Unemployment and the Search and Matching Model (Part 1)

PSE – Masters Year 2 (M2) – Quantitative Macro Term 1 (QM1)

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Welcome!

Who am I?

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What are we doing?

- Two lectures studying unemployment in modern quantitative macro, through the lens of the “search and matching” model
- One problem set solving the model with linear and nonlinear methods
- Everything this term will be representative agent. Next term we will do heterogeneous agents in QM2

Any questions? Let’s go!

Motivation

Why a search-and-matching approach to unemployment?

Big picture. So far you have studied RBC and NK models. These deliver elegant business-cycles, but their labour blocks are not designed to talk about unemployment:

- **RBC:** Perfectly competitive labour market clears each period $\Rightarrow$ no involuntary unemployment. Aggregate "hours" of a representative household adjust.
- **NK:** Nominal rigidities + monopolistic competition in goods; *baseline* NK labour block is still frictionless $\Rightarrow$ no unemployment margin even in recessions.
- **Reality:** There are always unemployed workers *and* unfilled vacancies; job search takes time and resources.

Today: Put tractable *frictions* into the labour block to endogenize unemployment, vacancies, and wage setting via bargaining.

- We will be studying the representative agent **search and matching model**, a key workhorse model of modern macro-labour
- The model is often called the **DMP** model, after the three economists who won the Nobel prize for developing the theory around it: Diamond, Mortensen, and Pissarides

Unemployment: a quick undergrad recap

Definitions:

- **Unemployment:** Number of people without a job and actively looking for one
- **Labour force:** Number of employed plus unemployed people
- **Unemployment rate:** Unemployment divided by labour force
- **Participation rate:** Fraction of population in the labour force (i.e. not retired, ...)

Types of unemployment: (informally)

- **Classical** (e.g. binding minimum wage) / **Structural** (skills mismatch, reallocation)
- **Cyclical** (insufficient demand) / **Frictional** (search, time-to-match)

Today:

- DMP model is at its core a model of **frictional unemployment**: even with flexible wages, search + matching imply some unemployment in steady state.
- But since the model delivers a theory of worker flows (hiring, firing), it is also an excellent base to build on to add structural, cyclical, classical unemployment

Why the Walrasian spot-market view fails for labour

Labour is heterogeneous: tasks, locations, contracts, schedules, match quality, ...

No centralized "spot" market: firms post vacancies; workers search, apply, interview. Matching is probabilistic and time-consuming

No Walrasian auctioneer: with bilateral meets and outside options, how are wages set?

Walrasian market:

- You costlessly check price at all sellers, go with the best value
- Common market-clearing price emerges since you can always go to the next guy

Real-life labour market:

- Worker and firm meet, and may not have any other valid options at the time
- If the firm (worker) offers you a wage that is slightly too low (high) relative to what you think is fair, is it worth the cost to walk away and try somewhere else?
- Bargaining power and outside options become important in wage setting

$\Longrightarrow$ frictional labour market <u>demands</u> a deeper theory of wage setting

Roadmap for today

1. Data
2. Baseline DMP model
3. Stochastic recursive equilibrium
4. Steady state and comparative statics
5. Efficiency & Hosios condition
6. Next week: quantitative business cycle implications (Shimer critique and solutions)

Data

Stocks vs flows: the accounting identity in a "two state" model

Ignore non-participation, so workers are either employed (n_t) or unemployed (u_t)

Normalise total labour force to 1, so that $n_t = 1 - u_t$. Implies u_t is both number of unemployed workers and the unemployment rate

Define two key **worker flows:**

- Job finding rate: $f_t = M_t / u_t$. Fraction of unemployed workers who find a job at $t+1$
- Job separation rate: s_t. Fraction of employed who become unemployed at $t+1$

