Econ 210C Final

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Due: 6/6/2022, 8:00PM PST, on Canvas. Upload your code packet on Canvas.

0. General Instructions

- The final is open book, open notes, open internet.
- You are not allowed to communicate with anyone about the midterm. You are not allowed to share code or answers.
- Some questions are hard! If you cannot figure out the exact answer to one part, continue with what you have.
- For several questions I impose length limits ("Max X sentences"). This is for your benefit so you do not spend too much time writing a long answer.
  - We will penalize lengthy answers that try to "fish" for the solution.
- You will be asked to download data from FRED. You should do a test run of your preferred software (Stata, Python, R, etc) before the final.
- You will need to submit the following deliverables on Canvas:
  1. A pdf document with your answers and figures.
  2. A zip file with your code.
     - The base directory of the code packet needs to contain "main" files that create all your figures with on click (e.g., main.do for Stata, main.m for Matlab).
     - We must be able to execute those main files on our computers without error messages.
       - To make sure it works on our computers you should **avoid absolute paths** such as C:/Myfiles/Mydata.xls. Import and save any data using relative paths such as Data/mydata.xls.
       - We will grade on whether the results are reproducible by us.
- To ensure fairness, the final is due at 8pm sharp! Late submissions will be graded out (100 - X)% where X solves the following formula:

$$X = (\exp(\text{minutes late}/100) - 1) * 100$$

1. Data Analysis

(a) Download data for the Federal Funds rate (FEDFUNDS), the unemployment rate (UNRATE), the CPI index (CPIAUCSL) from FRED.

- The frequency should be monthly.
- Your code should pull these data automatically from the FRED server.
  - Stata: "freduse" or (if you have a fred key) "import fred". You may have to run "ssc install freduse".
  - Python: use the module "pandas_datareader.data"

(b) Get the Federal Reserve Greenbook (Tealbook) inflation forecasts using the link in the Canvas Final assignment.

- Alternatively, download Federal Reserve Greenbook (Tealbook) inflation forecasts from https://johanneswieland.github.io/Teaching/inflationforecasts.csv

(c) Merge the two datasets together.

(d) Transform the CPI into a 12-month growth rate (CPI inflation).

(e) Keep only data from January 1970 to December 2007. Discard all other time periods.

(f) Plot each time series from January 1970 to December 2007. You should have no missing observations!

1. Federal Funds rate
2. Civilian unemployment rate
3. CPI inflation rate annualized
4. Federal Reserve Inflation Forecast

- Make sure all graphs are appropriately labelled.

(g) Estimate a three-variable VAR with your inflation series (π_t), your unemployment series (u_t) and your Federal Funds series (i_t). Your VAR should have 12 lags.

Apply a Cholesky Decomposition with the ordering π_t, u_t, i_t.

Then plot the IRFs for a shock to the interest rate equation. Your IRFs should have a horizon going from 0 to 36 months.

(h) To what extent do your IRFs show the expected patterns following an exogenous rise in interest rates: a decline in inflation and a temporary increase in unemployment?

(i) Same as part (g) but now we estimate a four-variable VAR. The ordering is π_t, u_t, z_t, i_t, where z_t is the Federal Reserve inflation forecast.

Plot the IRFs for shock to the interest rate equation from this VAR

(j) Briefly, describe how the IRFs from the 3-variable VAR and the 4-variable VAR are different.

(k) Can you provide an explanation for thesse differences? (Hint: what do you think is the inflation forecasts are capturing?)

(l) Explain why or why not we should order the inflation forecast before the nominal interest rate.

2. Model Simulation: Cost Push Shocks and the Phillips Curve Slope

Consider the new Keynesian model

$$\hat{y}_t = E_t\hat{y}_{t+1} - E_t(\hat{i}_t - \hat{\pi}_{t+1}) \tag{1}$$
$$\hat{\pi}_t = \beta E_t\hat{\pi}_{t+1} + \kappa(\hat{y}_t - \hat{y}_t^{flex}) \tag{2}$$
$$\hat{i}_t = \phi_\pi\hat{\pi}_t, \qquad \phi_\pi > 1 \tag{3}$$
$$\hat{y}_t^{flex} = -\alpha\hat{\mu}_t^W \tag{4}$$
$$\hat{y}_t^{eff} = 0 \tag{5}$$
$$\hat{\mu}_t^W = \rho_\mu\mu_{t-1}^W + \epsilon^\mu, \qquad \epsilon^\mu \sim N(0, \sigma_\mu^2) \tag{6}$$

where $\hat{\mu}_t^W$ is an inefficient mark-up shock in the FOC for labor supply:

$$\frac{W_t}{P_t} = \mu_t^W \frac{\chi N_t^\varphi}{C_t^{-\gamma}}$$

(a) Interpret each of the equations (1)-(5) (max 2 sentence each).

(b) Using either Dynare or the method of undetermined coefficients, plot IRFs for the following variables to a $\hat{\mu}_t^W$ shock (Suggested horizon is 40.):

- $\hat{\mu}_t^W$
- $\hat{y}_t$
- $\hat{y}_t - \hat{y}_t^{flex}$
- $\hat{\pi}_t$
- $\hat{i}_t$
- $\hat{r}_t = \hat{i}_t - E_t\hat{\pi}_{t+1}$

Use the following parameters:

$$\beta = 0.99, \kappa = 0.025, \phi_\pi = 1.5, \alpha = 1, \rho_\mu = 0.9, \sigma_\mu = 0.01.$$

(c) Explain intuitively how an inefficient mark-up shock affects output, the output gap, inflation, the nominal interest rate, and the real interest rate. (5 sentences should suffice.)

(d) Now set $\kappa = 1$ with all other parameters unchanged. Construct a new set of plots with the IRFs for $\kappa = 0.025$ and $\kappa = 1$ for each of the variables above.

(e) Explain intuitively how the slope of the Phillips curve affects the transmission of the mark-up shock.

(f) Use $\kappa = 0.025$ again. Simulate a time series for $\hat{\mu}_t^W$. Using that time series construct a time series of length 1000 for $\hat{\pi}_t$, $\mathbb{E}_t\hat{\pi}_{t+1}$, and $\hat{y}_t$. Plot each time series.

- Hint 1: from the method of undetermined coefficients you know that all variables are equal to a constant times $\hat{\mu}_t^W$. Hint 2: $\mathbb{E}_t\hat{\pi}_{t+1} = \rho_u\hat{\pi}_t$

- You should have four plots.

(g) Using your time series estimate the following regression by OLS and report your estimate for γ_1:

$$\hat{\pi}_t = \gamma_0 \mathbb{E}_t \hat{\pi}_{t+1} + \gamma_1 \hat{y}_t + \eta_t$$

(h) Explain why γ_1 does not equal κ.

(i) Suggest one procedure for identifying κ from the data. (Max 5 sentences.)

(j) State **one** reason why the central bank cares about knowing the true value of κ. (Max 2 sentences)