Vacancies and hiring through different recruiting channels

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  3. determine mapping from measured vacancies into hires
     - important advances in past decade; still work-in-progress
- We use rich dataset to study
  - Relationship b/w measured vacancies and hires *at firm level*
  - Firm recruiting, more broadly
  - Implications for aggregate labor markets

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3. Recruiting channels: market, networks, recall ($\sim$ 40-20-40%)
   - **Recall** hires are *negatively* correlated w/ vacancies
     - Recall hiring is *substitute* for vacancies
   - **Referral network** hires are positively correlated w/ vacancies

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4. **Matching function volatility** $\downarrow$ 40% if exclude recall hires

Data: 2003M1-2009M6, Denmark

1. **Matched employer-employee data**: Stats DK/Aarhus U
   - Workers: employment spells, wages...
   - Firms: employment, hires, separations...

2. **Firm revenues and purchases**: VAT accounts

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3. **Online job ads**: JobIndex, largest job board in DK
   - Posts ads directly or reposts from elsewhere ("all online ads")
   - Date of posting (flow), 1-digit occupation
   - *2/3 of ads include firm's Central Business Registry identifier*
     - Use CBR identifier to merge with MEE and VAT datasets
     - Discard firms w/o ads in 2003-09 (25% of VA) more

Definition of variables

Alternative definition of rates

- Levels, firm j:
  - N_{jt} = employment on first day of month t (stock)
  - H_{jt} = number of hires during month t (flow)
  - S_{jt} = number of separations during month t (flow)
  - V_{jt} = number of ads posted during month t (flow)
- Rates, firm j, month t:
  - Hiring rate: $h_{jt} = \frac{H_{jt}}{0.5(N_{jt}+N_{jt+1})}$
  - Separation rate: $s_{jt} = \frac{S_{jt}}{0.5(N_{jt}+N_{jt+1})}$
  - Vacancy rate: $v_{jt} = \frac{V_{jt}}{V_{jt}+N_{jt}}$

Descriptives

	Unweighted			Employment-weighted		
	Avg.	SD	% zero	Avg.	SD	% zero
Monthly hiring rate	0.069	0.155	50.9	0.060	0.135	13.8
Monthly separation rate	0.066	0.150	50.9	0.058	0.130	13.2
Monthly employment growth rate	0.003	0.207	42.8	0.001	0.180	13.6
Monthly vacancy rate	0.010	0.046	88.5	0.007	0.027	53.6

Number of firms: 21,160
Number of observations: 1,337,480

- Corr(v, u) = -0.81
- Monthly hiring rate is high (6.9%) and variable ($CV > 2$)

Empirical challenge

- Want to estimate relationship b/w vacancies and hires
- **Challenge**: many hires occur without measured vacancies
  - JOLTS survey: 42% of hires at establishments w/ 0 vacancies
  - Our data only captures firms' online recruitment effort
- **Literature** aggregates vacancies & hires for similar firms
  - *Davis, Faberman, Haltiwanger (2013)*; Carrillo-Tudela, Kaas, Gartner (2022); Mongey, Violante (2020); Mueller et al (2023)

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- **Our paper**: regress hiring rate on vacancy rate *at firm level*
  - Regression constant: *hiring w/o measured vacancies*
    - Alternative channels, passive search, measurement error...
  - Vacancy yield: *difference in firm-level hiring* w/ vacancies
  - If we aggregate: qualitatively similar results to literature

A simple model of firm recruiting

- $h_{jt} = h(\mathbf{e}_{jt}|\mathbf{x}_{jt})$
  - h_{jt}: hiring rate, firm j, month t
  - $\mathbf{e}_{jt} = (e_{jt}, e_{jt-1}...)$ = recruitment effort, including lags
    - Recruitment effort: vacancies *and vacancy yield*
  - $\mathbf{x}_{jt}$ = month, industry, industry-month effects (aggregates)

- Estimate relationship b/w measured vacancies and hires

Specification (1): static, linear

- $h_{jt} = \beta + \mathbf{x}'_{jt}\boldsymbol{\delta} + \pi_0 v_{jt} + \epsilon_{jt}$
- $\beta =$ constant; "no-vacancy hiring rate"
- $\mathbf{x}_{jt} =$ dummies for month, industry, industry-month
- $\Omega(v) =$ predicted hiring rate with vacancy rate v:
  - π_0: contemporaneous coefficient
  - $\Omega(v) = \pi_0 v$

Specification (2): dynamic, linear

- $h_{jt} = \beta + \mathbf{x}'_{jt}\boldsymbol{\delta} + \sum_{k=0}^{6} \pi_k v_{jt-k} + \epsilon_{jt}$
- β = constant; "no-vacancy hiring rate"
- $\mathbf{x}_{jt}$ = dummies for month, industry, industry-month
- $\Omega(v)$ = predicted hiring rate with vacancy rate v:
  - π_k: k-month lag coefficient
  - $\Omega(v) = \Pi v$, where $\Pi = \sum_k \pi_k$ is cumulative coefficient

Specification (3): static, non-linear

- $h_{jt} = \beta + \mathbf{x}'_{jt}\boldsymbol{\delta} + \sum_s \pi_0^s v_{jt} + \epsilon_{jt}$
- β = constant; "no-vacancy hiring rate"
- $\mathbf{x}_{jt}$ = dummies for month, industry, industry-month
- $\Omega(v)$ = predicted hiring rate with vacancy rate v:
  - Piecewise linear (σ_v, $2\sigma_v$, $3\sigma_v$); segment s coefficient: π_0^s
  - $v \in (0, \sigma_v) \quad \Rightarrow \quad \Omega(v) = \pi_0^1 v$
  - $v \in (\sigma_v, 2\sigma_v) \Rightarrow \quad \Omega(v) = \pi_0^1 \sigma_v + \pi_0^2 (v - \sigma_v)$ etc.
  - Vacancy yield $= \Psi(v) = \frac{\Omega(v)}{v}$

Specification (4): dynamic, non-linear

- $h_{jt} = \beta + \mathbf{x}'_{jt}\boldsymbol{\delta} + \sum_{k=0}^{6} \sum_s \pi_k^s v_{jt-k} + \epsilon_{jt}$
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  - $v \in (\sigma_v, 2\sigma_v) \Rightarrow \quad \Omega(v) = \Pi^1 \sigma_v + \Pi^2 (v - \sigma_v), \qquad$ etc.
  - Vacancy yield $= \Psi(v) = \frac{\Omega(v)}{v}$

Specification (5): dynamic, non-linear, fixed-effects

- $h_{jt} = \beta + \mathbf{x}'_{jt}\boldsymbol{\delta} + \sum_{k=0}^{6} \sum_s \pi_k^s v_{jt-k} + \rho_j + \epsilon_{jt}$
- β = constant; "no-vacancy hiring rate"
- $\mathbf{x}_{jt}$ = dummies for month, industry, industry-month
- $\Omega(v)$ = predicted hiring rate with vacancy rate v:
  - Piecewise linear (σ_v, $2\sigma_v$, $3\sigma_v$); segment s, k-lag coeff.: π_k^s
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  - Vacancy yield $= \Psi(v) = \frac{\Omega(v)}{v}$
- ρ_j = firm j fixed effect

Vacancies and hires

	(1)	(2)	(3)	**(4)**	(5)
β	0.063^{***} (0.000)	0.063^{***} (0.000)	0.064^{***} (0.000)	0.061^{***} (0.000)	0.061^{***} (0.000)
π_0	0.346^{***} (0.018)	0.322^{***} (0.012)	0.105^{***} (0.025)	-0.020 (0.019)	-0.036^{*} (0.019)
π_1		0.162^{***} (0.009)		0.328^{***} (0.020)	0.316^{***} (0.019)
π_2		0.046^{***} (0.008)		0.153^{***} (0.021)	0.144^{***} (0.019)
π_3		-0.018^{**} (0.007)		0.029 (.020)	0.024 (0.019)
π_4		-0.041^{***} (0.007)		0.014 (0.020)	0.012 (0.019)
π_5		-0.047^{***} (0.007)		-0.007 (0.020)	-0.005 (0.019)
π_6		-0.053^{***} (0.006)		-0.038^{*} (0.020)	-0.032^{*} (0.018)
$\Psi(\sigma_v)$	0.346^{***} (0.018)	0.370^{***} (0.038)	0.105^{***} (0.025)	$\mathbf{0.460}^{***}$ (**0.071**)	0.423^{***} (0.048)
$\Psi(2\sigma_v)$	0.346^{***} (0.018)	0.370^{***} (0.038)	0.327^{***} (0.019)	$\mathbf{0.561}^{***}$ (**0.052**)	0.586^{***} (0.039)
Dynamic effects	No	Yes	No	Yes	Yes
Nonlinear effects	No	No	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	Yes