Then **unemployment is a stock** which must evolve according to

$$u_{t+1} = u_t - f_t u_t + s_t(1 - u_t) \tag{1}$$

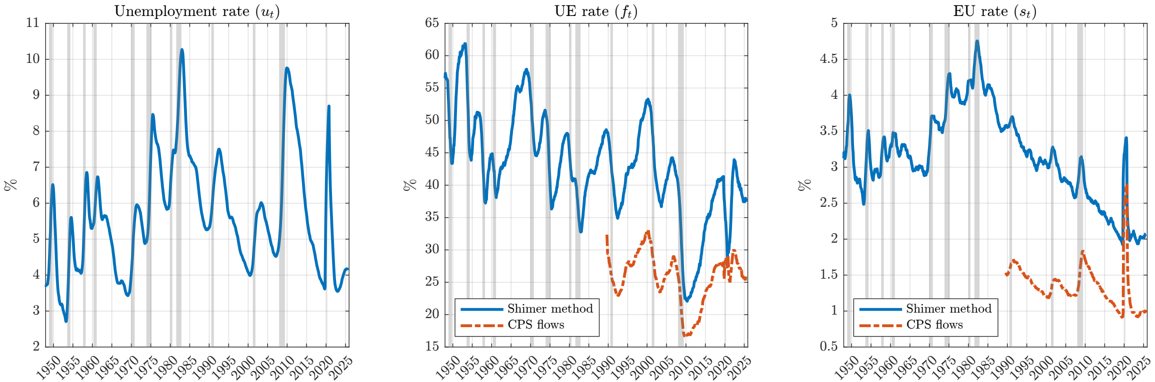
Unemployment rises ($\uparrow u_t$) either because 1) more workers lose their job ($\uparrow s_t$), or 2) fewer unemployed find jobs ($\downarrow f_t$).

In steady state, unemployment is given by

$$u = \frac{s}{s+f}$$

Key lesson: even a constant, low unemployment rate hides large, offsetting flows (*"churn"*)

US data: unemployment, job finding, and job separation rates ▸ unsmoothed



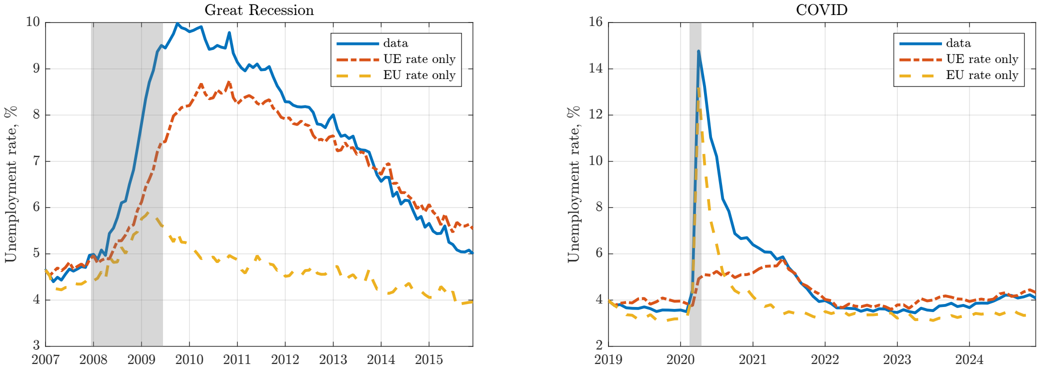
Monthly, seasonally adjusted, smoothed with 12 month moving average. Source: CPS and author's calculations.

Average levels: $u \approx 5\%$; $f \approx$ 25-40% per month; $s \approx$ 1-3% per month

Cyclicality: recessions feature a large and persistent fall in f_t, large short spike up in s_t

Data: Shimer (2005) method uses stocks to calculate flows in a two-state-consistent manner. CPS flows use panel dimension of CPS survey to directly compute UE and EU

Is job finding or separation rate more important for explaining u_t?



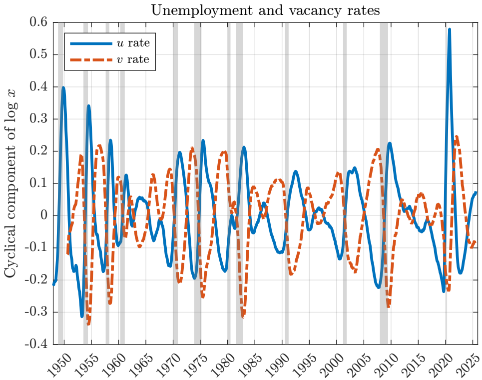
Monthly, seasonally adjusted. Source: CPS and author's calculations.

