1 Model

I model employment and unemployment in a life cycle model with non-absorbing reemployment. For now, the agents are Hand-to-Mouth (HtM).

2 Recursive formulation

Labor market status/Employed

$$j_t = \begin{cases} 2 & \text{Sickness leave} \\ 1 & \text{Employed} \\ 0 & \text{Unemployed.} \end{cases} \tag{1}$$

Health process is modeled as a latent variable in an AR(1) process, to make it a stochastic variable that considers last period's health, while also being bounded between 0 and 1.

$$z_t = \log\left(\frac{h_t}{1-h_t}\right) \tag{2}$$

$$z_{t+1} = \rho z_t + \varepsilon_{t+1}, \quad \varepsilon \sim N(0,\sigma^2) \tag{3}$$

$$h_{t+1} = \frac{\exp(z_{t+1})}{1+\exp(z_{t+1})} \tag{4}$$

Sickness leave duration will be build up during sickness leave and reset after a period of employment.

$$d^S_{t+1} = \begin{cases} d^S_t + 1 & \text{if } j_t = 2 \\ d^S_t & \text{if } j_t = 0 \text{ or } j_t = 1 \text{ and } \sum_{i=1}^M \mathbf{1}_{(j_t=1)} < \bar{S} \\ 0 & \text{if } j_t = 1 \text{ and } \sum_{i=1}^M \mathbf{1}_{(j_t=1)} \geq \bar{S}, \end{cases} \tag{5}$$

Sickness leave benefits The sickness benefit, b_t, is at one level for all until the reassessment date, t_r. At this time there is a risk of reduction in benefit, to a lower level or 0 in benefit. The risk δ, depends on the state of health as terminally ill and other serious illnesses are more likely to not be reduced in benefit. The probability of being reduced in benefit is assumed to be a quadratic function of the health state,

$$\delta^{low}_t(h_t) = \delta^{lower}_0 + \delta^{lower}_1 h_t + \delta^{lower}_2 h_t^2 \tag{6}$$

$$\delta^{out}_t(h_t) = \delta^{out}_0 + \delta^{out}_1 h_t + \delta^{out}_2 h_t^2 \tag{7}$$

$$\delta^{high}_t(h_t) = 1 - \delta^{lower}_t - \delta^{out}_t. \tag{8}$$

Where δ_0 is the baseline risk and δ_1 is the additional likelihood of being reduced in benefit as health improves, and δ_2 is the curvature of the risk. The quadratic form is to be able to have that; at high levels of health it is more likely to be reduced to 0 in benefit, while at medium health levels it is more likely to be reduced to the lower benefit. The benefit at time t is

$$b^S_t = \begin{cases} b^{high}, & \text{if } \; d^S_t < t_r \\ \tilde{b}, & \text{if } \; d^S_t \geq t_r \end{cases} \tag{9}$$

where $\tilde{b}$ is a stochastic variable that is b^{high} with probability $\delta^{high}_t(h_t)$, b^{low} with probability δ^{low}_t, and 0 with probability δ^{out}_t.

Origin of sickness leave determines how the agent can transition as someone on sick leave from unemployment cannot transition from sickness leave to employment. If they start a new sickness leave spell their origin becomes their last not sickness leave employment state and else their origin stays the same,

$$o_t = \begin{cases} j_{t-1} & \text{if } j_t = 2 \text{ and } d_t^S = 1 \\ o_{t-1} & \text{otherwise.} \end{cases} \tag{10}$$

Accumulated experience/Human capital

$$k_{t+1} = (1-\delta)k_t + \mathbf{1}_{\{j_t=1\}} h_t. \tag{11}$$

I added a discount factor to make the return wage decrease after a period away from the labor market. I also made the accumulation health dependent to represent the lower efficiency when sick but I actually think it would be more interesting to add a labor hours choice that would then depend on health and affect human capital that way.