- **Dynamics:** significant lagged coefficients (2, 4, 5)
- **Non-linearities:** vacancy yield variation (3,4,5)
- **Interaction:** vacancy yield highest w/ dyn+non-linearities (4,5)
- **FEs** don't affect estimates. **Preferred specification: (4)**

Taking stock (1)

1. Online advertisements are predictive of hiring:
   - $v = 4.6\%$ (1SD) $\Rightarrow h \uparrow 2.2$ ppts ($\sim 35\%$ over β)

2. Specification analysis:
   - Hiring elevated for 2-3 months after advertisement observed
   - Vacancy yield increases in vacancy rate
   - Dynamics and non-linearities interact
   - Results are robust if
     - separate regressions for 2003-05 and 2006-09 time periods
     - alternative definition of rates rates

3. *No-vacancy hiring is quantitatively very important*

Hiring rate heterogeneity

- Hiring rate varies a lot across time and firms ($CV > 2$)

- Variation in hiring rates associated with variation in:

  1. Vacancy rate (v): data
  2. Vacancy yield (Ψ): *direct estimate*
  3. No-vacancy hiring (β): residual

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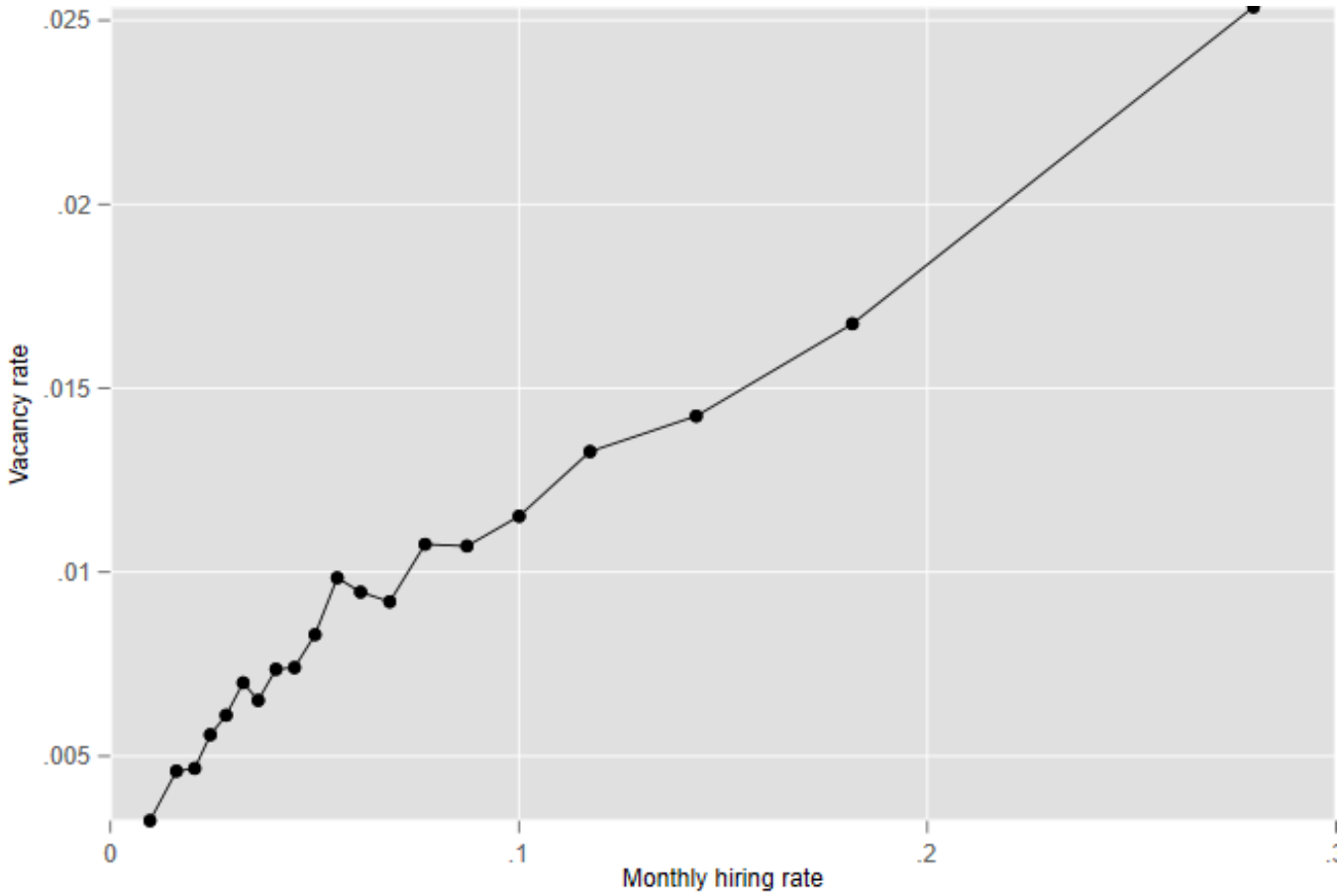
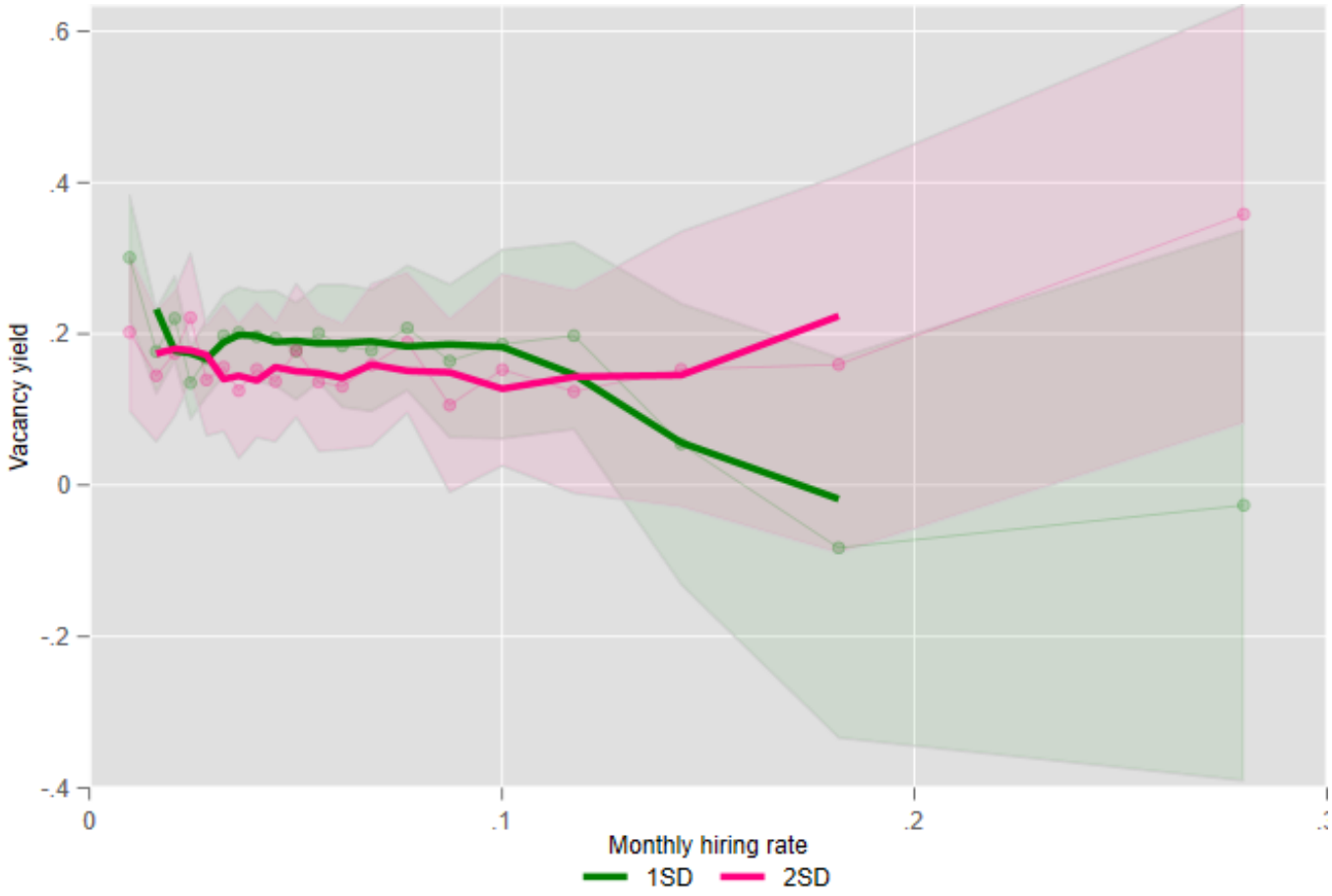
- Variation in hiring rates associated with variation in:
  1. Vacancy rate (v): data
  2. Vacancy yield (Ψ): *direct estimate*
  3. No-vacancy hiring (β): residual
- To evaluate importance of 1-3, we group firm-years by h:
  - $\overline{h}_{j,y}$ = avg monthly hiring rate, firm j, calendar year y
  - Allocate firm-year (j, y) to bin $b = b(j, y)$ according to $\overline{h}_{j,y}$
    - 20 equally-sized bins, $\overline{h}_b$ = avg. hiring rate of b
  - Compute $\overline{v}_b$ and estimate Ψ_b and β_b:
- $h_{jt} = \beta_b + \sum_k \sum_s \pi^s_{k,b} v_{jt-k} + \mathbf{x}'_{jt}\boldsymbol{\delta}_b + \epsilon_{jt}$

