

## **TA 1 - Monetary Theory and Policy 30159**

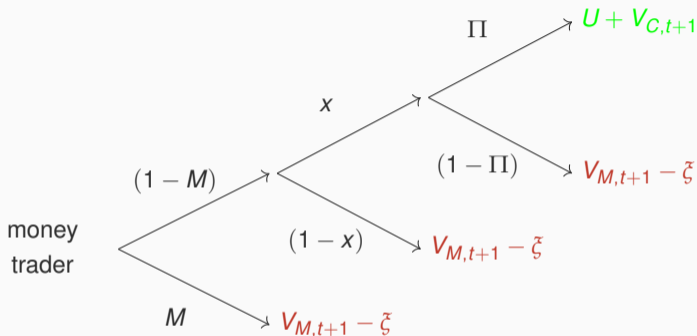
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Piero De Dominicis  
Bocconi University

## Plans for today

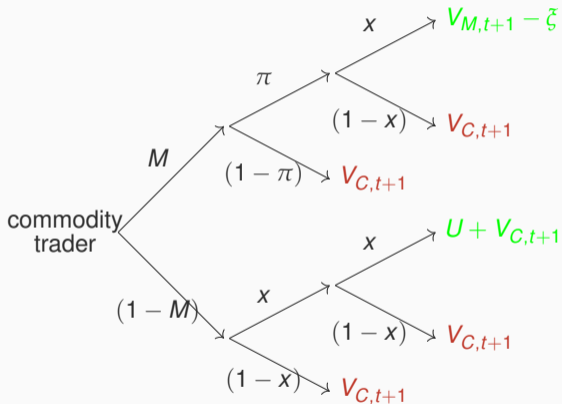
- Discussion of Problem Sets
- Understanding the status of the economy using the Beveridge curve

## Kiyotaki-Wright Model: Money Trader



- Green: payoffs from actual exchanges
- Red: payoffs not related to exchanges
- $\bar{\zeta}$ : utility cost of holding money

# Kiyotaki-Wright Model: Commodity Trader



## Payoffs from Holding Money and Goods at Time $t$

$$V_{M,t} = \frac{1}{1+r} \left\{ (1-M)x\Pi(U + V_{C,t+1}) + [1 - (1-M)x\Pi](V_{M,t+1} - \xi) \right\} \quad (1)$$

$$V_{C,t} = \frac{1}{1+r} \left\{ (1-M)x^2U + Mx\pi(V_{M,t+1} - \xi) + (1-Mx\pi)(V_{C,t+1}) \right\} \quad (2)$$

- $V_{M,t}$ : Expected utility of holding money at time  $t$
- $V_{C,t}$ : Expected utility of holding a good at time  $t$

## Simplified Difference: $V_C - V_M$

Using stationarity ( $V_{M,t} = V_{M,t+1} = V_M$ ,  $V_{C,t} = V_{C,t+1} = V_C$ ) and symmetry ( $\pi = \Pi$ ):

$$rV_M = (1 - M)x\Pi(U + V_C - V_M + \xi) - \xi \quad (3)$$

$$rV_C = (1 - M)x^2U - Mx\Pi(V_C - V_M - \xi) \quad (4)$$

Subtracting equation (3) from (4) and simplifying:

$$V_C - V_M = \frac{(1 - M)xU(x - \Pi) + \xi(1 - x\Pi)}{r + \Pi x} \quad (5)$$

## Threshold Equation

At the threshold  $\Pi^*$ , agents are indifferent:  $V_C = V_M$

This occurs when:

$$(1 - M) xU(x - \Pi^*) + \zeta(1 - x\Pi^*) = 0 \quad (6)$$

Solving for  $\Pi^*$ :

$$\Pi^* = x + \frac{(1 - x^2) \zeta}{(1 - M) Ux + \zeta x} \quad (7)$$

- When  $\Pi < \Pi^*$ : Never accept money ( $\pi = 0$ )
- When  $\Pi > \Pi^*$ : Always accept money ( $\pi = 1$ )
- When  $\Pi = \Pi^*$ : Indifferent ( $\pi \in (0, 1]$ )

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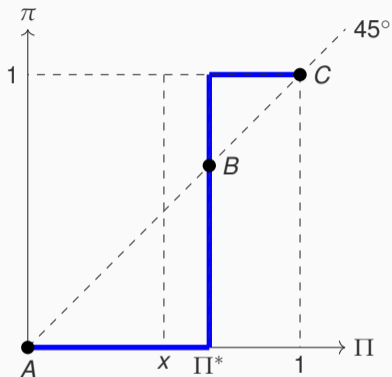
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Solving for  $\Pi^*$ :