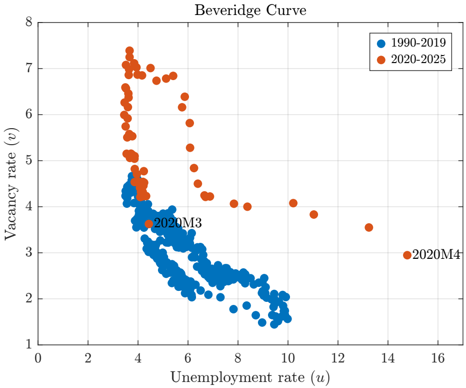
Counterfactual: Starting at date t_0 and unemployment u_{t_0}, what is the role of f_t and s_t in driving u_t in a recession? Method: simulate (1) forward from t_0, fixing $f_t = f_{t_0} \forall t$ **or** $s_t = s_{t_0} \forall t$.

Result: Fall in UE rate much more important for explaining $\uparrow u_t$. Less true during Covid.

Shimer (2012) shows (different method) UE rate more important than EU pre-2007 ▸ details

Vacancies and the Beveridge curve ‣ more beveridge curve





Monthly, seasonally adjusted. Left: log HP filtered (10^5), 12 month MA. Right: Beveridge Curve. Source: CPS.

Vacancy: an unfilled job opening for which a firm is actively recruiting

Beveridge curve: downward relation between unemployment u_t and vacancies v_t

- Tight markets: high v_t, low u_t
- *Shifts* reflect changes in matching efficiency (e.g. composition, search intensity, ...)

Baseline DMP Model

Environment

- Discrete time $t = 0, 1, 2, \ldots$
- All agents are risk neutral and discount the future at rate $\beta < 1$ (where $\beta = 1/(1+r)$)
- Workers: Continuum of measure 1 (“unit mass”) of ex-ante identical workers:
  - Can be either unemployed or employed (extensive margin), no intensive margin
  - No “large family” assumption as in Hansen (1985) $\implies$ unemployment is painful
- Firms: Large continuum of mass $>>> 1$ of potential firms
  - Firms may match with one worker. If matched, produce output y_t and pay worker wage w_t
  - If unmatched, firm decides whether to post a vacancy or not
- Goods market:
  - All output is used for consumption or vacancy posting costs
  - Can think of unemployed workers as doing home production (or assume UI benefits)
- Labour market:
  - Firms and workers meet via a “matching function” (next slide)
  - Worker-firm matches exogenously break down with *fixed* probability s per period
- Aggregate uncertainty: y_t is an aggregate shock following an AR(1) process

Note: Basic model as per Pissarides (2000) (continuous time) or Ljungqvist and Sargent (2017) (discrete time)

Matching and Tightness

Matching function: This is the key modelling innovation which makes this model work

$$M_t = M(u_t, v_t) \qquad \text{with } M_u, M_v > 0$$

Idea: if u_t unemployed workers are looking for a job and v_t vacancies are looking for a worker, then M_t matches will be formed, starting employment next period

This is an abstraction, capturing how it takes time for workers and firms to find the right match. Equal prob. of success for any worker ($f_t = M_t / u_t$) or vacancy ($q_t = M_t / v_t$)

Market tightness: $\theta_t = v_t / u_t$. Today we will assume constant returns to scale (evidence: Petrongolo and Pissarides, 2001) implying a key role for market tightness:

Worker job finding rate: $f(\theta_t) = \frac{M(u_t, v_t)}{u_t} = M(1, v_t / u_t) = M(1, \theta_t) \quad M_u > 1 \implies f'(\theta_t) > 0$

Firm job filling rate: $q(\theta_t) = \frac{M(u_t, v_t)}{v_t} = M(u_t / v_t, 1) = M(\theta_t^{-1}, 1) \qquad M_v > 1 \implies q'(\theta_t) < 0$

Interpretation: High θ_t favours workers, low θ_t firms (can show that $\theta_t = f_t / q_t$)

Worker Value Functions

Suppose workers receive income z per period when unemployed (home production, UI)

Simplest to state the problem directly using value functions:

Let U_t be the expected discounted value achieved by a currently unemployed worker

Let W_t be the expected discounted value achieved by a currently employed worker

These satisfy:

$$U_t = z + \beta \, \mathrm{E}_t \left[(1 - f_t) U_{t+1} + f_t W_{t+1} \right] \tag{2}$$

$$W_t = w_t + \beta \, \mathrm{E}_t \left[(1 - s) W_{t+1} + s U_{t+1} \right] \tag{3}$$

where conditional expectation E_t is over the future aggregate shock realisation y_{t+1}

