Instructions for the replication files of **"The Quarterly Japanese Economic Model (Q-JEM): 2019 version"** by Naohisa Hirakata, Kazutoshi Kan, Akihiro Kanafuji, Yosuke Kido, Yui Kishaba, Tomonori Murakoshi, and Takeshi Shinohara

- Simulation programs are written with EViews and Python. EViews is available at: www.eviews.com. Python can be downloaded from: www.python.org. The current version of Q-JEM is compatible with EViews 9 or 10 (not the student version) and Python 3.6.0.

I. Contents of the replication files: *qjem_replication*

The folder ***qjem_replication*** has one main program and five subdirectories.

- ***CALC_RESPONSE_TO_EXOGENOUS_SHOCKS.PRG*** is the main program of the simulation. This simulation program calculates impulse responses to the exogenous shocks.

The folder contains the following subdirectories:

- ***BLOCKEDEQ*** contains results of the Dulmage-Mendelsohn decomposition (DM decomposition).
  - ✓ ***qjem_plain_blocked.txt*** is the final output of the DM decomposition that contains information about blocked models.
  - ✓ ***qjem_plain_blocked_finest.txt*** and ***debug_print_args.txt*** are by-products of the final output.
- ***INPUT*** contains two input files.
  - ✓ ***BASECASE.wf1*** contains baseline path and coefficients of Q-JEM equations. The baseline path is hypothetical. The sample range on the workfile is set from 0001Q1 to 0010Q4.
  - ✓ ***qjem_plain.txt*** contains all Q-JEM equations.
- ***LIBRARY*** and ***SUBROUTINES*** contain EViews subroutines (.prg) and Python subroutines (.py), which are mainly used for solving the model.

- ***OUTPUT*** contains simulation outputs: ***RESULT.wf1.***

II. Replicating Figures 6 to 9 in the paper

- ***calc_response_to_exogenous_shocks.prg*** is the main program. To replicate the results of Figures 6 to 9 in the paper, run this program by EViews.
- Simulation results are saved in ***RESULT.wf1*** in the folder ***output***.
  - ✓ ***Basecase*** page of ***RESULT.wf1*** contains the baseline path.
  - ✓ ***Sim1*** page contains the simulation results of Figure 6.
  - ✓ ***Sim2*** page contains the simulation results of Figure 7.
  - ✓ ***Sim3*** page contains the simulation results of Figure 8.
  - ✓ ***Sim4*** page contains the simulation results of Figure 9.

Figures 6 to 9 are saved as graph objects ***fig_out*** in the corresponding pages of ***RESULT.wf1***.

III. Configuration

Check the following before running the program.

- ✓ Place the replication files in a directory path that does not contain blank spaces. Path names with spaces may cause an error in EViews' programs.
- ✓ Set your PATH environment variable to include the directory of your Python installation before executing programs in the ***qjem_replication*** folder.

IV. Equations list of Q-JEM

- ***qjemdoc.html*** in the folder ***qjem_html*** lists equations in Q-JEM. This document elaborates on the definitions of variables and the brief estimation results of equations.
- In addition to the variables listed in ***qjemdoc.html***, Q-JEM contains law of motion equations for exogenous variables and error variables, which are written in the text

file, ***qjem_plain.txt***, in the folder ***input***. For example, the law of motion for the exogenous variable associated with consumption (E_CP) is specified as E_CP=C_E_CP(1)*E_CP(-1)+V_CP, where V_CP is an error term.

V. Solution algorithm

- We use the Dulmage-Mendelsohn decomposition (DM decomposition) algorithm to solve the model quickly and stably by switching endogenous and exogenous variables.
- DM decomposition generates the blocked triangular matrix only by permuting rows (equations) and columns (variables) of the equation system. This matrix gives the identified partial models and the order in which models are to be solved.
- The DM decomposition programs are written in Python. These programs are called by the EViews subroutine ***solve_qjem.prg***.

The model blocking pattern depends on the setting of the endogenous and exogenous variables, and different block patterns are generated for different simulation exercises. The blocked model is recorded as a text file ***qjem_plain_blocked.txt***, which is then appended to the model object in the simulation workfile of EViews.

VI. Detail of the simulation program

Take a global economic expansion simulation in Section 3.1.1 (Sim1) as an example.

