Econ 210C Final

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Due: 6/14/2023, 8:30PM 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. Model Simulation: Monetary Policy in the New Keynesian Model

Consider the new Keynesian model

$$\hat{y}_t = E_t\hat{y}_{t+1} - E_t(\hat{i}_t - \hat{\pi}_{t+1}) \tag{1}$$
$$\hat{\pi}_t = \beta E_t\hat{\pi}_{t+1} + \kappa\hat{y}_t + u_t \tag{2}$$
$$\hat{i}_t = \phi_\pi\hat{\pi}_t + \bar{i}_t, \qquad \phi_\pi > 1 \tag{3}$$
$$u_t = \rho_r u^n_{t-1} + \epsilon^u_t, \qquad \epsilon^u_t \sim N(0, \sigma_u^2) \tag{4}$$
$$\bar{i}_t = \rho_i\bar{i}_{t-1} + \epsilon^i_t, \qquad \epsilon^i_t \sim N(0, \sigma_i^2) \tag{5}$$

where $\bar{i}_t$ is an exogenous monetary policy shock and u_t is a cost-push shock.

(a) Using either Dynare or the method of undetermined coefficients, plot IRFs for the following variables to a ϵ^u_t shock to a ϵ^i_t shock:

- $\bar{i}_t$
- u_t
- $\hat{y}_t$
- $\hat{\pi}_t$
- $\hat{i}_t$
- $\hat{r}_t = \hat{i}_t - E_t\hat{\pi}_{t+1}$

Use the following parameters:

$$\beta = 0.99, \kappa = 0.025, \phi_\pi = 1.5, \rho_u = \rho_i = 0.8, \sigma_u = 0.001, \sigma_i = 0.01.$$

The suggested horizon is 40 quarters.

(b) Explain intuitively how a cost-push shock affects output, inflation, the nominal interest rate, and the real interest rate. (5 sentences should suffice.)

(c) Explain intuitively how a monetary policy shock affects output, the output gap, inflation, the nominal interest rate, and the real interest rate. (5 sentences should suffice.)

(d) Simulate a time series of length 10000 for $u_t, \bar{i}_t$. Using that time series construct a time series of length 10000 for $\hat{i}_t$, $\hat{y}_t$ and $\hat{\pi}_t$. Plot each of the five time series.

- Hint: from the method of undetermined coefficients you know that all variables are equal to a constant times $\bar{i}_t$ plus a constant times u_t.

(e) Our goal is to recover the monetary policy shocks $\bar{i}_t$. Using your time series estimate the following regression by OLS and report your estimate for γ:

$$\hat{i}_t = \gamma\hat{\pi}_t + \eta_t$$

Save the residuals $\hat{\eta}_t$ from this regression.

(f) Explain why γ does not equal ϕ_π. (Max 5 sentences)

(g) Report the correlation coefficient of $\hat{\eta}_t$ with $\bar{i}_t$.

(h) Then use your residuals from part (e) regress

$$\hat{y}_t = \delta \hat{\eta}_t + \nu_t$$

and report your estimate for δ.

(i) Explain why δ differs from the model IRFs for a monetary policy shock. (Max 5 sentences)

(j) What data do you need to identify ϕ_π and $\bar{i}_t$ in the model? Explain your answer. (Max 5 sentences)

(k) Implement your proposed approach and show that it correctly recovers ϕ_π in the model.

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

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

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

1. Federal Funds rate (i_t)
2. Civilian unemployment rate (u_t)
3. CPI inflation rate annualized (π_t)

- Make sure all graphs are appropriately labelled.

(e) Estimate the following interest rate rule via OLS:

$$i_t = \alpha + \sum_{k=1}^{12} \beta_k i_{t-k} + \sum_{k=0}^{12} \gamma_k \pi_{t-k} + \sum_{k=0}^{12} \delta_k u_{t-k} + \eta_t$$

Report your coefficient estimates and plot the residuals from this regression.

(f) Use the residuals $\hat{\eta}_t$ to estimate

$$u_t = \kappa + \sum_{s=1}^{12} \zeta_s u_{t-s} + \sum_{s=0}^{12} \xi_s \hat{\eta}_{t-s} + \nu_t$$

Plot the IRF from this estimation equation.

(g) Briefly, describe the identification problems in parts (e) and (f).

(h) Romer and Romer (2004) use the Federal Reserve Boards internal forecasts ("Greenbook") to control for the endogenous component of monetary policy:

$$\Delta i_m = \alpha + \beta i_m + \sum_{i=-1}^{2} \gamma_i \tilde{\Delta y}_{mi} + \sum_{i=-1}^{2} \lambda_i (\tilde{\Delta y}_{mi} - \tilde{\Delta y}_{m-1,i})$$
$$+ \sum_{i=-1}^{2} \varphi_i \tilde{\pi}_{mi} + \sum_{i=-1}^{2} \theta_i (\tilde{\pi}_{mi} - \tilde{\pi}_{m-1,i}) + \rho \tilde{u}_{m0} + \epsilon_m$$

where m indexes the meeting. They then regress outcome variables on the residuals $\hat{\epsilon}$ aggregated to a monthly frequency:

$$y_t = \kappa + \sum_{s=1}^{12} \zeta_s y_{t-s} + \sum_{s=1}^{12} \xi_s \hat{\epsilon}_{t-s} + \nu_t$$

Under what assumptions does the Romer and Romer (2004) approach address the identification problems in parts (e) and (f)? (max 5 sentences)

(i) Argue whether or not these assumptions are satisfied in practice. (max 10 sentences)