Note that this model contains both:

- **Aggregate uncertainty:** productivity shock y_t
- **Idiosyncratic uncertainty:** unemployment and job finding risks

Firm Value Functions

Let J_t be the expected discounted value achieved by a firm currently matched with a worker (ie value of a filled job)

Let V_t be the expected discounted value achieved a firm currently unmatched and searching for a worker (ie value of a vacancy)

These satisfy:

$$V_t = -c + \beta \, \mathrm{E}_t \left[(1 - q_t) V_{t+1} + q_t J_{t+1} \right] \tag{4}$$

$$J_t = y_t - w_t + \beta \, \mathrm{E}_t \left[(1 - s) J_{t+1} + s V_{t+1} \right] \tag{5}$$

Note: So far we have stated all equations in the time domain (aka "sequence space") with variables indexed by $t, t+1, \ldots$. We will later move to the recursive (aka "state space") formulation, with variables as functions of the aggregate state

Free Entry and Unemployment Dynamics

Free-entry condition: In equilibrium, the expected discounted value of creating a new vacancy must be zero, because firms are free to enter the market and post vacancies until all profit opportunities are exhausted

Mathematically, means that in equilibrium $V_t = 0$ for all t. Putting this in (4) gives

$$c = \beta q(\theta_t) \, \mathrm{E}_t \, J_{t+1} \tag{6}$$

Key idea: firms post more vacancies ($\uparrow \theta_t$) when firm value is high ($\uparrow \mathrm{E}_t \, J_{t+1}$). Rearrange (6):

$$\theta_t = q^{-1}\left(\frac{c}{\beta \, \mathrm{E}_t \, J_{t+1}}\right)$$

Law of motion for unemployment:

$$u_{t+1} = (1 - f_t) u_t + s(1 - u_t) \tag{7}$$

Recalling that $f_t = f(\theta_t)$, we see a key mechanism: $y_t \rightarrow \mathrm{E}_t \, J_{t+1} \rightarrow \theta_t \rightarrow f(\theta_t) \rightarrow \Delta u_t$

Wage determination: The environment

So far we have six endogenous variables – U_t, W_t, J_t, θ_t, w_t, u_t – but only five equations – (2), (3), (5), (6), (7). Less equations than unknowns means the model is not identified

Why? We need one more equation to determine the wage

- RBC model: impose market clearing ($u_t = 0$) to pin down w_t
- DMP model: Walrasian market clearing is not valid. Many options for wage setting

The environment:

- Wage is not fixed before the worker and firm meet (no pre-commitment to wages)
- Search frictions mean you cannot instantly shop around for a different match: the worker and firm have to bilaterally negotiate, or walk away
- After worker and firm meet, there is a **"surplus"** to be split, which will be lost if either party walks away. Each party has a surplus over their outside option:

Worker surplus: $S_t^w = W_t - U_t = w_t - z + \beta \, \mathrm{E}_t \left[(1 - s - f_t)(W_{t+1} - U_{t+1}) \right]$
Firm surplus: $S_t^f = J_t - V_t = y_t - w_t + \beta (1 - s) \, \mathrm{E}_t \left[J_{t+1} \right]$

$\uparrow w_t \implies \uparrow S_t^w, \downarrow S_t^f$. *A range of wages are consistent with neither party walking away!*

Wage determination: Nash Bargaining

How to select the equilibrium wage within the range of mutually acceptable options? The most common approach is **Nash Bargaining:**

- Background: axiomatic derivation by Nash (1950, Econometrica)
- Generalised Nash Bargaining allows for different bargaining weights

In our context: the bargained wage is the one that maximises the Nash Product:

$$w_t = \arg\max_{w} \left(S_t^w(w)\right)^{\phi} \left(S_t^f(w)\right)^{1-\phi}$$

where $\phi \in (0,1)$ is the worker's relative bargaining power, and

$$S_t^w(w) = w - z + \beta\, \mathrm{E}_t \left[(1 - s - f_t)(W_{t+1} - U_{t+1})\right]$$

$$S_t^f(w) = y_t - w + \beta(1 - s)\, \mathrm{E}_t \left[J_{t+1}\right]$$

Taking the first-order condition shows that the solution satisfies

$$\frac{S_t^w}{S_t^f} = \frac{\phi}{1-\phi} \iff W_t - U_t = \frac{\phi}{1-\phi} J_t \tag{8}$$