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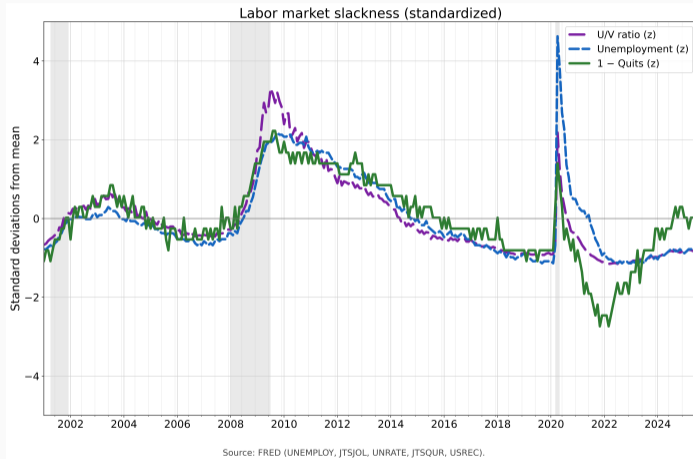
- When  $\Pi < \Pi^*$ : Never accept money ( $\pi = 0$ )
- When  $\Pi > \Pi^*$ : Always accept money ( $\pi = 1$ )
- When  $\Pi = \Pi^*$ : Indifferent ( $\pi \in (0, 1]$ )
- **Key difference:** With cost  $\zeta > 0$ ,  $\Pi^* > x$ , requiring higher money acceptability to compensate for the holding cost

## Threshold Graph: Three Equilibria



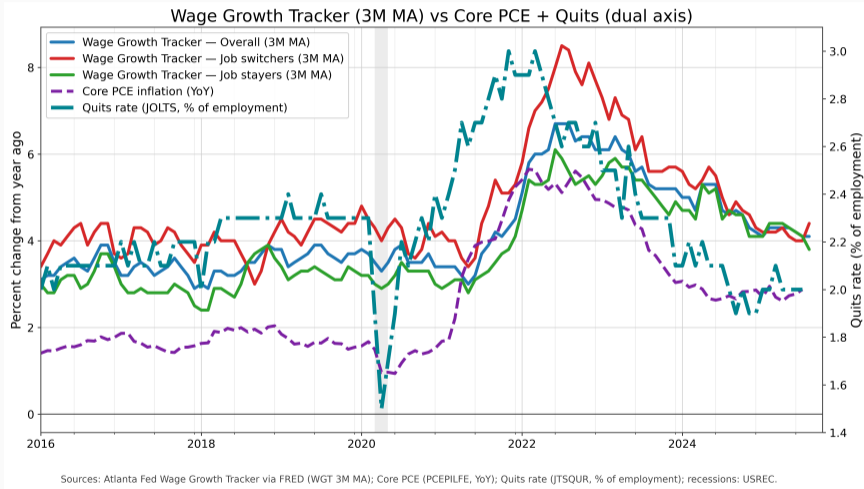
- $A$ : Nonmonetary equilibrium ( $\Pi = 0$ )
- $B$ : Mixed monetary equilibrium ( $\Pi = \Pi^*$ )
- $C$ : Pure monetary equilibrium ( $\Pi = 1$ )

# Standardized Measures of Labor Market Slackness

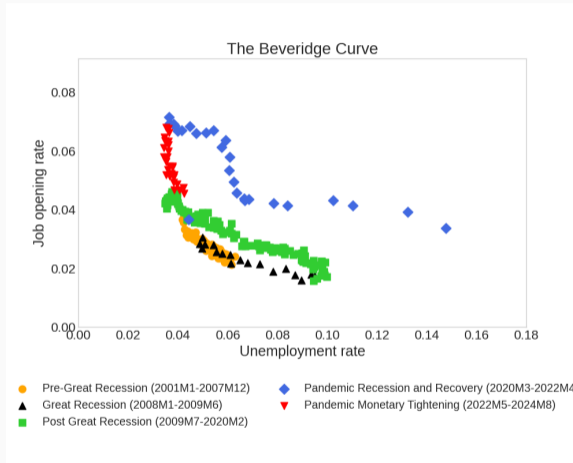


- After the pandemic, measures of labor market slackness diverged, what else can we say?