Vacancy rate, by hiring rate bin



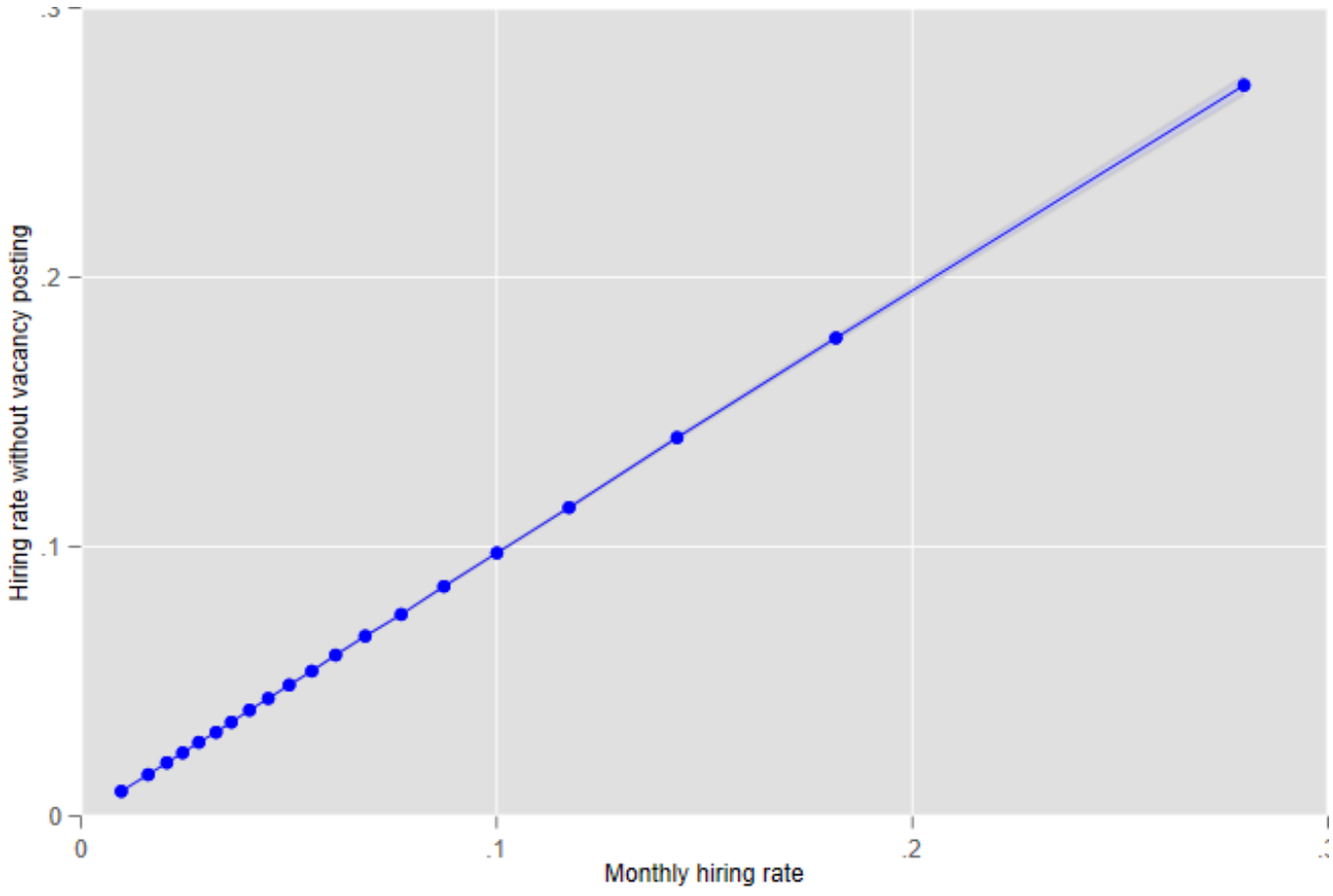
- Positive correlation between hiring rate and vacancy rate
- Slope $\approx$ 0.08-0.15

Vacancy yield, by hiring rate bin



- Yield is essentially flat at 0.15-0.2!

No-vacancy hiring rate, by hiring rate bin



- Variation in β accounts for most variation in hiring rate

Taking stock (2)

- **Glass half full:** stable relationship between measured inputs (vacancies) and outputs (hires) across:
  - different hiring rates
  - different employment growth rates growth DFH
  - different employment size and productivity productivity

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- **Glass half empty:** variation in measured inputs (vacancies, yield) account for small part of variation in outputs
  - *Non-market recruiting channels?*
  - Passive search?
  - Measurement error ME?
  - ...

Hiring channels

- Job advertisements:
  - Initiate contact with workers unconnected to firm
  - Market search
- Many hires occur through non-market channels:
  - *Recall*: re-hiring of previous worker ($\sim$ 40% of hires)
  - *Referral network*: hiring of worker indirectly connected to firm ($\sim$ 20-30% of hires)
- Q: Are non-market hires mediated by vacancies?

A (slightly) more complicated model of firm recruiting

$$h_{jt} = h^M(\mathbf{e}^M_{jt}|\mathbf{x}_{jt}) + h^N(\mathbf{e}^N_{jt}|\mathbf{x}_{jt}) + h^R(\mathbf{e}^R_{jt}|\mathbf{x}_{jt})$$

- Recruiting channels: market M, referral networks N, recall R
- Recruitment effort is channel-specific
  - Q: substitutes or complements?

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- Recruiting channels: market M, referral networks N, recall R
- Recruitment effort is channel-specific
  - Q: substitutes or complements?
- Data:
  - h: total hires
  - h^R: workers previously employed at same firm
  - h^N: coworker networks, subset of all referral hires
  - e^M: online advertisements (NB: JOLTS records $e^M + e^N$)
- Estimate relationship b/w vacancies and hires through each channel separately

Recalls

- First, examine recall (R) and non-recall ($NR = M + N$) hires
- We label a hire as "recall" if newly-hired worker was employed at same firm during previous 2 years alternative definitions of recall
- Each hire is labeled as R or NR: $h_{jt} = h_{jt}^{R} + h_{jt}^{NR}$

	Total	Recall	Non-recall
Monthly hiring rate	0.069	0.030	0.039
Share of total		43.3%	56.7%
Monthly hiring rate, employment weighted	0.060	0.027	0.033
Share of total, employment weighted		45.3%	54.7%

Vacancies and recall/non-recall hires

	All	Recall	Non-recall
β	0.061^{***} (0.000)	0.030^{***} (0.000)	0.032^{***} (0.000)
Yield (σ_v)	0.460^{***} (0.071)	-0.174^{***} (0.039)	0.634^{***} (0.046)
Yield ($2\sigma_v$)	0.561^{***} (0.052)	-0.035 (0.031)	0.595^{***} (0.033)
Dynamic effects	Yes	Yes	Yes
Nonlinear effects	Yes	Yes	Yes
Firm fixed effects	No	No	No

