

Recruitment Difficulties and Firms' Growth

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Bocconi

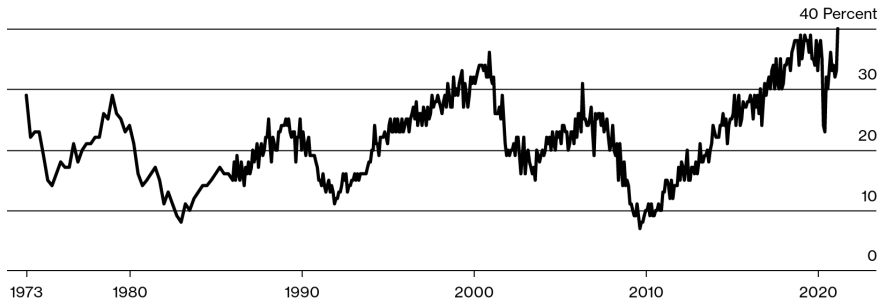
June 2022

Motivation - U.S.

Record Share of Small Businesses Say They Couldn't Fill Jobs

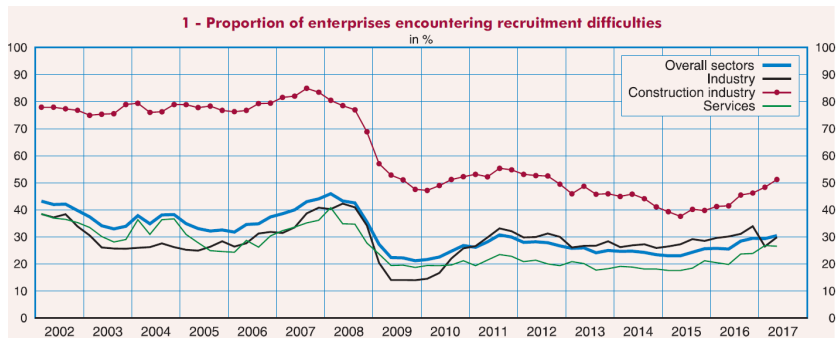
February survey by National Federation of Independent Business

✍ Couldn't Fill Job Openings



Data: National Federation of Independent Business

Motivation - France



Note: like any business tendency survey variable concerning employment, the results are weighted by the size of the workforce in the enterprises surveyed; for example, in April 2017, the industrial companies reporting recruitment difficulties employed 30% of the workforce in the sector.

Source: INSEE, business tendency surveys

Research questions

1. How large is the causal impact of hiring difficulties on individual firms' growth?
2. How do firms adjust to hiring difficulties?
3. Which firms are more sensitive to hiring difficulties?

What we do

1. Use granular data on recruiting difficulties (at the vacancy-level)
2. Construct shift-share predicted recruiting difficulties (Bartik IV) at the firm-level for French universe, exogenous to the individual firm
3. Estimate effects of recruiting difficulties on employment, investment, sales, and profits
4. Heterogeneous effects by labor intensity and occupation specificity

What we find

1. One std deviation $\uparrow$ in recruiting time (≈ 70 days) is associated with
 - ▶ 5-10% $\downarrow$ in employment
 - ▶ Worsening in performance: sales $\downarrow$ 4%, profits $\downarrow$ 4%
2. Adjustment margins:
 - ▶ Recruiting intensity: reduction in vacancy posting
 - ▶ less experience required for new hires
 - ▶ Higher retention of incumbents through higher hourly wages
3. Larger decline in employment for:
 - ▶ Labor-intensive firms
 - ▶ Firms with high occupation-specificity

Outline

Conceptual framework

Data

Empirical design

Results

Mechanisms

Heterogeneity Analysis

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Search and Matching Model

- ▶ Search and matching model with large firms (Cahuc et al, 2019)
- ▶ Value function of the firm satisfies:

$$\Pi(L_{t-1}) = \max_{V_t} A_t \cdot R(L_t) - w_t \cdot L_t - c_v \cdot V_t + \beta E_t \Pi(L_t)$$

subject to the law of motion of employment:

$$L_t = (1 - q_t)L_{t-1} + m_t V_t$$

where

- ▶ V_t number of vacancies posted
- ▶ flow vacancy cost c_v
- ▶ expected vacancy time-to-fill $1/m_t$
- ▶ job destruction rate q_t

Search and Matching Model

- Denoting time-to-fill $\tau_t = 1/m_t$, after some algebra, we get :

$$d \log L_t = \frac{c_v}{w_t} \frac{1}{(\alpha - 1)} d\tau_t$$

- $\alpha < 1$ is elasticity of labor in revenue function
- Time-to-fill depresses labor demand