# Real Wage Growth Tracker

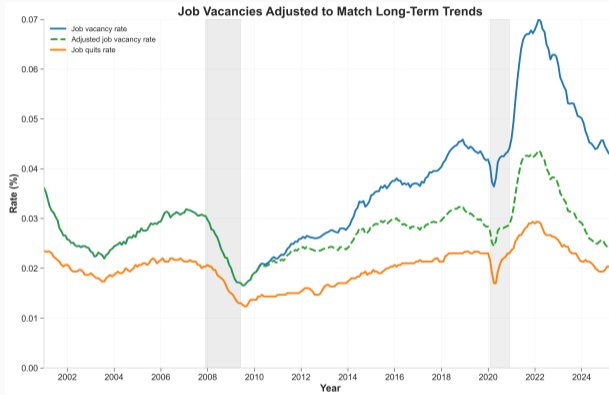


# Beveridge Curve



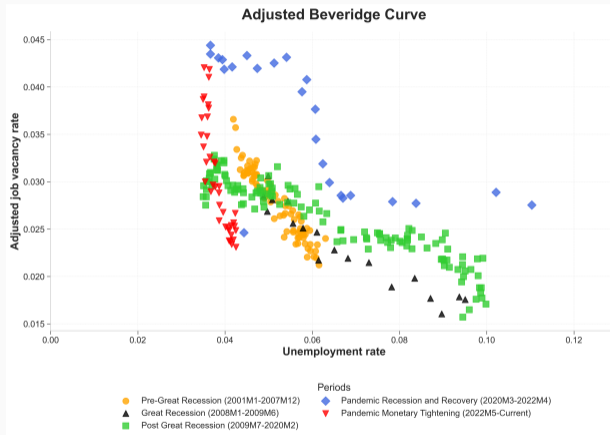
- Labor market tightness around pre-covid level

# Vacancy Rate, Adjusted Vacancy Rate and Quits Rate



- Removing the trend in vacancy rate shows a much lower labor demand

# Adjusted Beveridge Curve



- Labor market less tight than it seems!

# Plan

- Introduce framework from Blanchard, Domash and Summers (BDS) 2022 Policy Report.
- Following *“The Shifting Reasons for Beveridge-Curve Shifts”* Barlevy, Faberman, Hobbj, Sahin 2024 JEP
  - ⇒ Decompose shifts in the Beveridge curve during and after Covid using BDS framework
- Benigno Eggertson 2025 Jackson Hole Symposium: when  $v/u > 1$  Beveridge curve is steeper

## The discussion on “soft-landing”

- A key post-pandemic concern is whether inflation could be reduced without a significant rise in unemployment, achieving a “soft landing.”
- The Beveridge curve, which shows the relationship between vacancies and unemployment, helps assess this tradeoff.
- Understanding shifts in the Beveridge curve is essential to evaluate the path to a soft/hard landing.
- Structural factors influencing the Beveridge curve must be analyzed.

## Blanchard, Domash and Summers interpretative framework - Activity relation

- We can think of unemployment and vacancies as being determined by two relations
  1. **Activity relation:** relation between aggregate activity, unemployment and vacancies.
  2. **Matching relation:** captures the matching process going on in the labor market.
- **Activity relation:** the stronger aggregate activity, the higher the number of vacancies, the smaller the number of unemployed.
- Mathematically:  $\frac{V}{U} = x$  where  $V$  is vacancies,  $U$  is unemployment and  $x$  is an index of activity:

$$\frac{V}{U} = x \Leftrightarrow \frac{V/N}{U/N} = x \Leftrightarrow \frac{v}{u} = x$$

where  $N$  is the labor force,  $v$  is the *vacancy rate* and  $u$  is the *unemployment rate*.

- BFHS 2024 call this the *Job Creation Curve*: it reflects the strength of labor demand *i.e.* the job openings rate at different level of the unemployment rate.

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## Blanchard, Domash and Summers interpretative framework - Matching relation

- **Matching relation:** relation between gross hires, unemployment and vacancies.
- Gross hires depend on vacancies posted by firms and number of workers looking for job: the more  $U$  and the more  $V$ , the more hirings  $H$ .
- *Assumption:* only unemployed are looking for a job.
- Formalized as:

$$H = a \cdot m(U, V)$$

where  $m(\cdot)$  is the so-called *matching function* and  $a$  is *the matching efficiency*.

- Empirical studies suggests that  $m(\cdot)$  has CRS, use Cobb-Douglas to get:

$$H = a \cdot U^\alpha V^{1-\alpha}$$

- Normalize by  $N$  to get:

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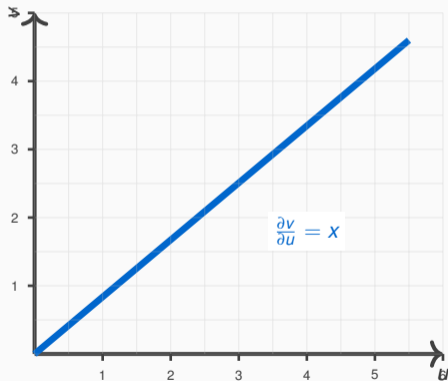
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## Beveridge space framework - Activity relation

We now plot the two relations in the Beveridge space, defined over  $(u, v)$

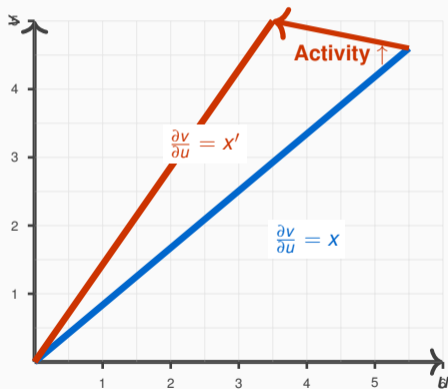
- Rewrite  $v = xu$ ,  $u$  and  $v$  have a linear relation governed by aggregate activity.



