Vacancy Yields in the Cross-section and Over Time

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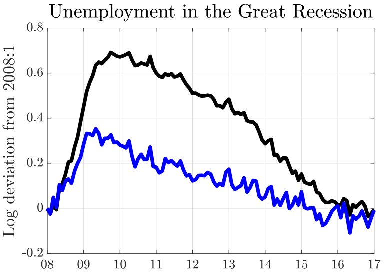
Unemployment Dynamics

- $u_{t+1} = \delta_t(1 - u_t) - p_t u_t$
- $H_t = \Phi_t V_t^{\alpha} U_t^{1-\alpha} \quad \rightarrow \quad p_t = \Phi_t \theta_t^{\alpha}$
- u_t: data u_t: counterfactual with constant Φ_t

Unemployment Dynamics



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Variation in match efficiency is crucial for labor market dynamics

Looking into the Black Box of Φ_t

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

Potential explanations:

- Mismatch btw vacancies and job seekers across sectors (Φ^O)
- Job seekers composition and job-search effort (Φ^W)

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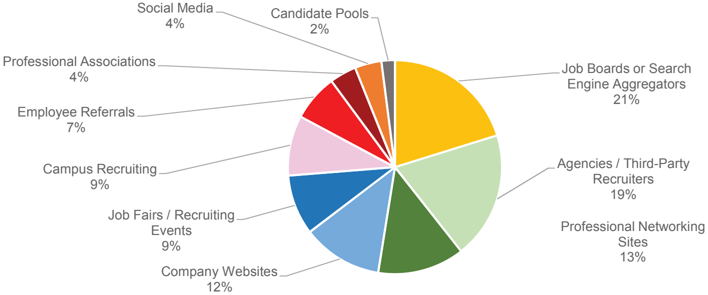
- Firm recruiting intensity per vacancy (Φ^{F})
  - Firms' recruiting expenditures

Recruiting Expenditures



Average cost per hire (>100 employees): $3,000-$4,000

Source: Bersin and Associates (2015)

Looking into the Black Box of Φ_t

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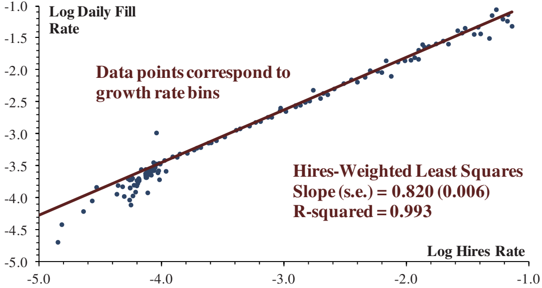
- Firm recruiting intensity per vacancy (Φ^F)
  - Firms' recruiting expenditures
  - Compensation
  - Hiring standards

Vacancy Yields in the Cross-Section



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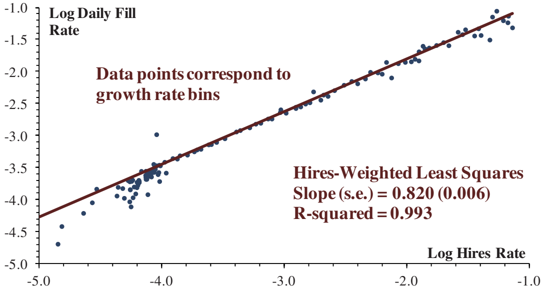

- Recruiting intensity varies across firms
- Strong log-linearity btw recruiting intensity and firm growth rate

Aggregate match efficiency: Decomposition

$$H_t = \Phi_t^W \cdot \Phi_t^F \cdot \Phi_t^O \cdot V_t^\alpha U_t^{1-\alpha}$$

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Define:

$$S_t = s_t^U U_t + s_t^N N_t + s_t^E E_t$$

$$V_t^* = \sum_i s_{it}^V(e_{it}, w_{it}, \varepsilon_{it}^{\min}) v_{it}$$

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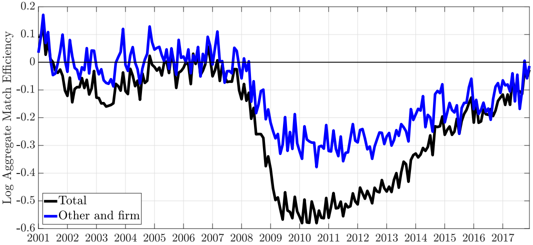
Combining:

$$H_t = \underbrace{\left[1 + \left(\frac{s_t^N}{s_t^U}\right)\frac{N_t}{U_t} + \left(\frac{s_t^E}{s_t^U}\right)\frac{E_t}{U_t}\right]^{1-\alpha}}_{\Phi_t^W = \left(\frac{S_t}{U_t}\right)^{1-\alpha}} \underbrace{\left[\sum_i s_{it}^V \frac{v_{it}}{V_t}\right]^{\alpha}}_{\Phi_t^F = \left(\frac{V_t^*}{V_t}\right)^{\alpha}} \Phi_t^O V_t^\alpha U_t^{1-\alpha}$$

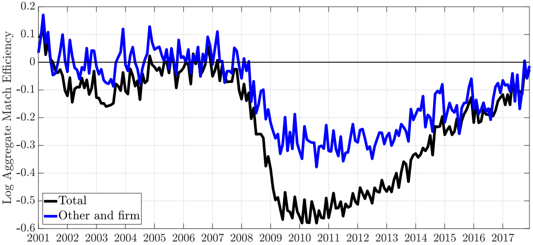
where Φ_t^O includes s_t^U.

Aggregate match efficiency: Decomposition



$$\Phi_t = \underbrace{\Phi_t^W}_{\approx 2/5} \cdot \underbrace{\Phi_t^F \cdot \Phi_t^O}_{\approx 3/5}$$

Aggregate match efficiency: Decomposition



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- What drives fluctuations in recruiting intensity Φ_t^F?
  - Composition effect: changes in the cross-section of hiring firms
  - Slackness effect: firm response to aggregate labor market conditions

Today

- Simple model to guide empirical analysis on recruiting intensity
  - It extends Gavazza-Mongey-Violante (2018)

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- Assess determinants of recruiting intensity at micro-level
- Relative importance of composition vs slackness effects
- Relative importance of expenditures, wages, and selectivity
- Road ahead

Recruiting Expenditures

Firm's problem:

$$
\begin{aligned}
v\left(n_{it}, z_{it}\right) &= \max_{n_{i,t+1}, v_{it}, e_{it}} \pi(z_{it}, n_{i,t+1}, n_{it}, v_{it}, e_{it}) + \beta \mathbb{E}_t \left[v\left(n_{i,t+1}, z_{i,t+1}\right)\right] \\
& \quad s.t. \\
\pi_{it} &= f\left(z_{it}, n_{i,t+1}\right) - W_t n_{i,t+1} - C\left(n_{it}, v_{it}, e_{it}\right) \\
h_{it} &:= n_{i,t+1} - (1-\delta)\, n_{it} = q\left(\Phi_t, \theta_t\right) e_{it} v_{it}
\end{aligned}
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- Separability between $n_{i,t+1}$ and (e_{it}, v_{it}): two-stage maximization
  1. Given (n_{it}, z_{it}), choose h_{it}
  2. Given h_{it}, choose (e_{it}, v_{it})

Choice of vacancies and effort

$$
\begin{aligned}
\mathcal{C}(h_{it}, n_{it}) &= \min_{e_{it}, v_{it}} : \left[\frac{\kappa_e}{\gamma_e} e_{it}^{\gamma_e} + \frac{\kappa_v}{1+\gamma_v} \left(\frac{v_{it}}{n_{it}} \right)^{\gamma_v} \right] v_{it} \\
& s.t. \\
h_{it} &= q(\Phi_t, \theta_t) \underbrace{\mu_{j(i)} e_{it} v_{it}}_{v_{it}^*}
\end{aligned}
$$

where $\gamma_e > 1$, $\gamma_v > 0$, $q\left(\Phi_t, \theta_t\right) = \Phi_t \theta_t^{-(1-\alpha)}$. Let $\gamma := \frac{\gamma_v}{\gamma_e + \gamma_v}$