- Measured vacancies associated with fewer recall hires!
  - Alternative definitions of recall yield same result alternative recall
- Removing recalls: $\uparrow$ vacancy yield, $\downarrow$ no-vacancy hiring rate
  - $v = 4.6\%$ (1SD) $\Rightarrow$ $h \uparrow 2.9$ ppts, 91% of β

Taking stock (3)

- An interpretation: when a firm wants to hire
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- Implication for theory:
  - Cost of screening new workers is very high

- Implications for measurement:
  - Measured vacancies capture *subset* of latent labor demand
  - Need to distinguish b/w R and NR hires in data
  - Need to create a measure of recallable workers

Referral networks

- Investigate market and referral network hires separately
- Identify referral hires from coworker networks (subset):
  - Worker i hired by firm j at t. Denote:
    - $E(i,s)$ = employer of i in month $s = t-37, ..., t-1$
    - $E(k,s)$ = employer of k in s, for all current firm-j workers k
  - If $E(i,s) = E(k,s)$, some k, s (i, k co-workers), then referral took place (Hensvik-Skans 2016, Glitz-Vejlin 2021)

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	Total	Recall	Referral	Market
Monthly hiring rate	0.069	0.030	0.006	0.033
Share of total		43.3%	8.5%	48.3%
Monthly hiring rate, employment weighted	0.060	0.027	0.012	0.021
Share of total, employment weighted		45.3%	19.9%	34.8%

- Coworker networks identify referrals at large firms, mostly

Vacancies and recall/network/market hires

	All	Recall	Network	Market
β	0.061^{***} (0.000)	0.030^{***} (0.000)	0.004^{***} (0.000)	0.028^{***} (0.000)
Yield (σ_v)	0.460^{***} (0.071)	-0.174^{***} (0.039)	0.474^{***} (0.019)	0.160^{***} (0.034)
Yield ($2\sigma_v$)	0.561^{***} (0.039)	-0.035 (0.031)	0.018 (0.014)	0.577^{***} (0.027)
Dynamic effects	Yes	Yes	Yes	Yes
Nonlinear effects	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No

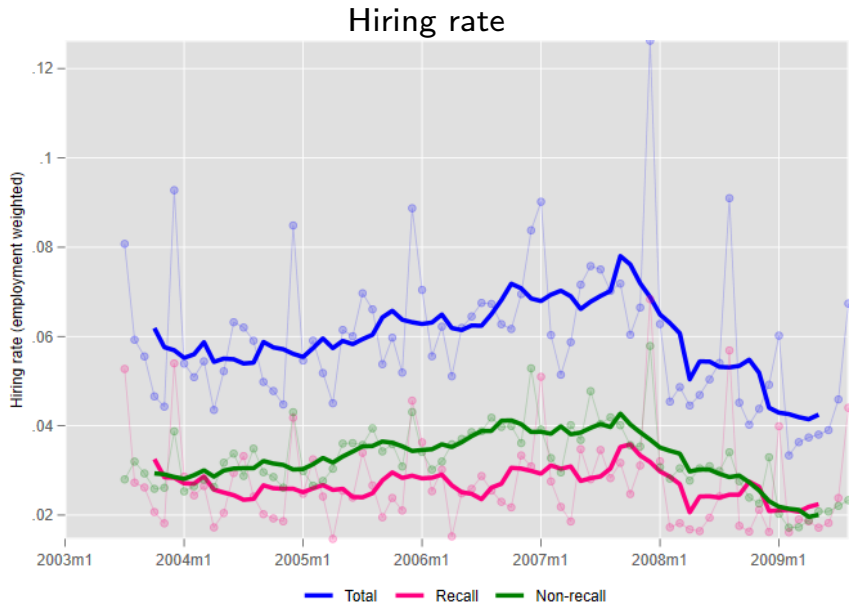
- Positive correlation b/w vacancies and network hires
  - High estimate of vacancy yield for network hires; lower with fixed effects with FE
- Taking stock (4):
  - Market effort and referral network effort are complements
  - Suffices to focus on recall vs no-recall hires

Implications for aggregate labor markets

- Job-finding and job-filling fluctuate more than tightness
  - Volatile matching efficiency, cyclical search effort, changing composition of u and/or v...

Implications for aggregate labor markets

- Job-finding and job-filling fluctuate more than tightness
  - Volatile matching efficiency, cyclical search effort, changing composition of u and/or v...
- Recall hires
  - in cross-section: uncorrelated w/ vacancies
  - in aggregate: uncorrelated w/ tightness: corr($h^R, v/u$)=0.065
  - might exacerbate matching function volatility?



Matching function estimation

- Matching function $h_t = \mu_t v_t^{\eta} u_t^{1-\eta}$. Estimate
  - $\ln(\frac{h_t}{v_t}) = -(1-\eta)\ln(\frac{v_t}{u_t}) + \ln(\mu_0) + d_{m(t)} + \zeta t + \epsilon_t$
    - v_t = aggregate vacancy rate v_t (our data)
    - u_t = unemployment rate (LFS)
    - Calendar month dummy, linear trend
    - Hiring rate h_t: total vs non-recall; $NE + EE$ and NE
- Measure of matching function stability: std dev$(\hat{\epsilon}_t)$

Standard deviation $(\hat{\epsilon}_t)$	NE+EE	NE
All channels	0.138	0.186
Non-recall	0.073	0.109
Difference	-47%	-41%

Conclusions

- We merge online advertisement data with MEE to investigate relation b/w vacancies and hires
- In the cross-section:
  - the vacancy yield is stable
  - measured vacancies do not account for hiring variation
- Recall hires negatively correlated with firms' market recruitment effort
- Removing recall hires improves matching function prediction

Firms with/without online job advertisements

Back

	w/ online job advert.	w/o online job advert.
Number of firms	21,160	105,204
Number of observations	1,337,480	2,607,050
Employment per firm-month	48.4	9.5
Revenue per firm-month (in DKK 1,000)	7,670.7	1,275.5
Value added per firm-month (in DKK 1,000)	2,359.7	387.9
Hires per firm-month	2.9	0.7
Net job creation	90,697	-40,391
Share of total employment	0.723	0.277
Share of total revenue	0.755	0.245
Share of total value added	0.757	0.243
Share of hires	0.687	0.313
Share of net job creation	1.803	-0.803

Note: 1 USD = 6.2 DKK in March 2021

Alternative definition of rates

Back

- $\overline{N}_j$: average employment at j in 2003M1-2009M6
- $h_{jt} = \frac{H_{jt}}{\overline{N}_j}$
- $s_{jt} = \frac{S_{jt}}{\overline{N}_j}$
- $v_{jt} = \frac{V_{jt}}{(V_{jt}+\overline{N}_j)}$

Alternative definition of rates ($\overline{N}_j$) Back

	All	Non-recall	Recall
β	0.059^{***}	0.040^{***}	0.019^{***}
	(0.000)	(0.000)	(0.000)
$\Omega(\sigma_v)\sigma_v$	0.732^{***}	0.757^{***}	-0.024
	(0.078)	(0.064)	(0.028)
$\Omega(2\sigma_v)/(2\sigma_v)$	0.778^{***}	0.802^{***}	-0.024
	(0.062)	(0.051)	(0.023)
Dynamic effects	Yes	Yes	Yes
Nonlinear effects	Yes	Yes	Yes
Firm fixed effects	No	No	No

- Similar qualitative patterns, slightly higher estimates

Separate analysis for 2003-05 and 2006-09

Back

	All	2003:01-2005:12	2006:01-2009:06
β	0.040^{***} (0.000)	0.042^{***} (0.000)	0.038^{***} (0.000)
Yield (σ_v)	0.576^{***} (0.053)	0.668^{***} (0.078)	0.540^{***} (0.049)
Yield($2\sigma_v$)	0.616^{***} (0.037)	0.876^{***} (0.051)	0.566^{***} (0.035)
Vacancy rate	1.0	0.7	1.1
SD vacancy rate	4.7	4.0	4.8
Dynamic effects	Yes	Yes	Yes
Nonlinear effects	Yes	Yes	Yes
Firm fixed effects	No	No	No