## Beveridge space framework - Activity relation

We now plot the two relations in the Beveridge space, defined over  $(u, v)$

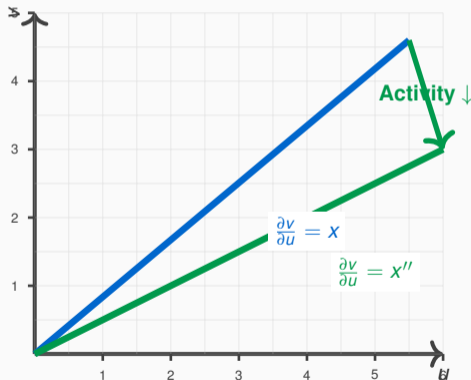
- Aggregate activity increases  $x \rightarrow x'$



## Beveridge space framework - Activity relation

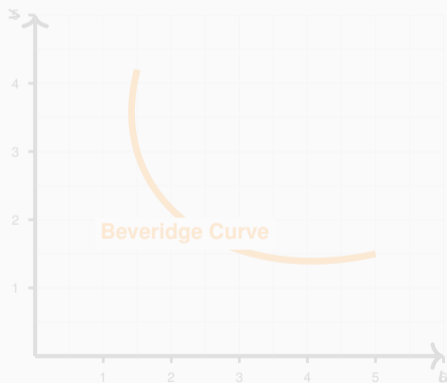
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- Aggregate activity decreases  $x \rightarrow x''$



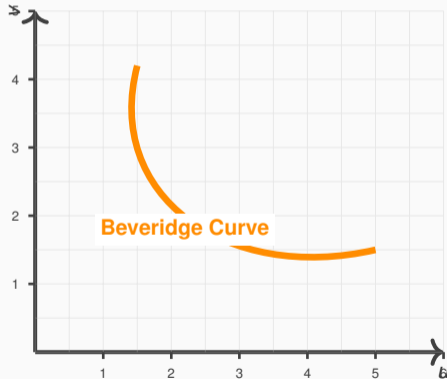
## Beveridge space framework - Matching relation

- Do some algebra to get  $v = \left(\frac{h}{au^\alpha}\right)^{\frac{1}{1-\alpha}}$
- *Convex* relation between the unemployment rate and the vacancy rate, that is the **Beveridge Curve!**



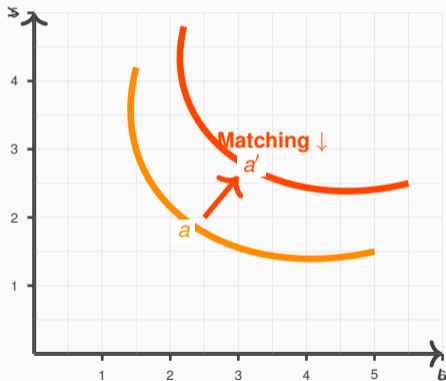
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## Beveridge space framework - Matching relation

- Do some algebra to get  $v = \left(\frac{h}{au^\alpha}\right)^{\frac{1}{1-\alpha}}$
- A decrease in the matching efficiency  $a \rightarrow a'$  shifts the curve upward!



## Beveridge space framework - Matching relation

- Do some algebra to get  $v = \left(\frac{h}{au^\alpha}\right)^{\frac{1}{1-\alpha}}$
- An increase in the gross hires wrt to the labor force  $h \rightarrow h'$  shifts the curve upward!
- We can also think of an increase in  $h$  as an increase in *labor reallocation*



# Beveridge space framework - Activity & Matching relation

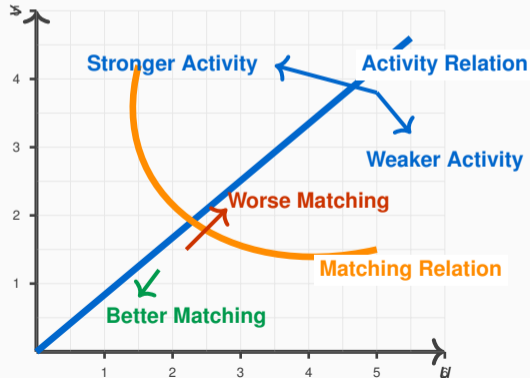
- Together, these two relations determine  $u$  and  $v$ :