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Choice of functional form dictated by reverse engineering

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Choice of functional form dictated by reverse engineering

Optimality:

$$
\log e_{it} = \Omega - \gamma \log q(\Phi_t, \theta_t) - \gamma \log \mu_{j(i)} + \gamma \log \left(\frac{h_{it}}{n_{it}} \right)
$$

Empirical implementation

Model:

$$\log\left(\frac{h_{it}}{v_{it}}\right) = \log\Omega + (1-\gamma)\log q(\Phi_t, \theta_t) + (1-\gamma)\log\mu_{j(i)} + \gamma\log\left(\frac{h_{it}}{n_{it}}\right)$$

Data:

$$\log\left(\frac{h_{it}}{v_{it}}\right) = \beta_0 + D_t + D_{j(i)} + \beta_1\log\left(\frac{h_{it}}{n_{it}}\right) + \vartheta_{it}.$$

- $\hat{\beta}_1 = \gamma$
- $\hat{D}_t = (1-\gamma)\log q(\Phi_t, \theta_t) \rightarrow \log q(\Phi_t, \theta_t)$

JOLTS

- Job Openings Labor Turnover Survey (since 2001)
- Survey of approximately 16,000 U.S. business establishments collected by the Bureau of Labor Statistics
- Monthly data on employment, vacancies, hires, quits and layoffs

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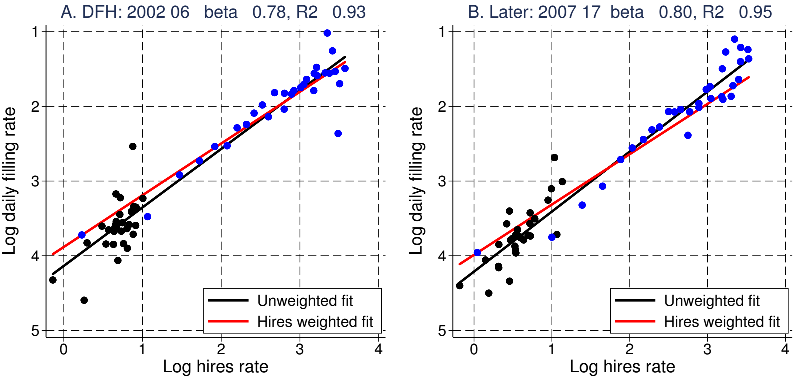
Estimation on JOLTS micro data



Notes: Firms binned by (net) growth rates. **Black** points are hires rates at firms with **net negative growth rates**. **Blue** points are hires rates at firms with **net positive growth rates**.

Aggregation

$$\Phi_t^F \quad := \left(\frac{V_t^*}{V_t}\right)^{\alpha} = \left[\sum_i \mu_{j(i)} e_{it} \frac{v_{it}}{V_t}\right]^{\alpha}$$

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Substituting the optimal effort decision:

$$\Delta \log \Phi_t^F \quad = \quad -\alpha\gamma\Delta \log q\left(\Phi_t, \theta_t\right) + \alpha\Delta \log \left[\sum_i \mu_{j(i)}^{1-\alpha} \left(\frac{h_{it}}{n_{it}}\right)^{\gamma} \left(\frac{v_{it}}{V_t}\right)\right]$$

$$q\left(\Phi_t, \theta_t\right) \quad = \quad \left(\Phi_t^F\right)^{-\left(\frac{1-\alpha}{\alpha}\right)} \cdot q\left(\Phi_t^W, \theta_t\right)$$

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$$q\left(\Phi_t, \theta_t\right) = \left(\Phi_t^F\right)^{-\left(\frac{1-\alpha}{\alpha}\right)} \cdot q\left(\Phi_t^W, \theta_t\right)$$

