Macroeconomics A; EI056

Short problems

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1 Drivers of the unemployment rate

1.1 Getting the data

Question: We consider the drivers of the US unemployment rate since 2007.
The first step is to get the data. To do so:

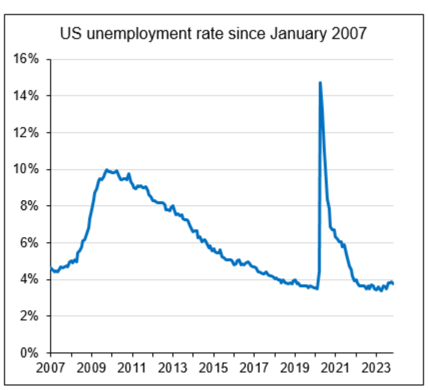
1. Go on the website of the Bureau of Labor Statistics https://www.bls.gov/
2. Under "subjects" in the blue banner, select "national unemployment rate" https://www.bls.gov/cps/
3. Scroll down to "CPI databases", Under the "one screen" search.
4. In fields 1 to 6 select "all" (the first entry), the in field 7 take "civilian non-institutional population", "civilian labor force", and "employed". Take monthly values since January 2000.

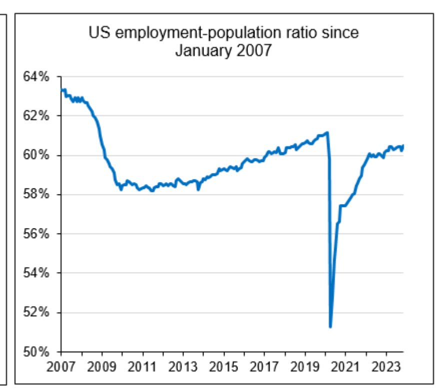
To make you life simpler, from step 2 you can scroll further down to "More tools –> series report" (https://data.bls.gov/cgi-bin/srgate) to just input the series codes. The codes are

- LNS10000000 for working age population.
- LNS11000000 for labor force.
- LNS12000000 for employment.

Compute the labor force participation rate, the unemployment rate, and the employment population ratio. Illustrate them as charts since January 2007.

Answer: The values are in the spreadsheet in Moodle. the charts are below.





1.2 Decomposing changes in the unemployment rate: the global financial crisis

Question: Show that the unemployment rate ur_t can be written as a function of the labor force participation $lfpr_t$ and the employment-population ratio epr_t:

$$ur_t = 1 - \frac{epr_t}{lfpr_t}$$

With this formula, we can compute changes in the unemployment rate from a period t forward into periods $t+h$. Specifically, we compute the effective change (the one in the data), the change if epr_t remains at its value of period t (i.e. unemployment rate at constant epr), and the change if $lfpr_t$ remains at its value of period t (i.e. constant unemployment rate at constant participation):

$$\begin{aligned}
\Delta u_{t+h}^{\text{effective}} &= ur_{t+h} - ur_t \\
\Delta u_{t+h}^{\text{constant epr}} &= \left(1 - \frac{epr_t}{lfpr_{t+h}}\right) - ur_t \\
\Delta u_{t+h}^{\text{constant lfpr}} &= \left(1 - \frac{epr_{t+h}}{lfpr_t}\right) - ur_t
\end{aligned}$$

Compute these three measures of unemployment rate starting from t is January 2007, until $t+h$ being December 2016. How have changes in participation impacted the unemployment rate during the global financial crisis?

Answer: Denote employment by E_t, unemployment by U_t, labor force by LF_t and population by P_t. The definitions of the ratios are:

$$ur_t = \frac{U_t}{LF_t} \quad ; \quad lfpr_t = \frac{LF_t}{P_t} \quad ; \quad epr_t = \frac{E_t}{P_t}$$

Recall also that $LF_t = U_t + E_t$.

We can write the unemployment rate as:

$$\begin{aligned}
ur_t &= \frac{U_t}{LF_t} \\
ur_t &= \frac{LF_t - E_t}{LF_t} \\
ur_t &= 1 - \frac{E_t}{LF_t} \\
ur_t &= 1 - \frac{epr_t \cdot P_t}{lfpr_t \cdot P_t} \\
ur_t &= 1 - \frac{epr_t}{lfpr_t}
\end{aligned}$$

The chart below shows the three measures of changes in the unemployment rate starting in January 2007.

