Simulation Guide

`Plot_package` contains a `1_Master_code` script that runs all the separate scripts for generating:

- **Figure 7:** Script `Fig_7.jl`
- **Figure 8:** Script `Fig_8.jl`
- **Table B2 (a):** Script `B2_(a).jl`
- **Table B2 (b):** Script `B2_(b).jl`

Julia Version and Platform Information

Julia Version: 1.11.1 or higher
Commit: 8f5b7ca12a (2024-10-16 10:53 UTC)
Build Info: Official https://julialang.org/JuliaLang release

Platform Information

- **Operating System:** Windows (x86_64-w64-mingw32)
- **CPU:** 8 $\times$ Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
- **Word Size:** 64-bit
- **LLVM Version:** libLLVM-16.0.6 (ORCJIT, skylake)

Guide on running the master code

1. Download **VS Code** and add the **Julia extension**.
2. After downloading and unzipping the package, open `1_Master_code.jl` in **VS Code**.
3. Edit line 19 of the master code to set the `base_dir` variable to the path of the unzipped package.
4. Run the master code:
   - In the **Julia REPL**, type `include(_Master_code.jl)`.
   - Or directly in **VS Code**, use the `Run` command or `Shift + Enter`.
5. Output plots will be saved in both .pdf and .png format in the output folder

The `1_Master_code` ensures seamless execution of all these scripts to reproduce the key analytical figures in the paper. You can also run the codes separately, provided that you add all the packages used in the Julia environment as specified in the master code.

Graph 7 specifications

$$\sigma = 0.8$$
$$\theta = 0.15$$
$$\kappa = 0.8$$
$$q_h = 0.35$$
$$c_{\text{unscaled}} = 0.01225$$
$$c = \frac{c_{\text{unscaled}}}{q_h^2}$$
$$\eta_0 = 5$$
$$\eta_1 = 5.5$$
$$r = 0.2$$

q_h is the median level from empirical results $c_{unscaled}$ is chosen to set c = 0.1 All specifications are kept the same for plots in the appendix except η_1, which is lowered. This only shifts down π_1^f and does not affect general results.

$$v_{sat} = \frac{2\kappa}{\sigma\theta}$$

$$v_s = \left(\sqrt{\kappa\sigma} + \sqrt{\kappa\sigma + \frac{(1-\theta)^2\kappa^2}{rc}}\right)^2 /2$$

v_{sat} set as the starting v value for the plot
$v_s + 1.5$ set as the highest v value for the plot

Plot the following curves of π on v

$$\pi_0^p(v) = \left(\frac{(v - \pi_0^p(v))^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2rc} \quad \text{for} \quad v_{sat} \leq v < v_s$$

$$\pi_0^f(v) = \left(\frac{(v - \pi_0^f(v))^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2rc} + \frac{\eta_0}{r}\left(\frac{(v - \pi_0^f(v))^2}{2\sigma v} - \kappa\theta\right) - \frac{\eta_0}{r}(1-\theta)\kappa \quad \text{for} \quad v_s \leq v \leq v_s + 1.5$$

$$\pi_1^f(v) = \left(\frac{(v - \pi_1^f(v))^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2rc} + \frac{\eta_1}{r}\left(\frac{(v - \pi_1^f(v))^2}{2\sigma v} - \kappa\theta\right) \quad \text{for} \quad v_{sat} \leq v \leq v_s + 1.5$$

Graph 8 specifications

In addition to the curves plotted in graph 7, we now add a plot for each of the 3 curves with a lower q: $q_l = 0.346 < q_h$, which represents a tighter labour market, leading to a higher cost of recruitment c.

$$
\begin{aligned}
\sigma &= 0.8 \\
\theta &= 0.15 \\
\kappa &= 0.8 \\
q_l &= 0.346 \\
c_{\text{unscaled}} &= 0.01225 \\
c &= \frac{c_{\text{unscaled}}}{q_l^2} \\
\eta_0 &= 5 \\
\eta_1 &= 5.5 \\
r &= 0.2
\end{aligned}
$$

The curves at q_{low} are plotted in dashed lines to compare with the curves at q_{high} in solid lines. With q_{low}, the curves are shifted to the left and down.

q_{low} curves are shifted down by 0.4 units to make the plots visually readable. To verify the general effect of setting a lower q, find `offset_value` in the script `Fig_8.jl` and set it to 0 to obtain the original plots.

B2(a) specifications

$$\sigma = 0.8$$
$$\theta = 0.15$$
$$\kappa = 0.8$$
$$c = 0.1$$
$$\eta_0 = 1.5$$
$$\eta_1 = 3$$
$$r = 0.2$$
$$v_{sat} = \frac{2\kappa}{\sigma\theta}$$
$$v_s = \left(\sqrt{\kappa\sigma} + \sqrt{\kappa\sigma + \frac{(1-\theta)^2\kappa^2}{rc}}\right)^2 /2$$

checked that $v_{sat} < v_s$
setting v such that $v_{sat} < v < v_s$

$$v = 1.2 * v_{sat}$$

checked that v satisfies $v_{sat} < v < v_s$
Plot the following curves

Curve 1:

$$r\pi$$

Curve 2:

$$y_0^p(\pi) = \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2c}$$

Curve 3:

$$y_0^f(\pi) = \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2c} + \eta_0 \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right) - \eta_0(1-\theta)\kappa$$

Curve 4:

$$y_1^f(\pi) = \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2c} + \eta_1 \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)$$

where $\pi \in [\pi_{min}, \pi_{max}]$ with

$$\pi_{\min} = v - \sqrt{2\sigma\kappa v} \quad \text{where} \quad y_0^p(\pi) = y_0^f(\pi)$$

$$\pi_{\max} = v - \sqrt{2\sigma\kappa v\theta} \quad \text{where} \quad y_0^p(\pi) = 0$$

x-axis range $[\pi_{min} - 0.3 : \ \pi_{max} + 0.2]$ and curve 1 shifted downward by r * $(\pi_{min} - 0.3)$ for better visualization

B2(b) specifications

Same values chosen for all parameters

$$v_{sat} = \frac{2\kappa}{\sigma\theta}$$

$$v_s = \left(\sqrt{\kappa\sigma} + \sqrt{\kappa\sigma + \frac{(1-\theta)^2\kappa^2}{rc}}\right)^2 /2$$

checked that $v_{sat} < v_s$
setting v such that $v_{sat} < v < v_s$

$$v = 2.5 * v_{sat}$$

checked that v satisfies $v_{sat} < v < v_s$

Plot the following curves

Curve 1:

$$r\pi$$

Curve 2:

$$y_0^p(\pi) = \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2c}$$

Curve 3:

$$y_0^f(\pi) = \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2c} + \eta_0 \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right) - \eta_0(1-\theta)\kappa$$

Curve 4:

$$y_1^f(\pi) = \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)^2 \frac{1}{2c} + \eta_1 \left(\frac{(v-\pi)^2}{2\sigma v} - \kappa\theta\right)$$

where $\pi \in [\pi_{min}, \pi_{max}]$ with the range of the

$$\pi_{\min} = v - \sqrt{2\sigma\kappa v} \quad \text{where} \quad y_0^p(\pi) = y_0^f(\pi)$$

$$\pi_{\max} = v - \sqrt{2\sigma\kappa v\theta} \quad \text{where} \quad y_0^p(\pi) = 0$$

x axis is adjusted to zoom in on where the curves intersect each other: $x_{min} = \pi_0^p - 1.5$, $x_{max} = \pi_{max} + 4$, where π_0^p is where y_0^p crosses r*π.