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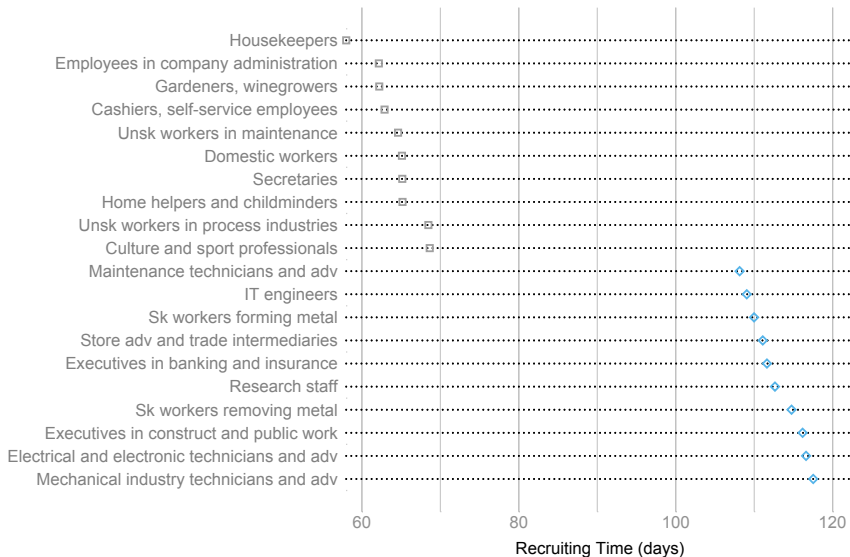
- ▶ Vacancies posted on *pole-emploi.fr*: occupation, location, posting firm id (and its industry), publication date, recruitment success, and delisting date
- ▶ Matched employer-employee registers (DADS): employment spells with occupation
- ▶ Firms' balance-sheet panel data: investment, profits, sales
- ▶ Sample: universe of French firms in private sector existing in 2009, observed until 2017 (excluding financial sector)

▶▶ Summary statistics

Pole-emploi vacancy data

- ▶ Operated by *Pole emploi*, the French Public Employment Service
- ▶ Any private firms can post online and screen job seekers profile (free of charge)
- ▶ Large coverage: almost 50% of hires with online advertising use pole-emploi.fr (OFER firm survey in 2016)
- ▶ Pole-emploi employees manage the website and monitor posting firms (record recruitment success, clean out inactive vacancies if needed).

Recruiting Time by Occupations

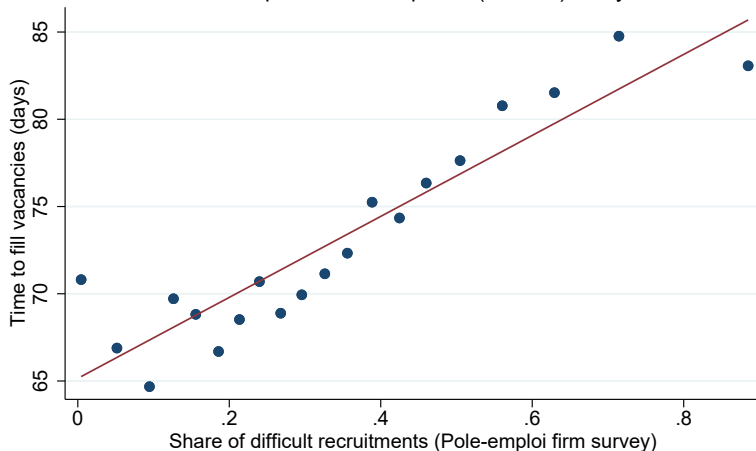


Note: RecTime set to 365 if failed recruitment

Comparison to workforce survey

Time-to-fill vs. firm-survey hiring difficulties

Across department, occupation (FAP-5d) and year



Note: weight by no of recruitments, restricted to 2015-2017

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Identification

- ▶ Consider following naive OLS regression firm $\times$ year level

$$Emp_{it} = \delta RecTime_{it} + FirmFE_i + yearFE + \epsilon_{it}$$

- ▶ δ biased for instance by:
 - ▶ market-level productivity or demand shock
 - ▶ direct $\uparrow$ in employment
 - ▶ $\uparrow$ labor market tightness $\rightarrow \uparrow$ firm-level recruiting time
 - ▶ firm-level productivity or demand shock
 - ▶ direct $\uparrow$ in employment
 - ▶ $\uparrow$ firm-level recruitment effort $\rightarrow \downarrow$ recruiting time