Proof: Optional exercise. [**Note:** Also can write as $S_t^w = \phi S_t$ where $S_t = S_t^w + S_t^f$]

Defining a stochastic recursive equilibrium

Stochastic Recursive Equilibrium

Let Ω denote the aggregate state this period. A **stochastic recursive equilibrium** is:

- Policy functions $\theta(\Omega),\ w(\Omega)$ and value functions $U(\Omega),\ W(\Omega),\ J(\Omega)$
- Law of motion for unemployment (7): $u' = G(\Omega) = \big(1 - f(\theta(\Omega))\big)u + s(1-u)$
- Stochastic process for productivity: $y' \sim F(y' \mid y)$

Where these objects satisfy:

- Worker Bellman equations (2) and (3):

$$U(\Omega) = z + \beta\, \mathrm{E}_{\Omega'}\left[(1 - f(\theta(\Omega)))U(\Omega') + f(\theta(\Omega))W(\Omega')\right],$$

$$W(\Omega) = w(\Omega) + \beta\, \mathrm{E}_{\Omega'}\left[(1-s)W(\Omega') + sU(\Omega')\right].$$

- Firm Bellman equation and free entry (5) and (6):

$$J(\Omega) = y - w(\Omega) + \beta(1-s)\, \mathrm{E}_{\Omega'}[J(\Omega')], \qquad c = \beta\, q(\theta(\Omega))\, \mathrm{E}_{\Omega'}[J(\Omega')]$$

- Nash bargained wage (8):

$$W(\Omega) - U(\Omega) = \frac{\phi}{1-\phi} J(\Omega)$$

Question: Among the variables U, W, J, θ, w, u, y, which should be included in Ω?

Useful result: y_t is sufficient state for most variables

Tightness block: While $\Omega = (u, y)$, notice that u or u' do not appear anywhere in the five equations for $\theta(\Omega)$, $w(\Omega)$, $U(\Omega)$, $W(\Omega)$, $J(\Omega)$ on the previous slide

Can therefore guess and verify that y is the only relevant state variable for these variables, leaving the simpler functions $\theta(y)$, $w(y)$, $U(y)$, $W(y)$, $J(y)$ satisfying

$$U(y) = z + \beta \, \mathrm{E}_{y'} \left[(1 - f(\theta(y))) U(y') + f(\theta(y)) W(y') \right]$$

$$W(y) = w(y) + \beta \, \mathrm{E}_{y'} \left[(1 - s) W(y') + sU(y') \right]$$

$$J(y) = y - w(y) + \beta(1 - s) \, \mathrm{E}_{y'}[J(y')], \quad c = \beta \, q(\theta(y)) \, \mathrm{E}_{y'}[J(y')]$$

$$W(y) - U(y) = \frac{\phi}{1 - \phi} J(y)$$

Unemployment dynamics block: It is only to calculate u' that we need to know u as well:

$$u' = G(\Omega) = \big(1 - f(\theta(y))\big) u + s(1 - u)$$

This is a **block recursivity** result, which makes numerical solution simpler. Why?

Summary: Baseline DMP over the Cycle

Summary of dynamics in response to a change in aggregate productivity:

- Suppose at time t productivity happens to jump down from y to $\hat{y} < y$
- Tightness **jumps** down from $\theta(y)$ to $\theta(\hat{y})$
  - Intuition: Decline in y reduces firm value $\mathrm{E}\, J(y')$ as long as y is persistent, which lowers incentives to post vacancies and hence lowers $\theta(y)$.
  - More precisely, lower $\mathrm{E}\, J(y')$ requires higher $q(\theta)$ to balance free entry condition, and $q'(\theta) < 0$ means θ must fall
- Worker job finding rate therefore **jumps** down from $f(\theta(y))$ to $f(\theta(\hat{y}))$
- Unemployment then **gradually** rises according to

$$u' = \big(1 - f(\theta(\hat{y}))\big)u + s(1 - u)$$

Numerically solving the model in practice:

1. (Log) linearise the model using Dynare. Generate IRFs or simulations
2. Nonlinearly solve the model using VFI, projection methods, ...
   - Discretise the productivity shock y and solve for $\theta(y)$ etc
   - Set an initial u_0, y_0 and simulate y_t to generate time series for θ_t, u_t, ...