$$\frac{v}{u} = x$$

$$h = au^\alpha v^{1-\alpha}$$

Activity relation

Matching relation



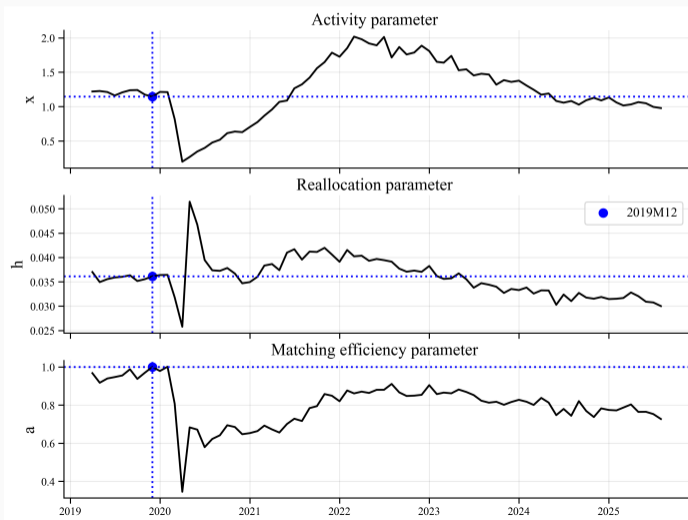
## Taking the model to the data

- With this framework we can decompose movements in  $u$  and  $v$  due to:
  1. aggregate activity;
  2. matching efficiency;
  3. reallocation.
- Using the following time series:
  - JTSJOL - *Job Openings: Total Nonfarm, Level in Thousands, Monthly, Seasonally Adjusted*
  - JTSHIL - *Hires: Total Nonfarm, Level in Thousands, Monthly, Seasonally Adjusted*
  - UNEMPLOY - *Unemployment Level, Thousands of Persons, Monthly, Seasonally Adjusted*
  - CLF16OV - *Civilian Labor Force Level, Thousands of Persons, Monthly, Seasonally Adjusted*
- **we can bring this framework to the data!** Steps:
  - Construct a time series for *aggregate activity* using activity relation  $\Rightarrow \hat{x}_t = \frac{v_t}{u_t}$
  - Construct a time series for *reallocation* using its definition  $\Rightarrow \hat{h}_t = \frac{H_t}{N_t}$
  - Assume  $\alpha = 0.6$  and construct a time series for *matching efficiency* using matching relation:

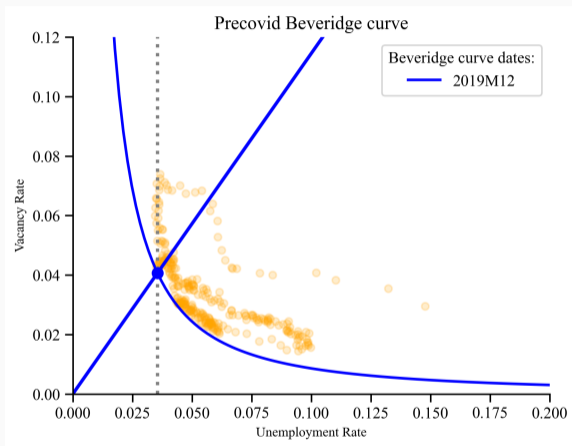
$$\hat{a}_t = \frac{\hat{h}_t}{u_t^\alpha v_t^{1-\alpha}}$$

## Precovid labor market - structural time series

- Throughout our analysis we will consider the Precovid level as our equilibrium benchmark

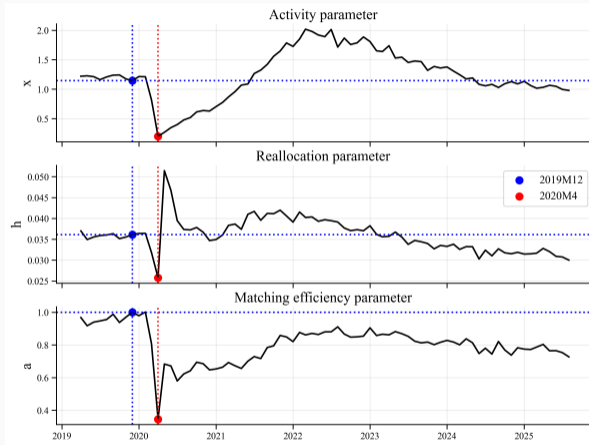


## Precovid labor market - Beveridge curve



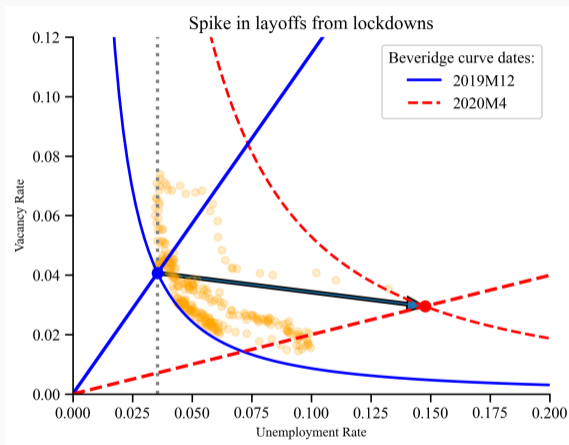
- Precovid the unemployment rate was relatively low