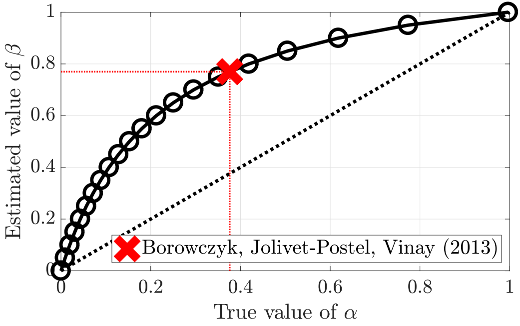
Collecting Φ_t^F terms:

$$\Delta \log \Phi_t^F = \underbrace{-\frac{\alpha\gamma}{1-\gamma\left(1-\alpha\right)}\Delta \log q\left(\Phi_t^W, \theta_t\right)}_{\text{slackness}} + \underbrace{\frac{\alpha}{1-\gamma\left(1-\alpha\right)}\Delta \log \left[\sum_i \mu_{j(i)}^{1-\gamma}\left(\frac{h_{it}}{n_{it}}\right)^{\gamma}\left(\frac{v_{it}}{V_t}\right)\right]}_{\text{composition}}$$

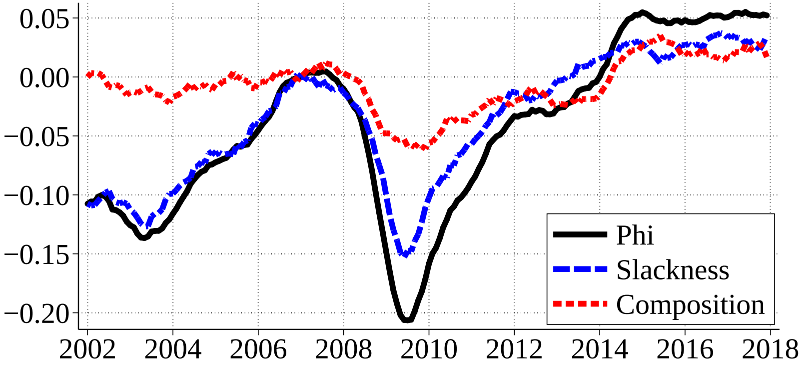
Bias in OLS estimates of α

$$\Delta \log \frac{H_t}{U_t} = \alpha \Delta \log \theta_t + \Delta \log \Phi_t$$

$$\Delta \log \frac{H_t}{U_t} = \underbrace{\left[\frac{\gamma(1-\alpha)\alpha}{1-\gamma(1-\alpha)} + \alpha \right]}_{\beta} \Delta \log \theta_t$$



Aggregate Recruiting Intensity



- Slackness effect is dominant
- Φ_t^F explains 80% of variation in $\Phi_t^F \cdot \Phi_t^O$

Allowing for heterogeneity in cost function

Proxy firm-level heterogeneity by observed characteristic x_i

$$\begin{aligned}
\mathcal{C}(h_{it}, n_{it}) &= \min_{e_{it}, v_{it}} : \left[\frac{\kappa_e\left(x_i\right)}{\gamma_e} e_{it}^{\gamma_e} + \frac{\kappa_v\left(x_i\right)}{1+\gamma_v} \left(\frac{v_{it}}{n_{it}}\right)^{\gamma_v} \right] v_{it} \\
& \quad s.t. \\
h_{it} &= q(\Phi_t, \theta_t) \underbrace{\mu\left(x_i\right) e_{it} v_{it}}_{v_{it}^*}
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Optimality:

$$\log e_{it} = \Omega\left(x_i\right) - \gamma \log q(\Phi_t, \theta_t) + \gamma \log\left(\frac{h_{it}}{n_{it}}\right)$$

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$$

Empirical implementation:

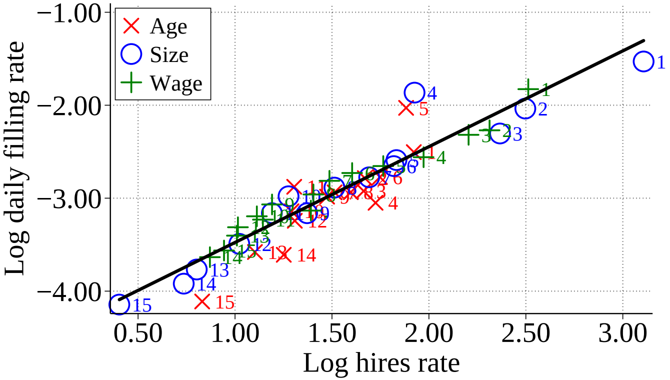
$$
\log \left(\frac{h_{it}}{v_{it}} \right) = D(x_i) + D_t + \beta_1 \log \left(\frac{h_{it}}{n_{it}} \right) + \vartheta_{it}.
$$