Steady State

Steady State

Many textbook analyses focus on steady state. Since this is a quantitative course, we are more interested in dynamics, but still need to compute the steady state first.

First list the equations in steady state:

$$U = z + \beta\left[(1 - f(\theta))U + f(\theta)W\right]$$

$$W = w + \beta\left[(1 - s)W + sU\right]$$

$$J = y - w + \beta(1 - s)J$$

$$W - U = \frac{\phi}{1 - \phi}J$$

$$c = \beta q(\theta)J$$

$$u = \frac{s}{s + f(\theta)}$$

Some useful insights:

- Since $\theta = v/u$, $u = \frac{s}{s+f(\theta)}$ traces out a steady-state Beveridge curve
- Common to trace out a "Wage curve" and "Job creation curve" to graphically determine steady state θ and w (see e.g. Pissarides, 2000)
- Wage curve is helpful for intuition:

$$w = \phi y + (1 - \phi)z + \phi\theta c$$

but beware, it does not hold exactly out of steady state!

Comparative statics and the Fundamental Surplus

Suppose the matching function has the Cobb–Douglas form $M(u, v) = Au^{\alpha} v^{1-\alpha}$, where $A > 0$, and $\alpha = 0.5$ is the elasticity of matching with respect to unemployment.

Shimer (2005):

- In the data, the cyclical standard deviation of tightness θ is around 20 times higher than that of labour productivity $\implies$ very high amplification needed to explain θ and u movements with productivity shocks alone
- The steady state elasticity of θ to y, $\eta_{\theta,y}$, is a very good approximation to the cyclical standard deviation $\implies$ need $\eta_{\theta,y} \simeq 20$ for the basic DMP model to match the data

Ljungqvist and Sargent (2017): In the basic DMP model with Nash bargaining:

$$\eta_{\theta,y} = \frac{(r+s) + \phi f(\theta)}{\alpha(r+s) + \phi f(\theta)} \frac{y}{y-z} \equiv \Upsilon^{\text{Nash}} \frac{y}{y-z}$$

- $\Upsilon^{\text{Nash}} \simeq 1$ for Nash wages. Maximum value of $\Upsilon^{\text{Nash}} = \Upsilon^{\text{Sticky}} = 1/\alpha = 2$ when $\phi = 0$.
- $\implies \eta_{\theta,y} = 20$ needs $\frac{y}{y-z} \geq 10$, aka a very low "fundamental surplus fraction" $\frac{y-z}{y}$
- Basic model needs high (and to a lesser extent sticky) wages to generate volatile u

Efficiency and the Planner's Problem

Planner's Problem

Definition of planner's problem: chooses decisions and consumption of everyone in the economy, but is still subject to the resource constraints and matching function.

Chooses sequence of vacancies to maximise expected discounted output net of posting costs. Let $V^p(n, y)$ be planner's current value. Can state recursively as

$$V^p(n, y) = \max_{\theta} yn + z(1 - n) - c\theta(1 - n) + \beta \, \mathrm{E}_{y'} \left[V^p(n', y') \right]$$

subject to $n' = f(\theta)(1 - n) + (1 - s)n$. Notice $u = 1 - n$ and $c\theta(1 - n) = cv$.

FOC for θ:

$$c = \beta f'(\theta) \, \mathrm{E}_{y'} \left[V_n^p(n', y') \right] \tag{9}$$

Envelope condition for $V_n^p(n, y)$:

$$V_n^p(n, y) = y - z + c\theta + \beta(1 - f(\theta) - s) \, \mathrm{E}_{y'} \left[V_n^p(n', y') \right] \tag{10}$$

Planner's Problem (II)

Guess and verify that $V^p(n,y) = V^0(y) + J^p(y)n$, which $\implies V^p_n(n,y) = J^p(y)$

