Financial Econometrics
Shanghai Jiao Tong University
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Empirical Exercise 16.2

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Reference: Stock, J.H. and Watson, M.W., Introduction to Econometrics (4th Edition, Global Edition)

Data: `us_macro_quarterly.csv`*. Real GDP is the column* `GDPC1`*; compute* $GDPGR_t = 400\,[\ln(GDP_t) - \ln(GDP_{t-1})]$*. Sample: 1960:Q1–2012:Q4.*

Empirical Exercise 16.2. The data file `us_macro_quarterly.csv` contains quarterly data on US real GDP. Real GDP is the column `GDPC1`. Construct the quarterly growth rate of GDP at an annual rate,

$$GDPGR_t = 400\left[\ln(GDP_t) - \ln(GDP_{t-1})\right],$$

where GDP_t denotes real GDP in quarter t. The factor of 400 converts the quarterly log change into an annualised percentage growth rate.

(a) Using data on $\texttt{GDPGR}_t$ from 1960:Q1 to 2012:Q4, estimate an AR(2) model for the growth rate of GDP with GARCH(1,1) errors. Report the estimated conditional mean equation and the estimated conditional variance equation.

(b) Plot the residuals from the AR(2) model together with $\pm\hat{\sigma}_t$ bands, where $\hat{\sigma}_t$ is the conditional standard deviation implied by the estimated GARCH(1,1) model, in the manner of Figure 16.4 in the text.

(c) Some macroeconomists have claimed that there was a sharp drop in the variability of the growth rate of GDP around 1983, which they call the *Great Moderation*. Is this Great Moderation evident in the plot that you formed in part (b)?

*Calculations performed in Stata (**arch** command) and cross-checked in Python (**arch** package).*