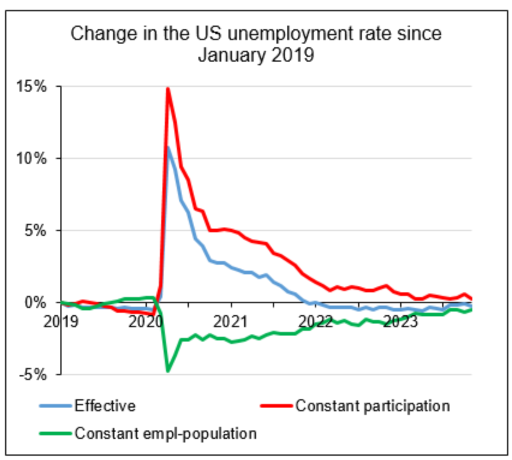
The unemployment rate (blue line) increased during the global crisis and gradually came down over the subsequent decade. While the decrease is good news, a lot of it reflected the decrease in the labor force participation rate. In other words, had participation remained unchanged, with only the movement in the employment-population ratio (red line), the unemployment rate would have increased more, and wouldn't have decreased much.

This is also seen if we consider that the employment-population ratio had remained constant, with only participation changing (green line). In that case, the unemployment rate would have trended down.

1.3 Decomposing changes in the unemployment rate: Covid

Question: Compute the same three measures of unemployment rate changes as above, but this time starting from t is January 2019, until $t + h$ being November 2022 (the last observation) How have changes in participation impacted the unemployment rate during the Covid crisis?

Answer: The measures are shown in the chart below.



During the Covid crisis, the unemployment rate (blue line) surges, and came back quite rapidly. Again a decrease in labor force participation limited the movement. Had participation remained unchanged, with only the movement in the employment-population ratio (red line), the unemployment rate would have increased more, and remained a bit higher. The gap is however not as sharp as during the global financial crisis.

The unemployment rate would have been lower if the employment-population ratio had remained constant, with only participation changing (green line).

2 Wage bargaining

2.1 Value of states and surpluses

Question: Consider the model where unemployed people and firms connect through a matching function.

A worker can be employed, which has a value V_E. In that case she gets a wage w. With exogenous probability λ she can become unemployed, which has a value V_U. If unemployed the person collects benefits b and with probability a can find a job. Using the discount factorρ we write:

$$\begin{aligned} \rho V_E &= w + \lambda (V_U - V_E) \\ \rho V_U &= b + a (V_E - V_U) \end{aligned}$$

A firm can post a vacant position, which can be in two states. It can be filled, with a value V_F, in which case the firm gets output produced by the worker, y, net of the wage w and the cost of having the position (cost of the desk and computer), c. The position can be ended with exogenous probability λ, it which case it becomes an unfilled vacant position. When unfilled, with value V_V, the position still costs c, but can be filled by a worker with probability α. Using the discount factorρ we write:

$$\begin{aligned} \rho V_F &= y - w - c + \lambda (V_V - V_F) \\ \rho V_V &= -c + \alpha (V_F - V_V) \end{aligned}$$

We compute the surpluses of filling a position for the worker, and for the firm (the value of a filled position compared to the alternative). Show that these are, for the worker and the firm:

$$\begin{aligned} V_E - V_U &= \frac{w-b}{\lambda + \rho + a} \\ V_F - V_V &= \frac{y-w}{\lambda + \rho + \alpha} \end{aligned}$$

Answer: The surplus for the worker is the extra value from being employed:

$$\begin{aligned} V_E - V_U &= \frac{w + \lambda (V_U - V_E)}{\rho} - \frac{b + a (V_E - V_U)}{\rho} \\ \rho (V_E - V_U) &= w - b + \lambda (V_U - V_E) - a (V_E - V_U) \\ (\rho + \lambda + a)(V_E - V_U) &= w - b \\ V_E - V_U &= \frac{w-b}{\lambda + \rho + a} \end{aligned}$$

The surplus for the firm is the value of a filled position minus the value of a vacant one:

$$\begin{aligned} V_F - V_V &= \frac{y - w - c + \lambda (V_V - V_F)}{\rho} - \frac{-c + \alpha (V_F - V_V)}{\rho} \\ \rho (V_F - V_V) &= y - w - c + \lambda (V_V - V_F) + c - \alpha (V_F - V_V) \\ (\rho + \lambda + \alpha)(V_F - V_V) &= y - w - c \\ V_F - V_V &= \frac{y-w}{\lambda + \rho + \alpha} \end{aligned}$$

2.2 Split of surpluses

Question: The wage is set to allocate the total surplus (sum of the worker's and firm's surpluses) between the two parties.