Plug into FOC and ET:

$$c = \beta f'(\theta^p(y)) \, \mathbb{E}_{y'}\left[J^p(y')\right] \tag{11}$$

$$J^p(y) = y - z + c\theta^p(y) + \beta(1 - f(\theta^p(y)) - s) \, \mathbb{E}_{y'}\left[J^p(y')\right] \tag{12}$$

where this gives two equations in $J^p(y)$ and $\theta^p(y)$ where n does not appear. Also confirms that planner's optimal tightness is a function of y only too $\theta^p(y)$

Check: Finally, plug $V^p(n,y) = V^0(y) + J^p(y)n$ into the Bellman to solve for $V^0(y)$ and check that assumed form is valid:

$$V^0(y) + J^p(y)n = yn + z(1-n) - c\theta^p(y)(1-n) + \beta \, \mathbb{E}_{y'}\left[V^0(y') + J^p(y')n'\right]$$

where $n' = f(\theta^p(y))(1-n) + (1-s)n$

Summary: (11) and (12) define planner's solution for J and θ. Looks familiar?

Planner versus market allocation

Equations (11) and (12) look very similar (but not identical) to free entry condition and firm value from the decentralised allocation:

Equilibrium tightness:

- Market: $c = \beta\, q(\theta(y))\, \mathrm{E}_{y'}[J(y')]$
- Planner: $c = \beta f'(\theta^p(y))\, \mathrm{E}_{y'}\left[J^p(y')\right]$

Value of a job:

- Market: $J(y) = y - w(y) + \beta(1-s)\, \mathrm{E}_{y'}[J(y')]$
- Planner: $J^p(y) = y - z + c\theta^p(y) + \beta(1 - f(\theta^p(y)) - s)\, \mathrm{E}_{y'}\left[J^p(y')\right]$

Decentralised equilibrium may be therefore be inefficient due to:

1. **Congestion externality**: vacancy posting lowers $q(\theta)$ for other firms ($\theta(y) > \theta^p(y)$)
2. **Hold-up problem**: vacancy costs are sunk before bargaining ($\theta(y) < \theta^p(y)$)

Hosios (1990): with $M(u,v) = Au^{\alpha}v^{1-\alpha}$, the decentralised allocation is constrained efficient in steady state iff $\phi = \alpha$. Intuition: bargaining internalises search externality.

Optional exercise: Prove the “Hosios condition” in our model.

Summary and next week

Summary and next week

Today: *(data and theory set up)*

- Flows (especially job finding rate) explain unemployment dynamics
- DMP provides a tractable framework, emphasising role of market tightness θ
- Planner's solution and Hosios condition clarify efficiency

Next week: *(quantitative solution and implications)*

- Baseline model underpredicts volatility (Shimer puzzle) $\Rightarrow$ role for wage rigidity, small surplus, NK amplification, removing free entry, ...
- How to solve the model linearly and nonlinearly

Reading List (Part 1)

Core Textbooks and required reading

Core textbooks: *[not required reading, but useful resources]*

- Pissarides (2000): *Equilibrium Unemployment Theory (2nd ed)*. Foundation of the DMP framework, Chapters 1–4
- Ljungqvist and Sargent (2018): *Recursive Macroeconomic Theory (4th ed)*. Chapters on search model.

Background reading / history of economic thought: *[not required reading]*

- Their Nobel prize acceptance speeches are great, see e.g. Pissarides (2011)

The following papers are considered required reading:

- Shimer (2005) "The Cyclical Behavior of Equilibrium Unemployment and Vacancies"
- Hall (2005) "Employment Fluctuations with Equilibrium Wage Stickiness"
- Ljungqvist and Sargent (2017) "The Fundamental Surplus"
- *[no need to memorise or perfectly understand everything, but you must at least read these]*

