

FINANCIAL ECONOMETRICS
SHANGHAI JIAO TONG UNIVERSITY
SUMMER SCHOOL 2026
EMPIRICAL EXERCISE 14.1

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

*Data: `us_macro_quarterly.csv` (1955:Q1–2017:Q4). SEW’s price index *PCEP* is the column *PCECTPI*. Use the sample period 1963:Q1–2012:Q4 (earlier data may serve as initial values for lags).*

Empirical Exercise 14.1. The data file `us_macro_quarterly.csv` contains quarterly data on several macroeconomic series for the United States over 1955:Q1–2017:Q4. The variable *PCEP* (stored in the column *PCECTPI*) is the price index for personal consumption expenditures from the U.S. National Income and Product Accounts. In this exercise you will construct forecasting models for the rate of inflation, based on *PCEP*. For this analysis, use the sample period 1963:Q1–2012:Q4 (where data before 1963 may be used, as necessary, as initial values for lags in regressions).

- (a) (i) Compute the inflation rate, $Infl_t = 400 [\ln(PCEP_t) - \ln(PCEP_{t-1})]$. What are the units of $Infl$? (Is $Infl$ measured in dollars, percentage points, percentage per quarter, percentage per year, or something else? Explain.)
- (ii) Plot the value of $Infl$ from 1963:Q1 through 2012:Q4. Based on the plot, do you think that $Infl$ has a stochastic trend? Explain.
- (b) (i) Compute the first four autocorrelations of $\Delta Infl$.
- (ii) Plot the value of $\Delta Infl$ from 1963:Q1 through 2012:Q4. The plot should look “choppy” or “jagged”. Explain why this behaviour is consistent with the first autocorrelation that you computed in part (i).

- (c) (i) Run an OLS regression of $\Delta Infl_t$ on $\Delta Infl_{t-1}$. Does knowing the change in inflation this quarter help predict the change in inflation next quarter? Explain.
- (ii) Estimate an AR(2) model for $\Delta Infl$. Is the AR(2) model better than an AR(1) model? Explain.
- (iii) Estimate an AR(p) model for $p = 0, \dots, 8$. What lag length is chosen by BIC? What lag length is chosen by AIC?
- (iv) Use the AR(2) model to predict the change in inflation from 2012:Q4 to 2013:Q1, that is, predict the value of $\Delta Infl_{2013:Q1}$.
- (v) Use the AR(2) model to predict the level of the inflation rate in 2013:Q1, that is, $Infl_{2013:Q1}$.
- (d) (i) Use the ADF test for the regression in Equation (14.31) with two lags of $\Delta Infl$ to test for a stochastic trend in $Infl$.
- (ii) Is the ADF test based on Equation (14.31) preferred to the test based on Equation (14.32) for testing for a stochastic trend in $Infl$? Explain.
- (iii) In (i) you used two lags of $\Delta Infl$. Should you use more lags? Fewer lags? Explain.
- (iv) Based on the test you carried out in (i), does the AR model for $Infl$ contain a unit root? Explain carefully. (Hint: does the failure to reject a null hypothesis mean that the null hypothesis is true?)
- (e) Use the QLR test with 15% trimming to test the stability of the coefficients in the AR(2) model for $\Delta Infl$. Is the AR(2) model stable? Explain.
- (f) (i) Using the AR(2) model for $\Delta Infl$ with a sample period that begins in 1963:Q1, compute pseudo out-of-sample forecasts for the change in inflation beginning in 2003:Q1 and going through 2012:Q4 (that is, compute $\Delta Infl_{2003:Q1 | 2002:Q4}$, $\Delta Infl_{2003:Q2 | 2003:Q1}$, $\dots$, $\Delta Infl_{2012:Q4 | 2012:Q3}$).
- (ii) Are the pseudo out-of-sample forecasts biased? That is, do the forecast errors have a nonzero mean?
- (iii) How large is the RMSFE of the pseudo out-of-sample forecasts? Is this consistent with the AR(2) model for $\Delta Infl$ estimated over the 1963:Q1–2002:Q4 sample period?
- (iv) There is a large outlier in 2008:Q4. Why did inflation fall so much in 2008:Q4? (Hint: collect some data on oil prices. What happened to oil prices during 2008?)

Calculations performed using Stata. See accompanying E14_1_solution.do file.