- Higher estimated effects in early period

Heterogeneity: firm productivity back

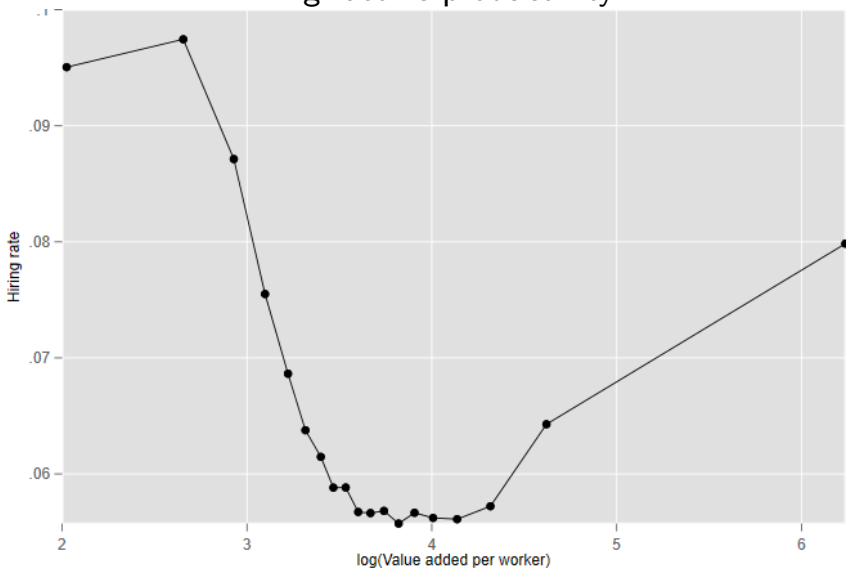
- Q: does hiring yield vary with firm productivity?
- Group firms by value added per worker
  - Allocate firm (j) to bin $b(j)$ by avg VA/worker (2003-09)
    - 20 equally-sized bins
  - Estimate pref. spec. for non-recall hires, where $b = b(j)$:
  - $h_{jt} = \beta_b + \sum_k \sum_s \pi^s_{k,b} v_{jt-k} + \mathbf{x}'_{jt}\boldsymbol{\delta}_b + \epsilon_{jt}$

  medskip
- Report yield $(\Psi(v))$ and no-vacancy hiring rate (β)

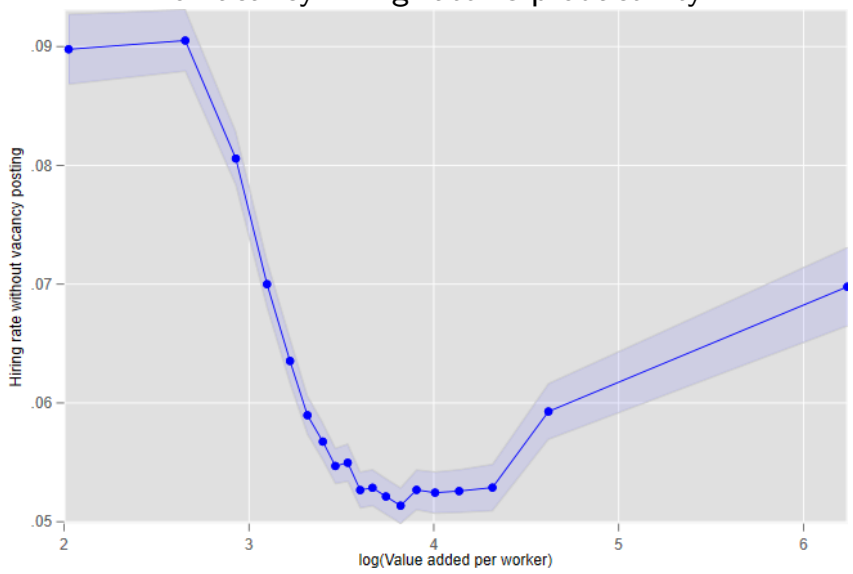
Hires, vacancies, and yield by productivity

back

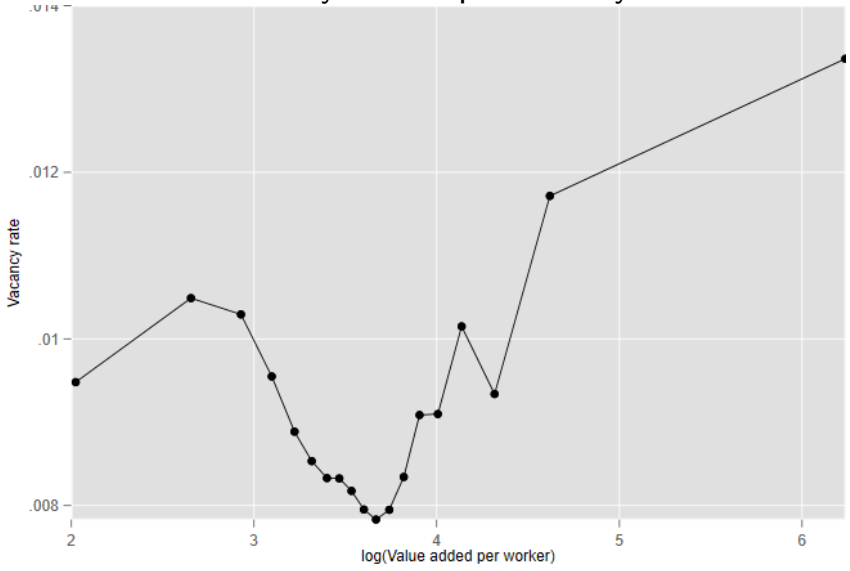
Hiring rate vs productivity



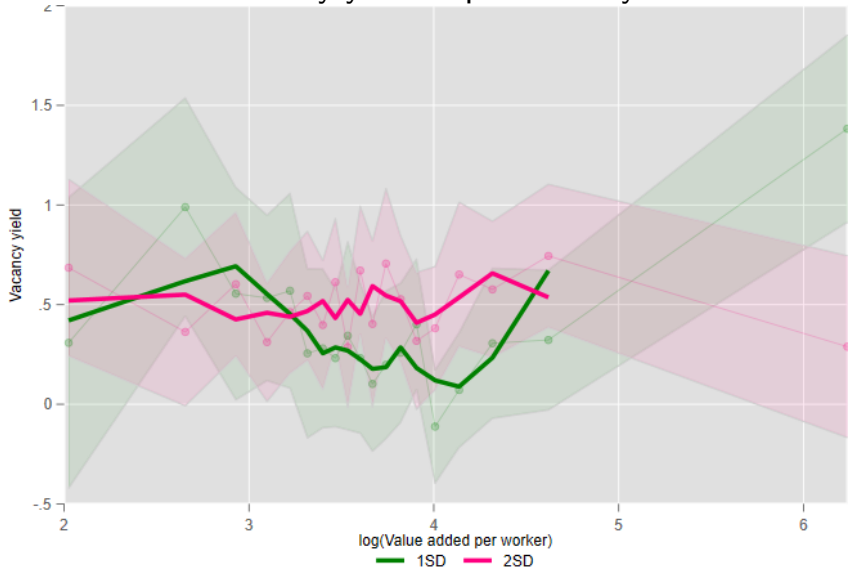
No-vacancy hiring rate vs productivity



Vacancy rate vs productivity



Vacancy yield vs productivity



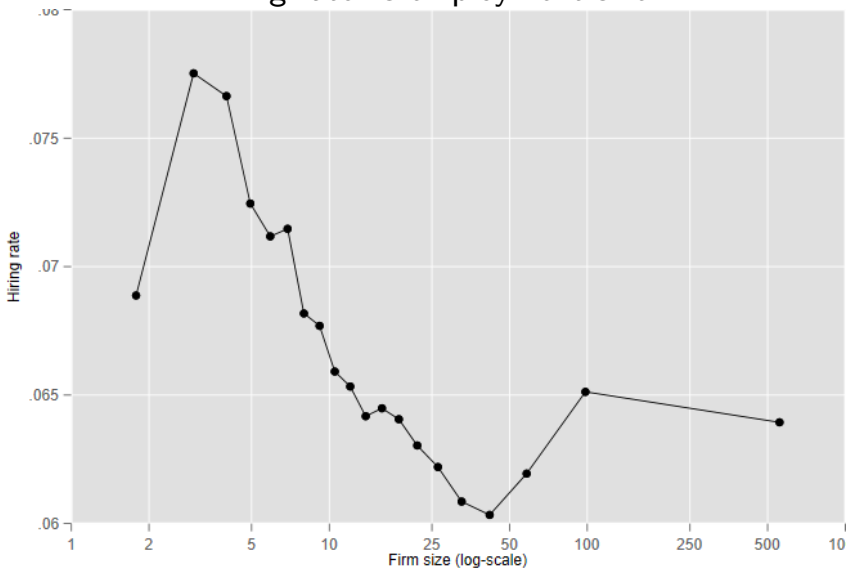
Heterogeneity: firm size back

- Q: does hiring yield vary with firm size?
- Group firms by average number of workers
  - Allocate firm (j) to bin $b(j)$ by avg # workers (2003-09)
    - 20 equally-sized bins
  - Estimate pref. spec. for non-recall hires, where $b = b(j)$:
  - $h_{jt} = \beta_b + \sum_k \sum_s \pi^s_{k,b} v_{jt-k} + \mathbf{x}'_{jt}\boldsymbol{\delta}_b + \epsilon_{jt}$
- Report yield $(\Omega(v)/v)$ and no-vacancy hiring rate (β)