x_i: industry, size, turnover, age, wage

QCEW

- Quarterly Census of Employment and Wages
- QCEW microdata are a byproduct of the unemployment insurance (UI) accounting system
- BLS receives information on employment and wages from all employers covered under the UI program.
- Matched to JOLTS micro data through EIN
- Obtain: average establishment wage and firm age

Across Categories - Job Filling Rates



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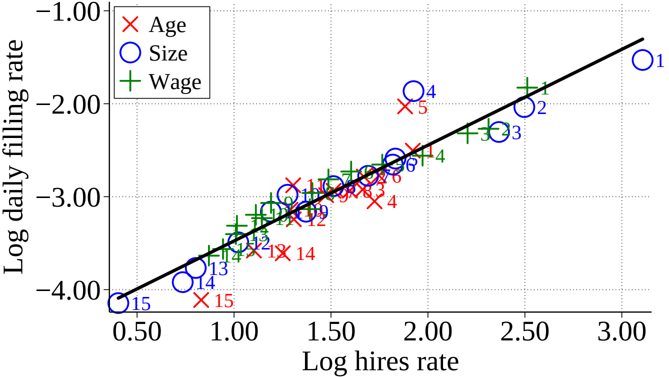

Heterogeneity in recruiting intensity across firms is revealed to us through differences in hiring rates

Adding Compensation

$$
\begin{aligned}
\mathcal{C}(h_{it}, n_{it}) &= \min_{e_{it}, v_{it}, w_{it}} : \frac{w_{it}}{1-\beta(1-\delta)} h_{it} + \left[\frac{\kappa_e}{\gamma_e} e_{it}^{\gamma_e} + \frac{\kappa_v}{1+\gamma_v} \left(\frac{v_{it}}{n_{it}} \right)^{\gamma_v} \right] v_{it} \\
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h_{it} &= q(\Phi_t, \theta_t) \psi(w_{it}) e_{it} v_{it} \\
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Optimality:

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\log\left(\frac{h_{it}}{v_{it}}\right) = \Omega_f + \frac{\gamma_e}{\gamma_e+\gamma_v} \log q_t + \frac{\gamma_v}{\gamma_e+\gamma_v} \log\left(\frac{h_{it}}{n_{it}}\right) + \psi\left(\frac{\gamma_e}{\gamma_e+\gamma_v}\right) \log w_{it}
$$

$$
\log w_{it} = \Omega_w - \frac{\gamma_e(1+\gamma_v)}{\gamma_e+\gamma_v+\psi\gamma_e(1+\gamma_v)} \log q_t + \frac{\gamma_v(\gamma_e-1)}{\gamma_e+\gamma_v+\psi\gamma_e(1+\gamma_v)} \log\left(\frac{h_{it}}{n_{it}}\right)
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$$

Identification: 3 estimated coefficients and 3 unknowns $(\psi, \gamma_e, \gamma_v)$

QWI

- Quarterly Workforce Indicators (Census)
- Source data: Longitudinal Employer-Household Dynamics (LEHD) linked employer-employee microdata
- The LEHD data is massive longitudinal database covering over 95% of U.S. private sector jobs
- It contains wages of new hires
- Census and BLS do not talk to each other, so we can't merge at firm-level, but can do it by (very disaggregated) cell

Road Ahead

- Two main results so far:
    - Slackness > Composition in driving aggregate recruiting intensity
    - Heterogeneity beyond hiring rate does not seem to matter

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- Two main results so far:
  - Slackness > Composition in driving aggregate recruiting intensity
  - Heterogeneity beyond hiring rate does not seem to matter
- Long to-do list:
  - We can incorporate the compensation margin (need to merge in data)
  - Hiring standards as a source of recruiting effort?
  - How do we deal with Φ^O component?