Unemployment eligibility will be build up during employment and run down during unemployment. If the agent is unemployed, $j_t = 0$, and not UI eligible, $d_t^U = 0$, they will receive social assistance.

$$d_{t+1}^U = \begin{cases} d_t^U & \text{if } j_t = 2 \\ d_t^U + \zeta & \text{if } j_t = 1 \\ d_t^U - 1 & \text{if } j_t = 0, \end{cases} \tag{12}$$

where ζ depends on the current policy on re-qualification. This does not ensure that a full UI right is obtained before starting a spell. That would require that the eligibility is set to zero, $d_t^U \equiv 0$, if the worker has not obtained the full right, $d_t^U < \bar{U}$, at job separation, $j_{t-1} = 1$, and that the worker did have not weeks left from a previously obtained UI eligibility, $d_m^U = 0$, $j_m = 1$, $j_{m-1} = 0$. I fear this is quite complicated to model so I might just start with Eq. 12 and hope it matches data approximately.

Separation wage

$$w_t = w(1 + \alpha k_t) \tag{13}$$

Not a state, simply a function of human capital.

UI benefit is pinned down at spell start and is therefore also a state. Among UI recipients, the high benefit b^{emp} (beskæftigelsestillæg) applies for the first J periods of the spell, which equivalently means the last J periods have not yet been reached and the UI eligibility is a full right.

$$b_t^U(w_t(k_t), d_t^U) = \begin{cases} b^{wel} & \text{if} \quad d_t^U = 0 \\ b^{emp} & \text{if} \quad d_t^U > \bar{U} - J \\ \min(0.8\, w_t(k_t), b^{max}) & \text{if} \quad 0 < d_t^U \leq \bar{U} - J. \end{cases} \tag{14}$$

Thus, UI spells are characterized by a regular benefit level $b^{UI}(w_t(k_t))$ throughout the eligibility window, except that a subset of UI-eligible workers receive a temporarily higher benefit for J initial periods. This could have been modeled closer to the rules by adding a probability of receiving the short term higher benefit conditional on human capital equivalent to the probability of being eligible.

Value of being unemployed I changed the utility of consumption to match the form of disutility of search effort and Keane (2016).

$$
\begin{aligned}
V_t^U(h_t, k_t, d_t^U, d_t^S, o_t) &= \max_{s_t\in[0,1], g_t\in\{0,1\}} \Big\{ \eta \frac{c_t^{1+\mu}}{1+\mu} - (1-h_t)\lambda_n \frac{s_t^{1+\gamma}}{1+\gamma} \\
&\quad + \beta E\big[(1-g_t)\big(s_t V_{t+1}^E(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1}) \\
&\quad + (1-s_t)V_{t+1}^U(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1})\big) \\
&\quad + g_t V_{t+1}^S(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, 0)\big|h_t\big] \Big\} \qquad (15) \\
&\text{s.t.} \\
c_t &= y_t = (1-\tau) b_t^U(w_t(k_t), d_t^U), \qquad (16)
\end{aligned}
$$

where the search effort s_t directly translates to the probability of being employed the following period. The search cost is modeled like in DellaVigna et al. (2017), and $n \in \{1,2,3\}$ represents the types of unobserved heterogeneity in the level of search cost.

Value of being employed When employed, individuals earn wage income, face exogenous job separation risk σ and choose endogenous job separation, q, and consumption, c (no intensive working choice for now)

$$
\begin{aligned}
V_t^E(h_t, k_t, d_t^U, d_t^S, o_t) &= \max_{q_t, g_t\in\{0,1\}} \Big\{ \eta \frac{c_t^{1+\mu}}{1+\mu} - \nu_n \frac{(1-h_t)^{1+\iota}}{1+\iota} + \beta E\Big[(1-g_t)\Big(q_t V_{t+1}^U(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1}) \\
&\quad + (1-q_t)\left((1-\sigma)V_{t+1}^E(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1}) + \sigma V_{t+1}^U(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1})\right)\Big) \\
&\quad + g_t V_{t+1}^S(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, 1)\big|h_t\Big] \Big\} \qquad (17) \\
&\text{s.t.} \\
c_t &= y_t = (1-\tau) w_t(k_t). \qquad (18)
\end{aligned}
$$

Value of being on sick leave

$$
\begin{aligned}
V_t^S(h_t, k_t, d_t^U, d_t^S, o_t) &= \max_{r_t\in\{0,1\}} \Big\{ \eta \frac{c_t^{1+\mu}}{1+\mu} + \beta E\Big[(1-r_t)V_{t+1}^S(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1}) \\
&\quad + r_t \left(\mathbf{1}_{\{o_t=1\}}\big((1-\sigma)V_{t+1}^E(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1}) + \sigma V_{t+1}^U(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1})\big) \right. \\
&\quad \left. + \mathbf{1}_{\{o_t=0\}} V_{t+1}^U(h_{t+1}, k_{t+1}, d_{t+1}^U, d_{t+1}^S, o_{t+1})\right)\big|h_t\Big] \Big\} \qquad (19) \\
&\text{s.t.} \\
c_t &= y_t = (1-\tau) w_t(k_t). \qquad (20)
\end{aligned}
$$