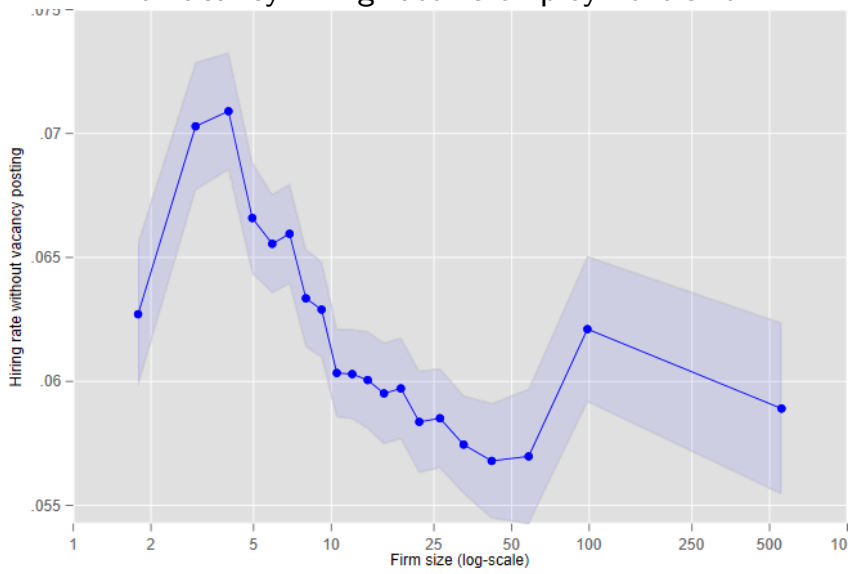
Hires, vacancies, and yield by employment size

back

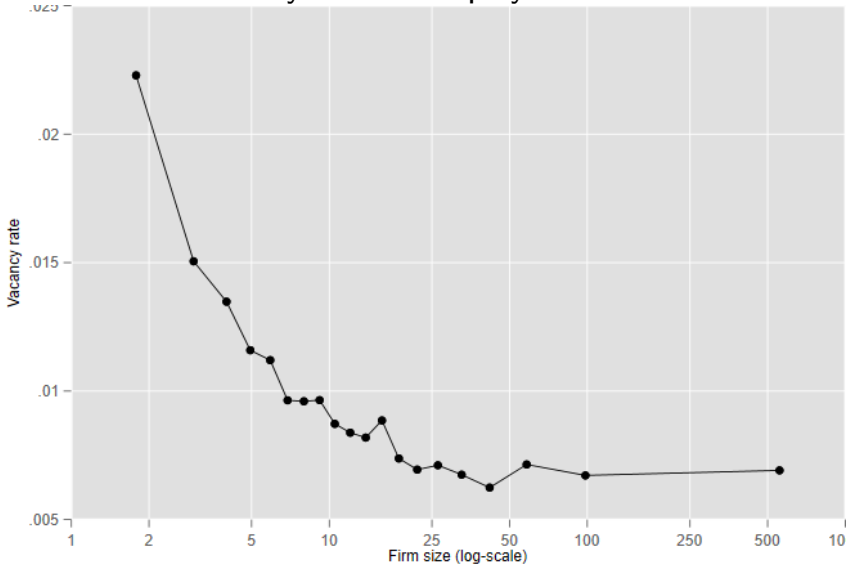
Hiring rate vs employment size



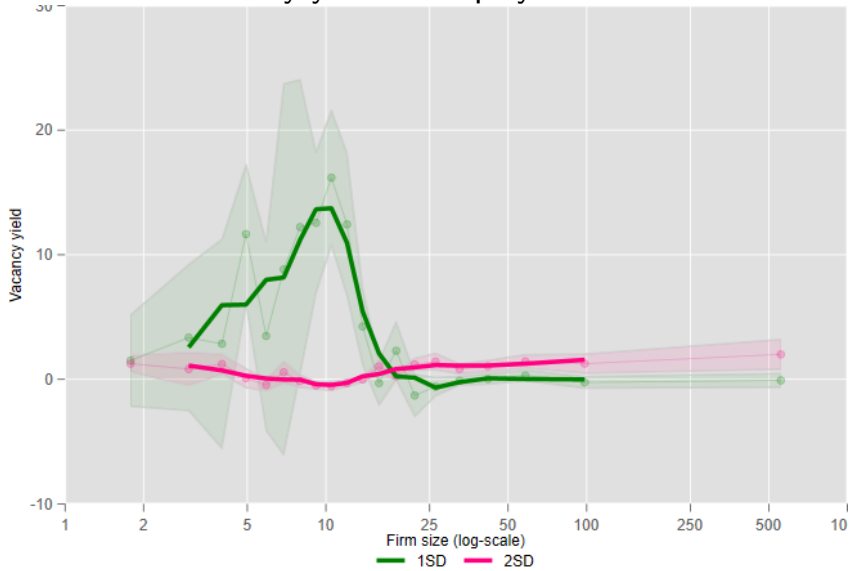
No-vacancy hiring rate vs employment size



Vacancy rate vs employment size



Vacancy yield vs employment size



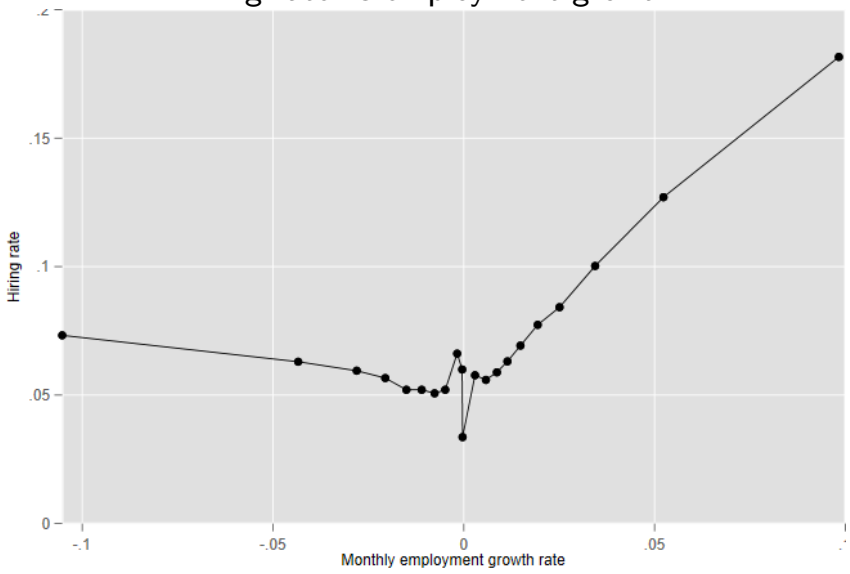
Heterogeneity: firm employment growth rate back DFH

- Q: Does vacancy yield vary with employment growth rate?
- Group firm-years by employment growth rate:
  - $g_{j,y}$ = avg monthly empl. growth rate, firm j, calendar year y
  - Allocate firm-year (j, y) to bin $b(j, y)$ according to $g_{j,y}$
    - 20 equally-sized bins + $[g = 0]$
- Estimate preferred specification for each bin
  - $h_{jt} = \beta_b + \sum_k \sum_s \pi^s_{k,b} v_{jt-k} + \mathbf{x}'_{jt}\boldsymbol{\delta}_b + \epsilon_{jt}$
- Report vacancy rate $\overline{v}_b$, vacancy yield (Ψ_b) and no-vacancy hiring rate (β_b) for each bin

