ECON 4490 T12
Fall 2023
Final Quiz

1. **Revisiting the dynamic effects of monetary policy on economic activity**

   This empirical analysis draws on the monetary model of Christiano, Eichenbaum, and Evans(1999) for the US economy. You will use data from the (Excel) file entitled 'US CEE1999 data.xlsx' (in the Supplementary folder), which contains aggregate and monetary variables from the U.S. at monthly frequency for the period 1959m1:2023m9. You will use this data to estimate how the U.S. economy responds to a *contractionary* monetary policy shock, and a surprise increase in oil prices.

   Your task is to estimate the impulse response of key aggregate variables to a monetary policy shock and an oil price shock, using an identified vector autoregression (VAR).

   The variables to be used in the VAR are: Employment ($EMPL$) as indicator of real activity and measured in thousands of workers, the Consumer Price Index (CPI), the federal funds rate ($FEDFUNDS$) measured in percent, Spot price of crude ($Poil$) measured in dollars per barrel, Non-Borrowed Reserves (NBR) measured in millions of dollars, total reserves (MB) measured in billions of dollars, and the M2 money stock (M2) measured in billions of dollars. *Hint:* You will have to scale all these variables, except the interest rate and oil prices, to unit scale, then log these variables, and finally multiply them by 100, in order to interpret the changes as percentages. In addition you will need to convert (nominal) oil prices to real oil prices using the CPI price index.

   Identification: Let X_t denote the 7x1 vector of variables included in the analysis. We will partition X_t as follows:

   $$X_t = [X_{1t}, R_t, X_{2t}]'.$$

   The vector X_{1t} is composed of the variables whose time t values are assumed not to respond contemporaneously to a monetary policy shock. The vector X_{2t} consists of the time t values of all the other variables used in the analysis. The variables in X_{1t} are $\{log(empl), log(cpi)\}'$. The variables in X_{2t} are $\{RP_{oil}, log(NBR), log(MB), log(M2)\}'$. R_t is the federal funds rate (FFR).

   The ordering of the variables in X_t embodies two key identifying assumptions. First, the variables in X_{1t} do not respond contemporaneously to a monetary policy shock. Second, the time t information set of the monetary authority consists of current and lagged values of the variables in X_{1t} and only on past values of the variables in X_{2t}.

   A. Estimation

   (a) In a single graph, plot all the (transformed) variables to be used as the X_t vector. ***Note:*** *If you plot separately the non-transformed NBR, you will find that for a short period it has negative values, since the log of a negative value is not defined you can then offset the NBR by adding a (large enough) constant that eliminates the negative values, and then proceed to take the log of that variable.*

(b) Run a lag selection test for the X_t vector. What is the optimal lag length?

(c) Estimate the seven-variable VAR using the number of lags indicated by AIC in the previous step for each variable, a constant, and a trend.

(d) Use a standard form Cholesky decomposition to estimate the corresponding SVAR.

B. Analysis

(a) Plot the impulse response functions (IRFs) of *Employment, CPI, Federal Funds Rate, Oil Prices* to a contractionary monetary policy shock (n=48 periods, and include the 95 confidence bands). *Hint:* Your single chart should only include four IRF panels, that is the 3 response variables and the impulse variable (where the latter is plotted as a response variable).

(b) Discuss your results about the dynamic effect of a monetary policy shock with regards to the timing and size of the responses of: i) economic activity; ii) CPI price level.

(c) Repeat parts (a) and (b) above to analyse the effect of a oil price shock.

(d) How large is the monetary policy shock and the oil price shock components in accounting for the observed variation in the data? Run and plot the forecast error variance decomposition (FEVD) in the elements of X_{1t} due to a monetary policy shock and an oil price shock, for $k = 12$, 24, and 48 months ahead. Interpret your results as to how important are monetary policy and oil price shocks in accounting for the variation of employment and CPI prices in the US economy.

2. **Small monetary model of the Canadian Economy**

The second part of the test asks you to perform a similar empirical analysis as in Part (1) but with a smaller model using Canadian data. For this part you will use data from the (Excel) file entitled 'CAN macro data.xlsx' (in the Supplementary folder), which contains aggregate and monetary variables from Canada at monthly frequency for the period 1961m1:2023m8. Again, you will use this data to estimate how the Canadian economy responds to a *contractionary* monetary policy shock, and a surprise increase in oil prices.

Your task is to estimate the impulse response of key aggregate variables to a monetary policy shock and an oil price shock, using an identified vector autoregression (VAR).

The variables to be used in the VAR are: Employment (*EMPL*) as indicator of real activity and measured in individual workers, the Consumer Price Index (*CPI*), the overnight rate (*OVERNIGHT*) measured in percent, Spot price of crude (*Poil*) measured in U.S. dollars per barrel, and the M1 money stock (M1) measured in dollars. *Hint:* You will have to scale all these variables, except the interest rate and oil prices, to unit scale, then log these variables, and finally multiply them by 100, in order to interpret the changes as percentages. In addition you will need to convert (nominal) oil prices to real oil prices using the CPI price index.

Identification: Let X_t denote the 5x1 vector of variables included in the analysis. We will partition X_t as follows:

$$X_t = [X_{0t}, X_{1t}, R_t, X_{2t}]'.$$

The vectors X_{0t} and X_{1t} are composed of the variables whose time t values are assumed not to respond contemporaneously to a monetary policy shock. The vector X_{2t} consists of the time t values of all the other variables used in the analysis. X_{0t} consists of one variable, namely the real price of crude oil (RP_{oil}), the variables in X_{1t} are $\{log(empl), log(cpi)\}'$. The variable in X_{2t} is $\{log(M1)\}'$. R_t is the overnight rate (OVERNIGHT).

The ordering of the variables in X_t embodies three key identifying assumptions. First, Canada is a small open economy, as such economic events in the Canadian economy do not affect the world price of oil contemporaneously. Second, the variables in X_{1t} do not respond contemporaneously to a monetary policy shock. Third, the time t information set of the monetary authority consists of current and lagged values of the variables in X_{0t} and X_{1t}, and only on past values of the variables in X_{2t}.

(a) Perform again and report the **A. Estimation** and **B. Analysis** sections as in Part (1) above, this time using the small monetary model for the Canadian economy.

(b) What qualitative and quantitative differences do you find between the US and the Canadian economies with regards to the effect of monetary and oil price shocks? Interpret your findings.