References

DellaVigna, S., Lindner, A., Reizer, B., & Schmieder, J. F. (2017). Reference-Dependent Job Search: Evidence from Hungary*. *The Quarterly Journal of Economics*, *132*(4), 1969–2018. https://doi.org/10.1093/qje/qjx015

Keane, M. P. (2016). Life-cycle Labour Supply with Human Capital: Econometric and Behavioural Implications. *The Economic Journal*, *126*(592), 546–577. https://doi.org/10.1111/ecoj.12363

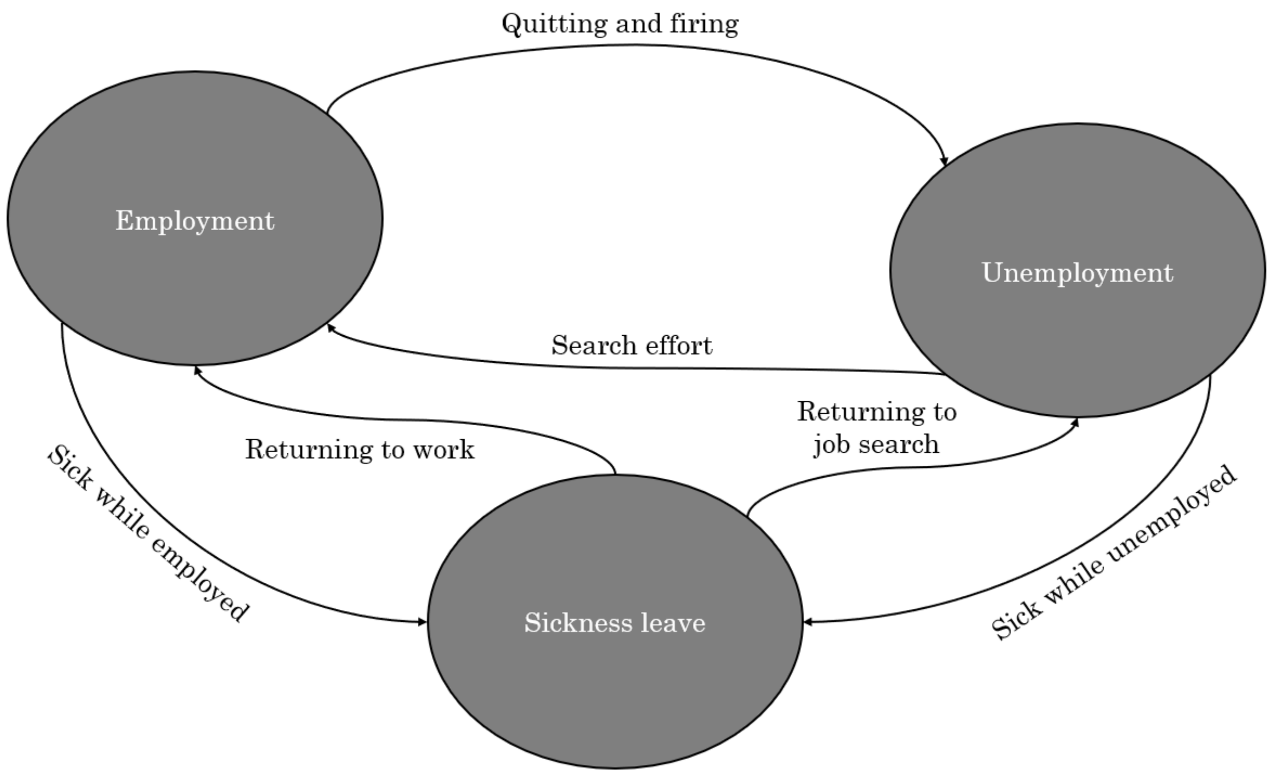

Figure 1: Model flow to and from employment, unemployment and sickness leave