To achieve identification, we exploit exogenous variation in recruiting difficulty at firm-level based on shift-share analysis

Empirical design

- ▶ Exogenous firm-level variation in recruiting difficulty based on shift-share analysis:
 1. **Shifts:** $\overline{RecTime}_{kzt,-j}$
average recruiting time in year t , commuting zone z , occupation k , leaving out own industry j
 2. **Shares:** $s_{ik,2009}$
employment share of occupation k within firm i in 2009
- ▶ For each firm i in year t , the shift-share instrument for recruiting time is given by:

$$\widehat{RecTime}_{it} = \sum_k s_{ik,2009} \times \overline{RecTime}_{kzt,-j}$$

Empirical design

- ▶ Panel at firm $\times$ year level

$$Perf_{it} = \delta \widehat{RecTime}_{it} + FirmFE_i + ComZone \times Industry \times yearFE + \epsilon_{it}$$

- ▶ where $Perf_{it}$ is either employment, investment, sales or profits firm i in year t
- ▶ $\widehat{RecTime}$ shift-share prediction of recruiting time
- ▶ Standard errors are clustered at the commuting zone level

First stage

Subsample of firms posting at least one vacancy within the year

	(1)	(2)	(3)	(4)
	Share Not Filled		Time to Fill	
Share Not Filled Predicted	0.088*** (0.010)	0.069*** (0.013)		
Time to Fill Predicted			0.091*** (0.009)	0.075*** (0.012)
Firm FE	Yes	Yes	Yes	Yes
Ind*Year	Yes	No	Yes	No
Cz*Year	Yes	No	Yes	No
Ind*Cz*Year	No	Yes	No	Yes
Observations	563474	563474	563474	563474
R-Sq	0.346	0.447	0.365	0.464
Dep Var Mean	0.133	0.133	0.218	0.218

Note: ~ 350 commuting zone, 85 2-digit occupation, and 372 3-digit industry

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Effects on Employment

	(1)	(2)	(3)	(4)
	Log Employment			
Share Not Filled Predicted	-0.017*** (0.004)	-0.022*** (0.005)		
Time to Fill Predicted			-0.022*** (0.004)	-0.029*** (0.005)
Firm FE	Yes	Yes	Yes	Yes
Ind*Year	Yes	No	Yes	No
Cz*Year	Yes	No	Yes	No
Ind*Cz*Year	No	Yes	No	Yes
Observations	2616644	2616644	2616644	2616644

Two-Stage Least Square Effects on Employment

	(1)	(2)	(3)	(4)
	Log Employment - 2SLS			
Share Not Filled	-0.193*** (0.049)	-0.314*** (0.092)		
Time to Fill			-0.24*** (0.049)	-0.391*** (0.092)
Firm FE	Yes	Yes	Yes	Yes
Ind*Year	Yes	No	Yes	No
Cz*Year	Yes	No	Yes	No
Ind*Cz*Year	No	Yes	No	Yes
Obs. (red. form)	2616644	2616644	2616644	2616644
Obs. (1st stage)	563474	563474	563474	563474

- 1 sd increase in hiring difficulties → 5-10% less employees
- Compares well with calibrated model prediction:

$$d \log L_t = \frac{c_v/w_t}{(\alpha - 1)} d\tau_t = \frac{0.058}{-0.33} d\tau_t = -0.168 d\tau$$

Firms' performance

	(1)	(2)	(3)	(4)	(5)	(6)
	Investment		Profits (ROA)		Log Sales	
	(basis points)		(basis points)			
Share Not Filled Predicted	-0.3** (0.1)		-0.8** (0.3)		-0.013* (0.007)	
Time to Fill Predicted		-0.3** (0.1)		-1.0*** (0.3)		-0.015** (0.007)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2558587	2558587	2558493	2558493	2616344	2616344
Dep Var Mean	3.8	3.8	6.9	6.9		
1 sd increase effects	0.075	0.075	0.20	0.25	0.3%	0.37%

Note: Investments and profits divided by total net assets

Robustness

- ▶ Robust to input-output linkages

▶ link

- ▶ Robust to business-stealing

▶ link

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Effects on Vacancies

	(1) Vacancy Dummy	(2) Vacancy Dummy	(3) Vacancy Rate	(4) Vacancy Rate	(5) Offered Jobs Rate	(6) Offered Jobs Rate
Share Not Filled Predicted	-0.012** (0.005)		-0.004** (0.002)		-0.004*** (0.002)	
Time to Fill Predicted		-0.015*** (0.005)		-0.005*** (0.002)		-0.005*** (0.002)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2616644	2616644	2579014	2579014	2579014	2579014
Dep Var Mean	0.260	0.260	0.058	0.058	0.061	0.061

