The Cyclical Behavior of Equilibrium Unemployment and Vacancies
Shimer (2005)

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Bellman Equation

Worker

- Unempolyment value

$$U_p = z + \delta\{f(\theta_p)\mathbb{E}_p W_{p'} + (1 - f(\theta_p))\mathbb{E}_p U_{p'}\} \tag{1}$$

- Employment value

$$W_p = w_p + \delta\{(1 - s))\mathbb{E}_p W_{p'} + s\mathbb{E}_p U_{p'}\} \tag{2}$$

Bellman Equation

Firm

- Hiring value

$$J_p = p - w_p + \delta(1-s)\mathbb{E}_p J_{p'} \tag{3}$$

- Vacancy value

$$V_p = -c + \delta q(\theta_p)\mathbb{E}_p J_{p'} \equiv 0 \tag{4}$$

Optimal Control

Market tightness

- Control in this problem consists of w_p, θ_p, u_p and the state is p
- Market tightness θ_p is given by solving following equation for hire rate from free entry condition

$$q(\theta_p) = \frac{c}{\delta \mathbb{E}_p J_{p'}} \tag{5}$$

- And market tightness

$$\theta_p = (\frac{q(\theta_p)}{\mu})^{-\frac{1}{\eta}} \tag{6}$$

- Employ Rate is given by

$$f(\theta_p) = \mu^{\frac{1}{\eta}} q^{\frac{\eta-1}{\eta}} \tag{7}$$

Optimal Control

Continued

- Optimal wage at each productivity level is given by the Nash Bargaining:
$$W_p - U_p = \beta(W_p - U_p + J_p) \tag{8}$$
- Note Bellman Equation of W_p given by 2, U_p given by 1, J_p given by 3
- Following the algebra given in slide 6, optimal wage for each p is
$$w_p = \beta p + (1-\beta)z + \beta c\theta_p$$
- And unemployment rate
$$u_p = \frac{\delta}{\delta + f(\theta_p)} \tag{9}$$

Appendix A

Optimal wage

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Reference I

Shimer, R. (2005), 'The cyclical behavior of equilibrium unemployment and vacancies', *American Economic Review* **95**(1), 25–49.
URL: *https://www.aeaweb.org/articles?id=10.1257/0002828053828572*