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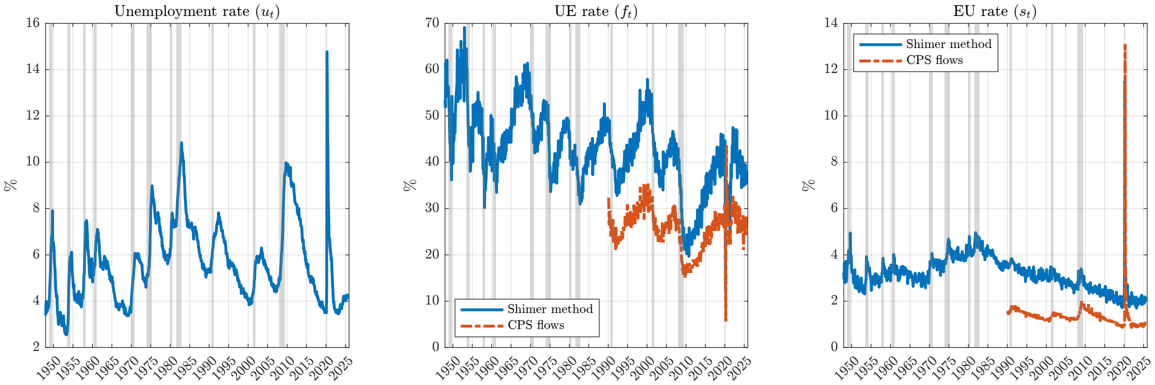
Appendix

US data: unemployment, job finding, and job separation rates ▸ return



Monthly frequency, seasonally adjusted, not smoothed. Source: CPS and author's calculations.

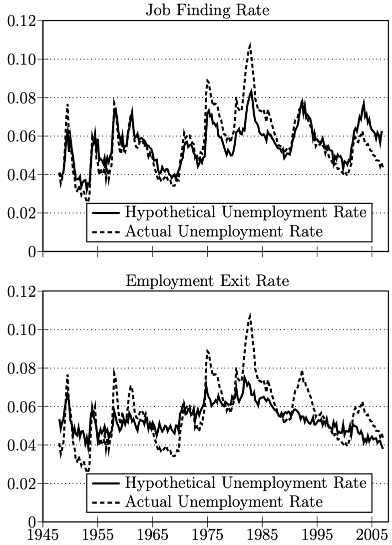
Average levels: $u \approx 5\%$; $f \approx 25\text{-}40\%$ per month; $s \approx 1\text{-}3\%$ per month

Cyclicality: recessions feature a large and persistent fall in f_t, large short spike up in s_t

Data: Shimer (2005) method uses stocks to calculate flows in a two-state-consistent manner. CPS flows use panel dimension of CPS survey to directly compute UE and EU

Shimer (2012): Ins and Outs of Unemployment

return



Goal: Decompose unemployment dynamics into contributions from (i) inflows s_t and (ii) outflows f_t

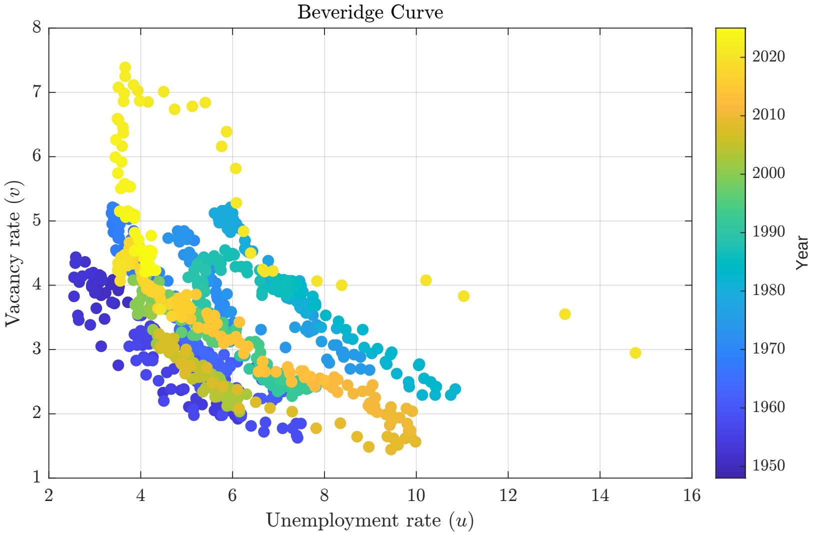
Method:

- Start with steady state approximation $u_t \simeq \frac{s_t}{s_t+f_t}$
- Construct a *hypothetical unemployment rate* holding one flow constant at its mean while allowing the other to vary
- Compare hypothetical series to the actual unemployment rate

Result:

- Fluctuations in the **job-finding rate** account for *nearly all* cyclical unemployment variation
- Separation rate plays a small role except in recessions with large spikes

US Beveridge Curve ▸ return



Monthly frequency, seasonally adjusted. Source: CPS and author's calculations.