# Spike in layoffs from lockdowns - structural time series



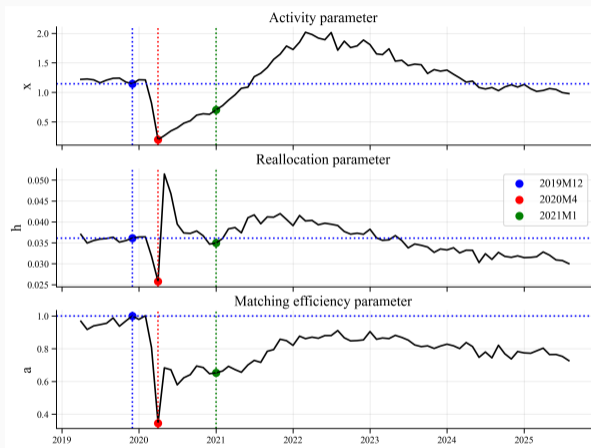
- Record layoffs in March 2020 (many layoffs were temporary)

## Spike in layoffs from lockdowns - Beveridge curve



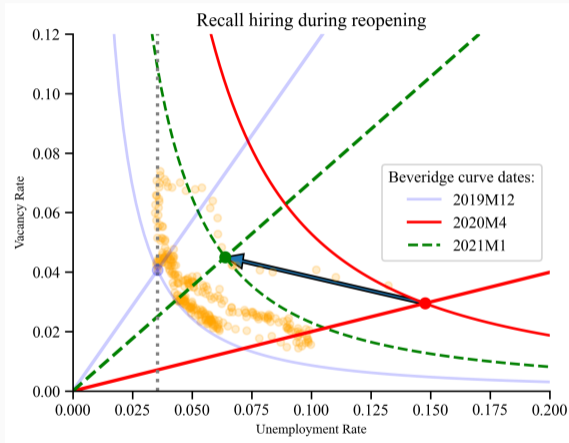
- Decrease in matching dominated the decrease in hiring.
- $u$  jumped to a post-war record 14.7%, job openings barely changed.

## Recall hiring during reopening - structural time series



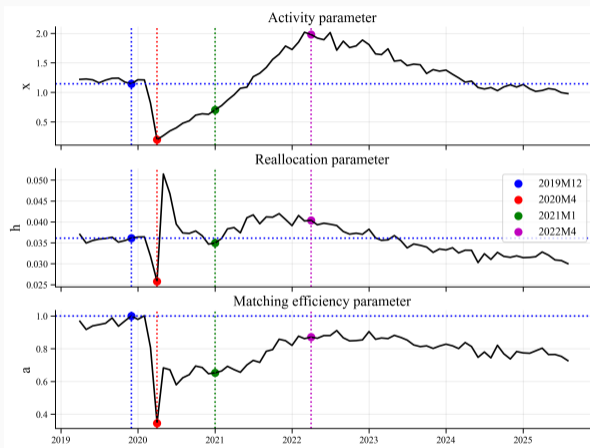
- Matching goes up as workers were “rematched” with former employers
- Change in composition of demand away from in-person services create a gap between the needs of employers and skills of those unemployed

# Recall hiring during reopening - Beveridge curve



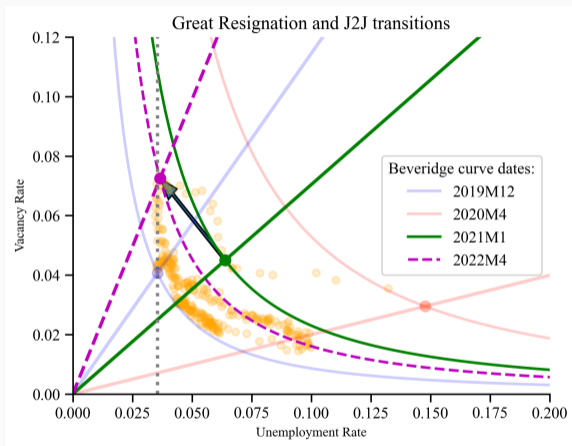
- Unemployment rate retreated to 6.3% without notable increase in job openings rate.
- Limited renormalization of life resulted in recovery and demand for workers.

