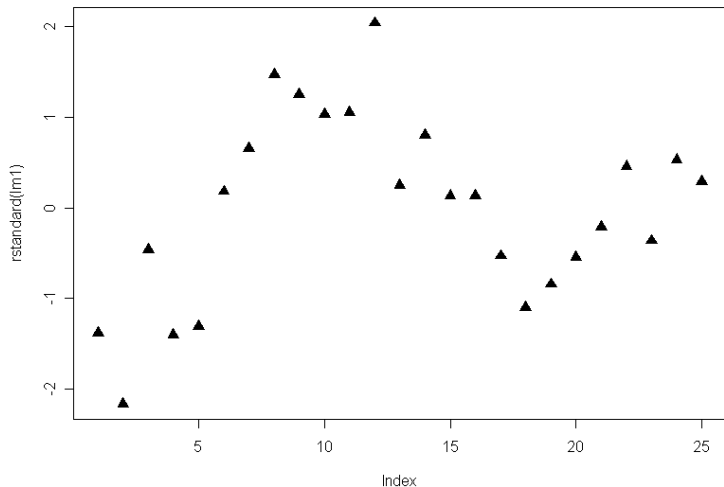
H_t : housing starts (millions). P_t Size of the 22 to 44 year population group (millions).

$$H_t = \beta_0 + \beta_1 P_t + \epsilon_t$$



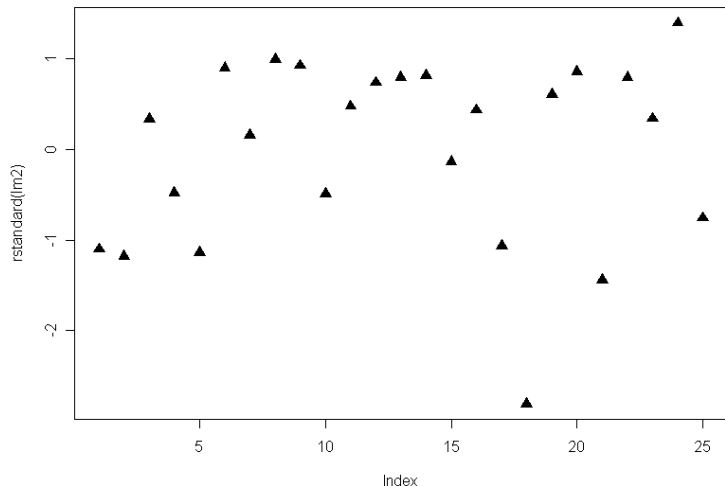
Housing Starts

Standard residuals from ordinary least squares.



Housing Starts

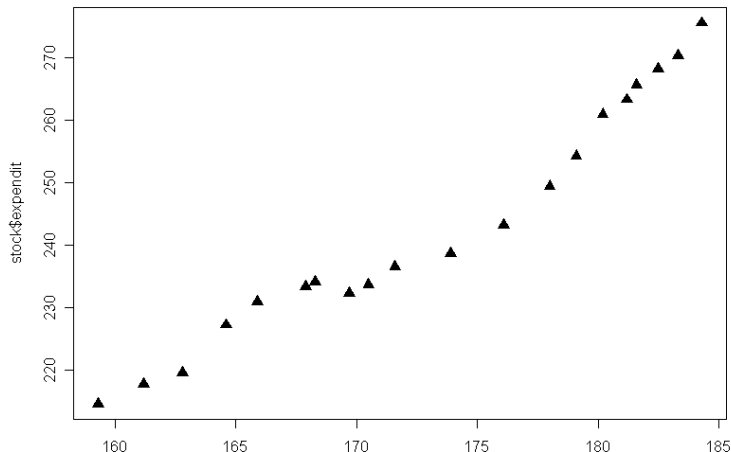
Standard residuals after including mortgage availability index.



Consumer Expenditure

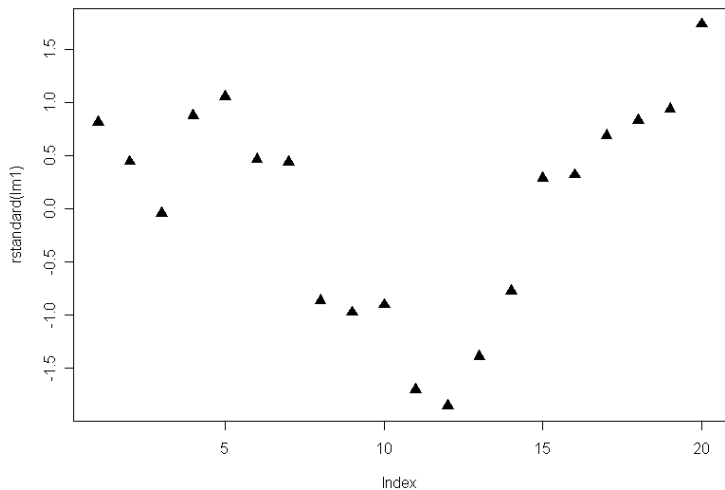
How does consumer expenditure depend on the price of money?

Y is the consumer expenditure, X is the stock of money, both in billions of current dollars for the United States.



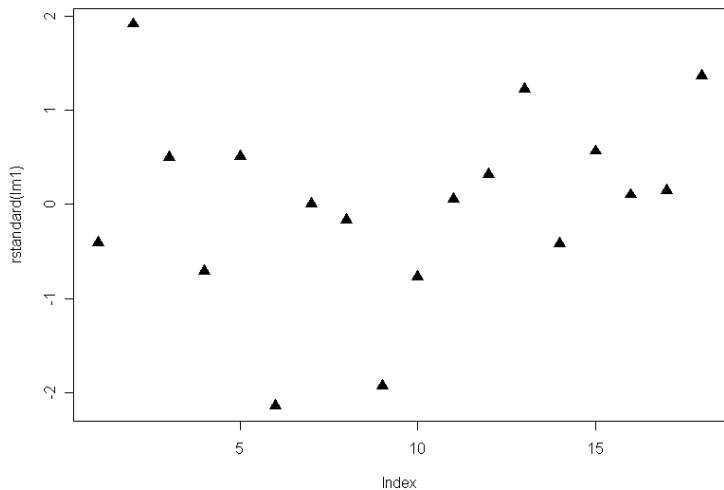
Consumer Expenditure

Standardized residuals from ordinary least squares:



Consumer Expenditure

After Cochran Orcutt procedure:



Summary

- The simplest kind of correlation in the errors is autocorrelation. Often, it works as a first approximation.
- The Durbin Watson Test can be used to detect autocorrelation.
- Sometimes, autocorrelation is caused by a seasonal variable being missing from the model (e.g. Housing Starts data).
- When autocorrelation can not be removed from the data, the Cochran-Orcutt procedure can be used to correct for it.