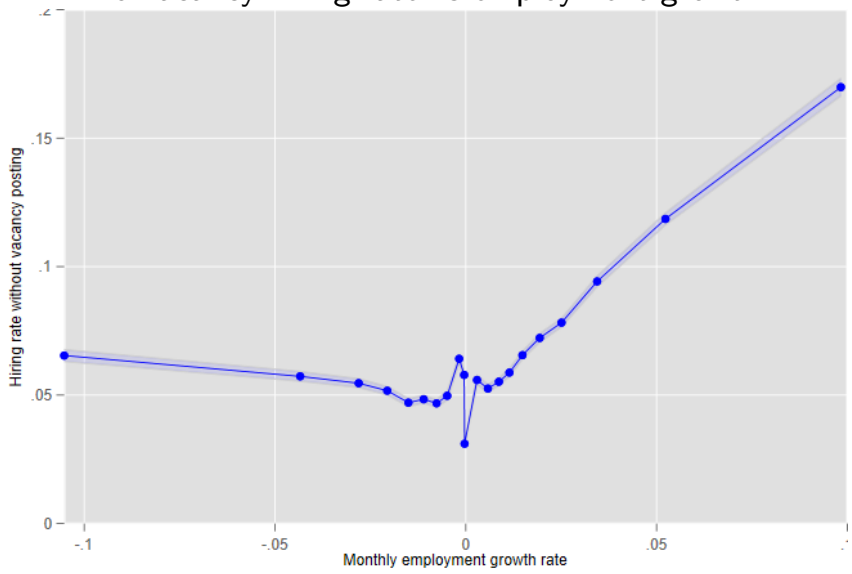
Hires, Vacancies, and yield by employment growth

back

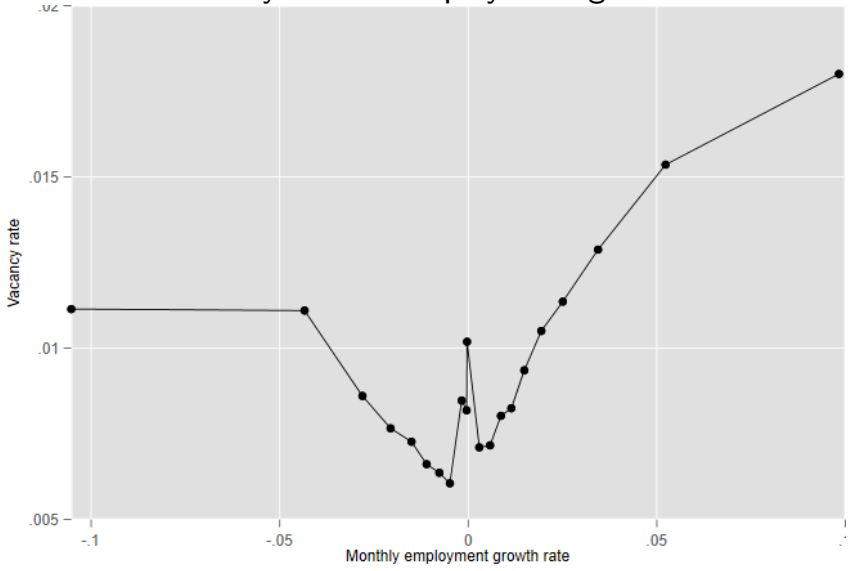
Hiring rate vs employment growth



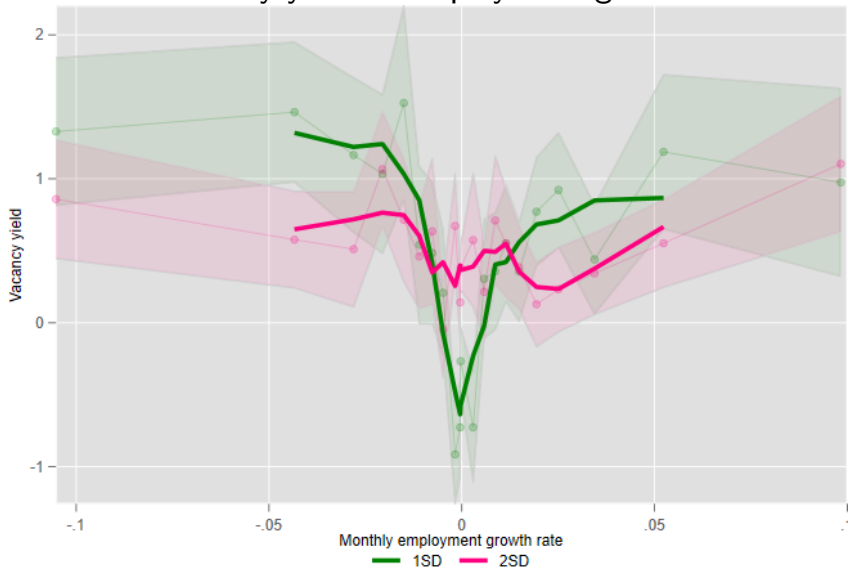
No-vacancy hiring rate vs employment growth



Vacancy rate vs employment growth



Vacancy yield vs employment growth

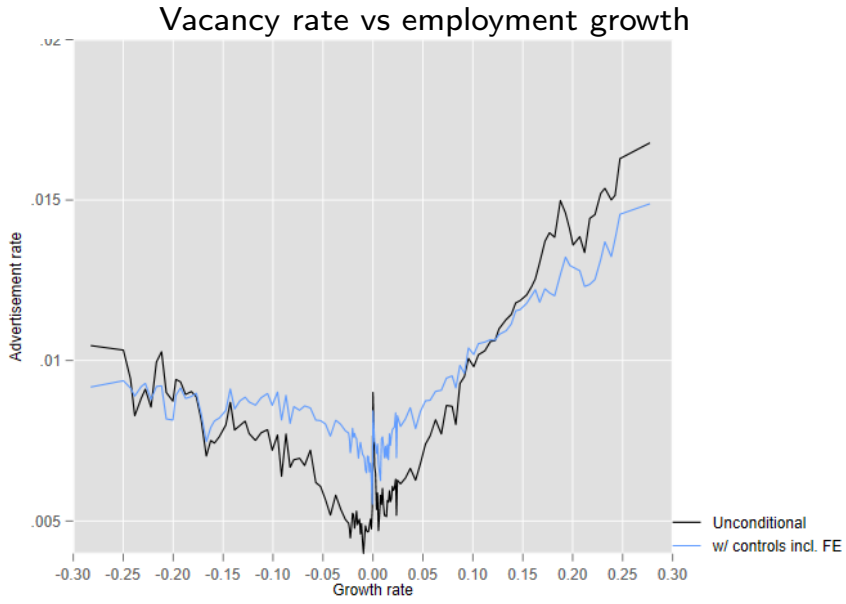


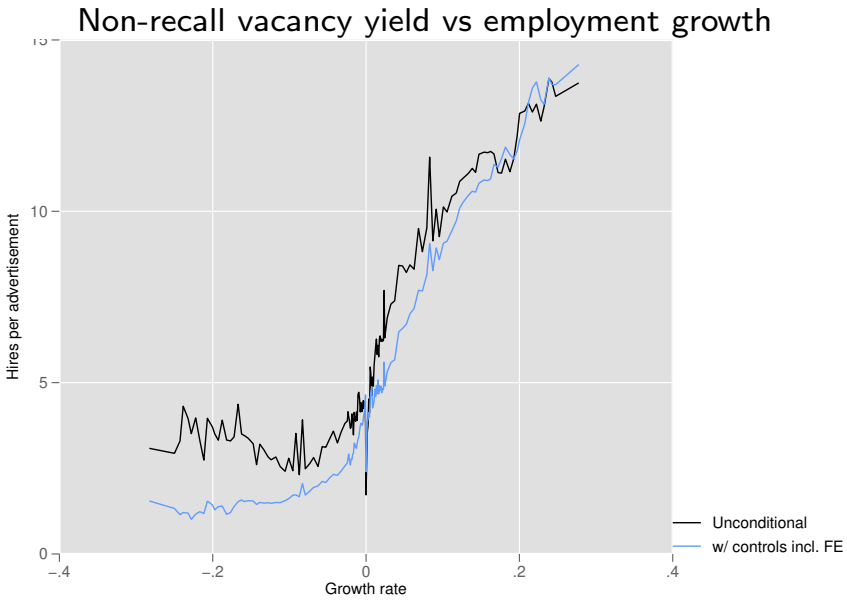
DFH methodology back growth

- Group firm-months according to monthly employment growth
  - D_{jt}^b is dummy for firm-month (j,t) and bin b
- Estimate
  - $h_{jt} = \sum_b \gamma_h^b D_{jt}^b + \mathbf{x}_{jt}' \boldsymbol{\delta}_h + \rho_j + \epsilon_{jt}$
  - $v_{jt} = \sum_b \gamma_v^b D_{jt}^b + \mathbf{x}_{jt}' \boldsymbol{\delta}_v + \rho_j + \epsilon_{jt}$
- Hockey stick graphs: plot avg. growth rate in bin b against
  - Hiring rate: γ_h^b
  - Vacancy rate: γ_v^b
  - Vacancy yield: $\frac{\gamma_h^b}{\gamma_v^b}$