Assume that the worker gets a share ϕ of the total surplus, which this parameter reflecting her bargaining power.

Show that the wage is:

$$\begin{aligned} w &= b + \Phi\phi\left(y - b\right) \\ \Phi &= 1 - \frac{\left(\alpha - a\right)\left(1 - \phi\right)}{\lambda + \rho + a + \left(\alpha - a\right)\left(1 - \phi\right)} \end{aligned}$$

What is the interpretation of $y - b$?

Interpret the coefficient Φ. Think first of the case where $\alpha = a$, and then of the case where $\alpha < a$.

Answer: The total surplus is given by:

$$\left(V_E - V_U\right) + \left(V_F - V_V\right) = \frac{w - b}{\lambda + \rho + a} + \frac{y - w}{\lambda + \rho + \alpha}$$

A share ϕ goes to the worker, therefore:

$$
\begin{aligned}
(V_E - V_U) &= \phi\left[(V_E - V_U) + (V_F - V_V)\right] \\
(1-\phi)(V_E - V_U) &= \phi(V_F - V_V) \\
V_E - V_U &= \frac{\phi}{1-\phi}(V_F - V_V) \\
\frac{w-b}{\lambda+\rho+a} &= \frac{\phi}{1-\phi}\frac{y-w}{\lambda+\rho+\alpha} \\
\left(\frac{1}{\lambda+\rho+a} + \frac{\phi}{1-\phi}\frac{1}{\lambda+\rho+\alpha}\right) w &= \frac{\phi}{1-\phi}\frac{1}{\lambda+\rho+\alpha} y + \frac{1}{\lambda+\rho+a} b \\
\left(1 + \frac{\phi}{1-\phi}\frac{\lambda+\rho+a}{\lambda+\rho+\alpha}\right) w &= \frac{\phi}{1-\phi}\frac{\lambda+\rho+a}{\lambda+\rho+\alpha} y + b \\
\left(1-\phi + \phi\frac{\lambda+\rho+a}{\lambda+\rho+\alpha}\right) w &= \phi\frac{\lambda+\rho+a}{\lambda+\rho+\alpha} y + (1-\phi) b \\
\left(1-\phi + \phi\frac{\lambda+\rho+a}{\lambda+\rho+\alpha}\right) w &= \phi\frac{\lambda+\rho+a}{\lambda+\rho+\alpha}(y-b) + \left(1-\phi + \phi\frac{\lambda+\rho+a}{\lambda+\rho+\alpha}\right) b \\
w &= \frac{\phi\frac{\lambda+\rho+a}{\lambda+\rho+\alpha}}{1-\phi+\phi\frac{\lambda+\rho+a}{\lambda+\rho+\alpha}}(y-b) + b \\
w &= b + \phi\frac{\lambda+\rho+\alpha}{(1-\phi)(\lambda+\rho+\alpha) + \phi(\lambda+\rho+a)}(y-b) \\
w &= b + \phi\frac{\lambda+\rho+a}{\lambda+\rho+(1-\phi)\alpha+\phi a}(y-b) \\
w &= b + \phi\frac{\lambda+\rho+a}{\lambda+\rho+a+(\alpha-a)(1-\phi)}(y-b) \\
w &= b + \phi\frac{\lambda+\rho+a+(\alpha-a)(1-\phi)-(\alpha-a)(1-\phi)}{\lambda+\rho+a+(\alpha-a)(1-\phi)}(y-b) \\
w &= b + \phi\left[1 - \frac{(\alpha-a)(1-\phi)}{\lambda+\rho+a+(\alpha-a)(1-\phi)}\right](y-b) \\
w &= b + \phi\Phi(y-b)
\end{aligned}
$$

The social flow gain of employing someone is the production that a job generates, y, minus what the worker renounces by leaving unemployment, b.

The wage is above the unemployment benefit, as otherwise no unemployed person would accept a job. By how much above depends on the situation of the labor market, $\alpha - a$.

If the probability of a worker finding a job is the same as the probability of a firm finding an employee, $\alpha = a$, then $\Phi = 1$ and $w = b + \phi(y-b)$. The worker gets a share of the social flow gain $y - b$ that simply reflects her bargaining power, ϕ.

If $\alpha < a$, the worker has the upper hand. Specifically, the probability for the firm to find someone, α, is lower than the probability for an unemployed person to fin a job, a. In that case $\alpha - a < 0$, thus $\Phi > 1$. The worker gets a share of the social flow gain $y - b$ that exceeds her bargaining power, $\phi\Phi > \phi$, because the worker is in a favorable position.