- The first line in the execution part of ***calc_response_to_exogenous_shocks.prg*** determines the simulation name.

```
%sim_name = "Sim1"
```

- The second line of the execution part calls the subroutine named ***"create_simpage"*** in the program. This subroutine creates a new page named ***"Sim1"*** in output workfile ***RESULT.wf1***. In addition, the subroutine copies all objects from ***Basecase*** page and determines the simulation sample range.

```
call create_simpage
```

- The third and fourth line give the pre-defined scenarios to the variables to be switched from endogenous to exogenous. This simulation assumes that *USGDP* and *NUSGDP* increase by one percent.

```
series USGDP  = USGDP*1.01

series NUSGDP = NUSGDP*1.01
```

- The next two lines select variables to be switched from exogenous to endogenous and vice versa. "*%endo2exog*" selects endogenous variables to be switched to exogenous variables. Correspondingly, "*%exog2endo*" selects exogenous variables to be switched to endogenous variables. The number of variables in both lists should match, and variables to be switched should be placed in corresponding order.

```
%endo2exog = "NUSGDP   USGDP"

%exog2endo = "V_NUSGAP V_USGAP"
```

- In this particular case, it should be mentioned that both *USGDP* and *NUSGDP* do not have their own error terms as exogenous variables since they are determined by identity equations. In the case of *USGDP*, *V_USGAP* in the *E_USGAP* equation can be used as an endogenous variable. See below for details.

```
LOG(USGDP/USGDPQ)*100=USGAP

        USGAP=f(.)+E_USGAP

E_USGAP=C_E_USGAP(1)*E_USGAP(-1)+V_USGAP.
```

  Similar to this case, *V_NUSGAP* can be used for *NUSGDP*.

- The next two lines call the subroutine that solves the model where selected endogenous variables and exogenous variables are switched. The start date and end date are specified by "*%shocksdate*" and "*%shockedate*". Some arguments in the subroutine are prepared in the general setting part of the program. "*%model_name*" is the name of the input model text file, "!EPSILON" is the convergence criterion of the solution, "*%dir_input*" is the full path of the ***input*** folder, and "*%dir_blockedEq*" is the full path of the ***blockedeq*** folder.

```
smpl %shocksdate %shockedate

call solve_qjem(%model_name, %endo2exog, %exog2endo, !EPSILON, _
```

```
%dir_input, %dir_blockedEq)
```

- The last two lines execute the subroutine for making the graph object of the main result. First argument of subroutine "***make_graph***" is the baseline page name. The second argument is the simulation page name. The third argument is the graph title.

```
%graph_title = "Responses to one percent permanent increase in Foreign GDP"

call make_graph("Basecase", %sim_name, %graph_title)
```

VII. Run your own simulation

- To change the intended variable in the simulation (e.g., *TOPIX*: Tokyo stock price index), follow the instructions below.

  ✓ Give the pre-defined value to the variable. For example:

  ```
  series TOPIX  = TOPIX*1.01
  ```

  For a different magnitude of the shock, change the multiplier:

  ```
  series TOPIX  = TOPIX*1.2,
  ```

  To give an arbitrary fixed value (e.g., 1000), write as below:

  ```
  series TOPIX  = 1000.
  ```

  To increase the growth rate of TOPIX by one percent from ***Basecase***, write as below:

  ```
  series TOPIX  = (basecase¥TOPIX/basecase¥TOPIX(-1)+0.01)*TOPIX(-1),
  ```

  where ***basecase¥TOPIX*** is TOPIX data in ***Basecase*** page.

  ✓ Next, change the variable list as shown below. In doing so, check that V_TOPIX exists in ***BASECASE.wf1***.[1]

  ```
  %endo2exog = "  TOPIX"

  %exog2endo = "V_TOPIX"
  ```

- To obtain the response to a one-time shock, follow the instructions below. The

[1] If an exogenous variable corresponding to a variable of interest does not exist, try a related exogenous variable (e.g., `V_USGAP` for `USGDP`).

following code can also apply to multiple shock periods.

✓ Reset the sample range to set a pre-defined scenario.

```
smpl %shocksdate %shocksdate

series TOPIX = TOPIX*1.01
```

✓ First solve the model at %shocksdate, where selected endogenous variables and selected exogenous variables are switched. Then solve the rest of periods.

```
%endo2exog = "  TOPIX"

%exog2endo = "V_TOPIX"

smpl %shocksdate %shocksdate

call solve_qjem(%model_name, %endo2exog, %exog2endo, !EPSILON, _

                %dir_input, %dir_blockedEq)

%endo2exog = ""

%exog2endo = ""

smpl %shocksdate+1 %shockedate

call solve_qjem(%model_name, %endo2exog, %exog2endo, !EPSILON, _

                %dir_input, %dir_blockedEq)
```