Hockey sticks in Danish data

back growth

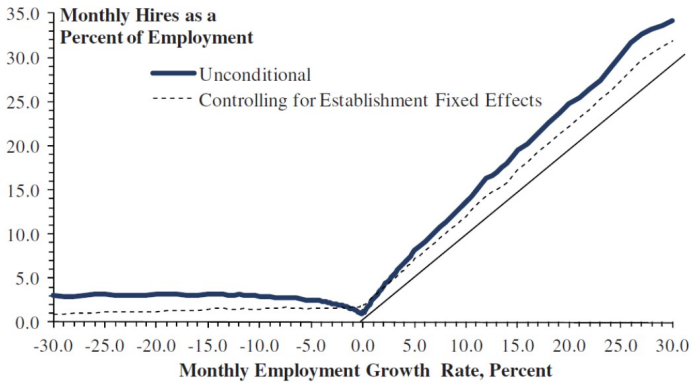




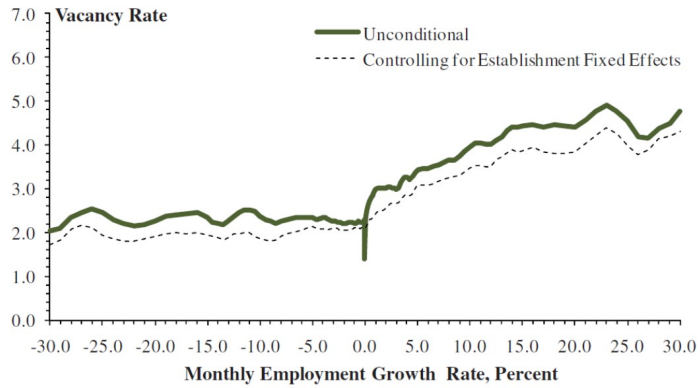
Hockey sticks in JOLTS (DFH 2013)

back growth

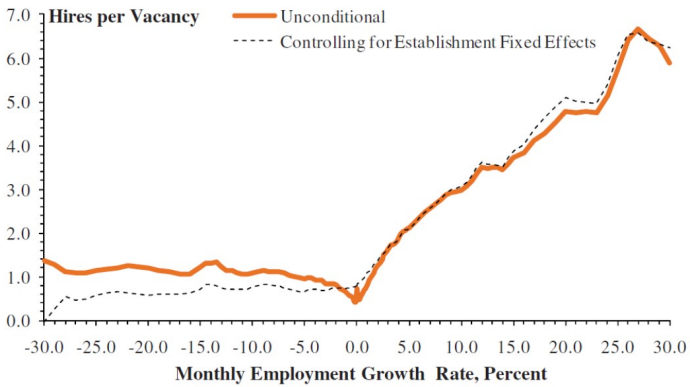
Hiring rate vs employment growth



Vacancy rate vs employment growth



Vacancy yield vs employment growth



Alternative definitions of recall

Back

Out of all hires at firm j:

1. 32.0% are from non-employment w previous job at j
2. 31.8% observed as firm-j employee in past 92 days
3. 36.4% observed as firm-j employee in past 183 days
4. 41.3% observed as firm-j employee in past 365 days

5. *43.3% observed as firm-j employee in past 730 days*

6. 44.0% observed as firm-j employee in past 1095 days
7. 44.6% observed as firm-j employee in past 1825 days
8. 45.2% observed as firm-j employee at any time in the past

Vacancies and recall hires, alternative definitions

Back

	RE1	RE2	RE3	RE4
β	0.022^{***}	0.022^{***}	0.025^{***}	0.028^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
Yield (σ_v)	-0.116^{***}	-0.100^{***}	-0.127^{***}	-0.163^{***}
	(0.032)	(0.033)	(0.036)	(0.038)
Yield($2\sigma_v$)	-0.061^{**}	-0.027	-0.042	-0.035
	(0.026)	(0.027)	(0.029)	(0.031)

	RE5	RE6	RE7	RE8
β	0.030^{***}	0.030^{***}	0.031^{***}	0.031^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
Yield (σ_v)	-0.174^{***}	-0.175^{***}	-0.172^{***}	-0.166^{***}
	(0.039)	(0.039)	(0.040)	(0.040)
Yield($2\sigma_v$)	-0.035	-0.033	-0.033	-0.034
	(0.031)	(0.032)	(0.032)	(0.032)
Dynamic effects	Yes	Yes	Yes	Yes
Nonlinear effects	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No

- Recall hires are negatively correlated with vacancy-posting in all recall definitions

Vacancies and recall/network/market hires - FE

back

	All	Recall	Network	Market
β	0.061^{***} (0.000)	0.029^{***} (0.000)	0.004^{***} (0.000)	0.027^{***} (0.000)
Yield (σ_v)	0.423^{***} (0.048)	-0.227^{***} (0.039)	0.135^{***} (0.010)	0.515^{***} (0.022)
Yield ($2\sigma_v$)	0.586^{***} (0.039)	0.056^{*} (0.030)	0.049^{***} (0.008)	0.481^{***} (0.020)
Dynamic effects	Yes	Yes	Yes	Yes
Nonlinear effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes

- Qualitatively, same pattern: positive correlation b/w h^N and v
- Quantitatively, vacancy yield is lower for h^N than for h^M

- Large firms:
  - Post vacancies more frequently
  - Hire through co-worker networks more intensely

- Fixed effects control for correlation between network hiring and frequency of vacancy-posting.

Measurement error example

Back

- Static, linear model: $h^* = \beta + \pi v^* + \epsilon$
  - Vacancies are measured with classical error: $v = v^* + e$
  - Hires are measured perfectly (immaterial): $h = h^*$

Measurement error example

Back

- Static, linear model: $h^* = \beta + \pi v^* + \epsilon$
  - Vacancies are measured with classical error: $v = v^* + e$
  - Hires are measured perfectly (immaterial): $h = h^*$
- OLS regression of h on v :
  - $\hat{\pi} \xrightarrow{p} \pi \frac{\sigma^2_{v*}}{\sigma^2_{v*} + \sigma^2_e} < \pi$
  - $\hat{\beta} \xrightarrow{p} \beta + \pi \frac{\sigma^2_{v*}}{\sigma^2_{v*} + \sigma^2_e} \mu_{v^*} > \beta$
  1. Attenuation bias reduces v-coefficient, increases constant

Measurement error example

Back

- Static, linear model: $h^* = \beta + \pi v^* + \epsilon$
  - Vacancies are measured with classical error: $v = v^* + e$
  - Hires are measured perfectly (immaterial): $h = h^*$
- OLS regression of h on v :
  - $\hat{\pi} \xrightarrow{p} \pi \frac{\sigma^2_{v*}}{\sigma^2_{v*} + \sigma^2_e} < \pi$
  - $\hat{\beta} \xrightarrow{p} \beta + \pi \frac{\sigma^2_{v*}}{\sigma^2_{v*} + \sigma^2_e} \mu_{v^*} > \beta$
  1. Attenuation bias reduces v-coefficient, increases constant
- Heterogeneity in h, bin b: $\hat{\pi}_b \left(1 + \frac{\sigma^2_{e,b}}{\sigma^2_{v*,b}}\right) \xrightarrow{p} \pi_b$
  - Estimation: $\hat{\pi}_b$ constant across bins (h)
    - π_b increases in h if $\frac{\sigma^2_{e,b}}{\sigma^2_{v*,b}}$ increases in b
  - Data: $\sigma^2_{v*,b} + \sigma^2_{e,b} \uparrow$ in h
  2. Does $\sigma^2_{e,b}$ increase more than $\sigma^2_{v*,b}$ for high-h?