# Great Resignation and J2J transitions - structural time series



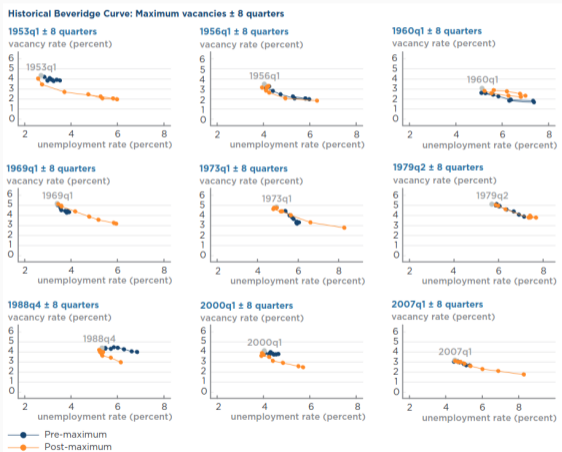
- *The Great Resignation*: many workers decided to switch jobs.
- Spring 2022 peak in the quits rate (3%), higher reallocation.

## Great Resignation and J2J transitions - Beveridge curve



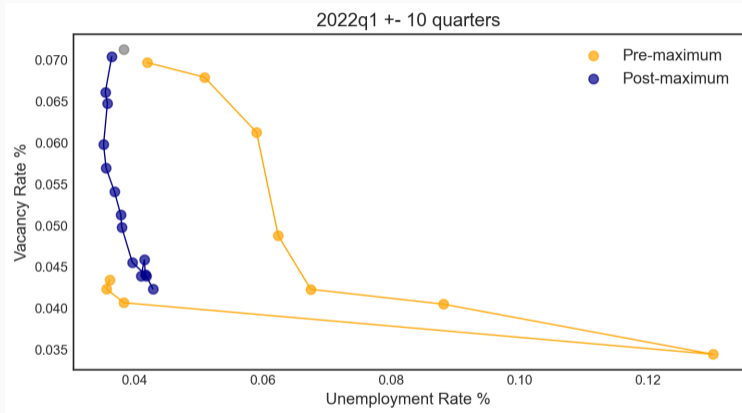
- Higher competition  $\Rightarrow$  jobs finding rate for unemployed decreases
- Firms' decision to post vacancies are higher when more employed looking to change jobs  $\Rightarrow$   $v \uparrow$  to a post-war high of 7.4%

# What happens after reaching a peak in vacancy rate - historical evidence



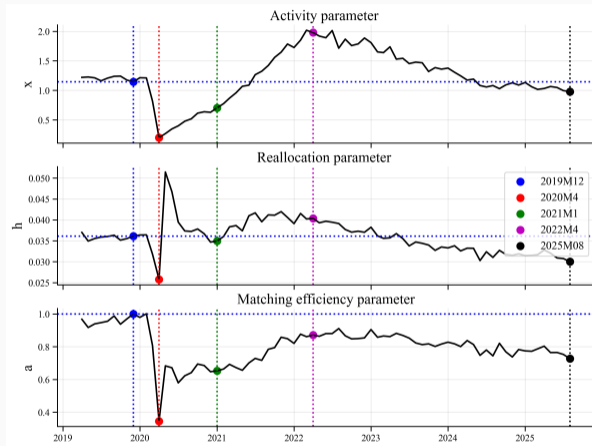
- After vacancies reached a peak, the unemployment rate always rose as the vacancy rate fell

# What happens after reaching a peak in vacancy rate - new evidence



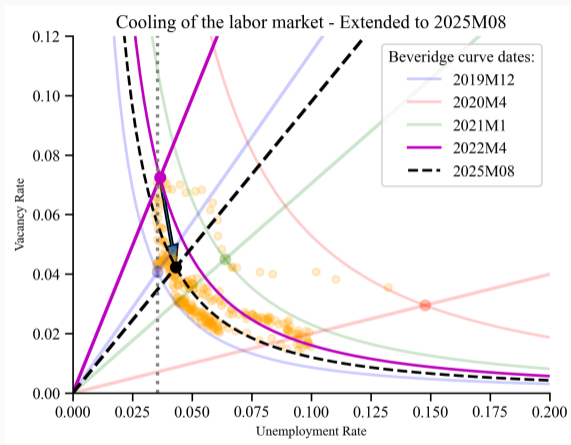
- New peak 2022q1 (in grey in the figure below)
- First time unemployment rate did not increase much as the vacancy rate drops

# Cooling of the labor market - structural time series



- Since early 2022, the quits rate declined more than other labor market measures
- Matching remains at lower level compared to before the Pandemic (Takehome 1)

## Cooling of the labor market - Beveridge curve



- Horizontal movements of the curves almost offset each other  $\Rightarrow v \downarrow$  and  $u \approx \text{constant}$

## Key takeaways from BDS framework

- Recovery from the pandemic was very different from previous recessions
- Characterized by rapid recovery in labor demand and, more importantly, by *a surge in workers actively looking for new jobs!*
- Changes in job preferences for amenities likely reduced matching efficiency
- Employers posted more vacancies to compensate
- Labor market cooling did not increase the unemployment rate significantly

⇒ **It is likely that there has been a soft landing!**

# Benigno Eggertson Beveridge Curve

- Key modifications wrt to BDS (standard) framework:
  1. households decide whether to participate in the labor force  $F_t$
  2. exogenous fraction  $(1 - z_t)F_t$  are "attached" to existing firm
  3. fraction  $z_t F_t$  are "unattached" and search for employment
- At the end of each period, unattached workers are either employed or unemployed:

$$z_t F_t = H_t + U_t$$

- Matching function is the same:

$$H_t = a_t \cdot U_t^\alpha V_t^{1-\alpha}$$

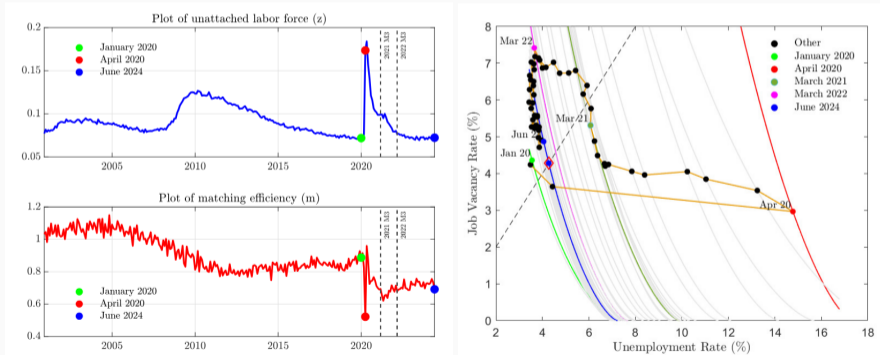
- Divide by the labor force  $F_t$ :

$$z_t - u_t = a_t u_t^\alpha v_t^{1-\alpha}$$

# Benigno Eggertson Beveridge Curve

- Beveridge curve is now:

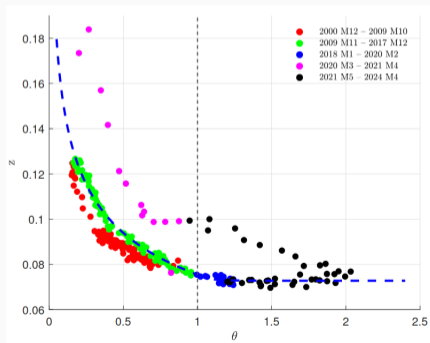
$$v_t = \left( \frac{z_t - u_t}{a_t u_t^\alpha} \right)^{\frac{1}{1-\alpha}}$$



# Benigno Eggertson Beveridge Curve with Threshold

- BE curve seems to do better after the Pandemic recovery
- Endogenize  $z_t$  assuming that:

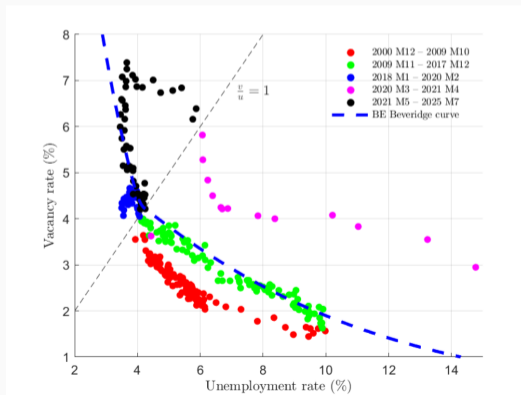
$$z(\theta_t) = \begin{cases} (\bar{z}_t - a_h) + a_h \theta_t^{-b_h}, & \text{if } \theta_t \geq 1, \\ (\bar{z}_t - a_l) + a_l \theta_t^{-b_l}, & \text{if } \theta_t < 1. \end{cases}$$



# Benigno Eggertson Beveridge Curve with Threshold

- New (and last) Beveridge Curve (of the day...), from  $z_t - u_t = a_t u_t^\alpha v_t^{1-\alpha}$  add  $z(\theta_t)$ :

$$0 = \begin{cases} m_t u_t^\eta v_t^{1-\eta} - \bar{z}_t - a_h (u_t^{b_h} v_t^{-b_h} - 1) + u_t, & \text{if } \theta_t \geq 1, \\ m_t u_t^\eta v_t^{1-\eta} - \bar{z}_t - a_l (u_t^{b_l} v_t^{-b_l} - 1) + u_t, & \text{if } \theta_t < 1. \end{cases}$$



## Policy Lessons from Benigno Eggertson 2025

- Inflation reductions more costly once the labor market crosses the Beveridge threshold ( $V/U < 1$ ).
- $V/U \approx 1$ : labor market still tight; normalization is gradual, not recessionary.
- Inflation  $\sim 3\%$  + tariff risks  $\Rightarrow$  wait for clear convergence to 2% before cutting.