Note: one vacancy may offer several jobs/positions

$$\text{Vacancy Rate} = \text{Vac}_t / (\text{Vac}_t + \overline{\text{Emp}}_t)$$

$$\text{Offered Jobs Rate} = \text{OfferedJobs}_t / (\text{OfferedJobs}_t + \overline{\text{Emp}}_t)$$

Vacancy Requirements

- Firms facing hiring difficulties ↓ hiring standards in terms of experience required

	(1) Experience Required (years)	(2) Education Required (years)	(3) Contract Open ended	(4) Contract Full-time
Time to Fill Predicted	-1.974** (0.780)	0.023 (0.052)	-0.000 (0.021)	0.009 (0.012)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	562965	562965	562965	562965
Dep Var Mean	18.02	11.61	0.51	0.87

Hirings-Separations

	(1)	(2)
	Yearly hirings	yearly separations
Time to Fill Predicted	-0.308** (0.125)	-0.263* (0.151)
Firm FE	Yes	Yes
Ind*Cz*Year	Yes	Yes
Observations	2616644	2191350
Dep Var Mean	4.693	4.488

Wages

	(1)	(2)	(3)	(4)
	Payroll wages (log)	Yearly wages per worker (log)	Yearly Hours per worker (log)	Hourly wages per worker (log)
Time to Fill Predicted	-0.020*** (0.006)	0.017*** (0.005)	0.006 (0.005)	0.035*** (0.006)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	2616644	2616644	2616644	2615559

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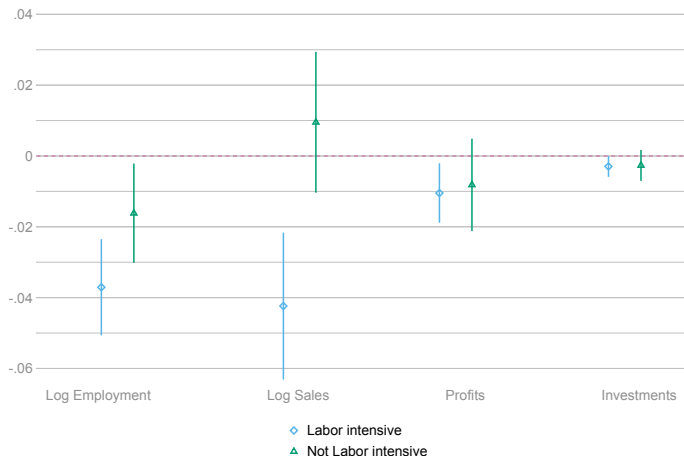
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Labor Intensive vs Not Labor Intensive

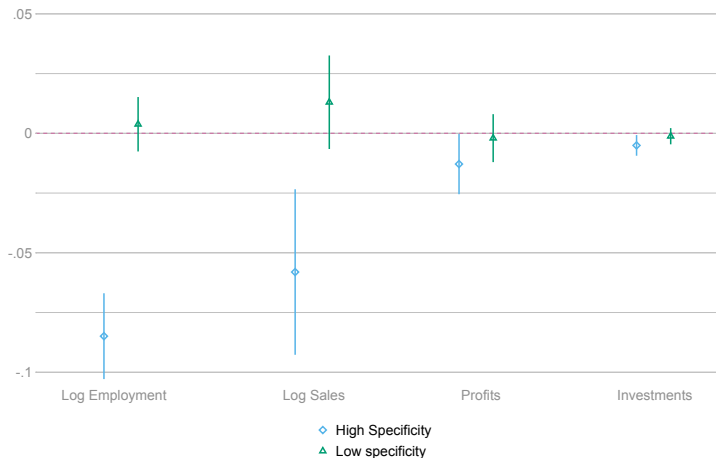


► Labor intensive: emp in 2009/total asset above median

Low vs High occupation specificity

- ▶ Sample of all firm-to-firm transitions
- ▶ Compute the number of transitions from occupation O to occupation D
- ▶ **Occupation specificity:** for every occupation D , compute the share of transitions coming from the same occupation
- ▶ for every firm, compute the average of the occupation specificity of its employees in 2009

Low vs High occupation specificity



- Specificity of average firm-level occupation in 2009 (above median)

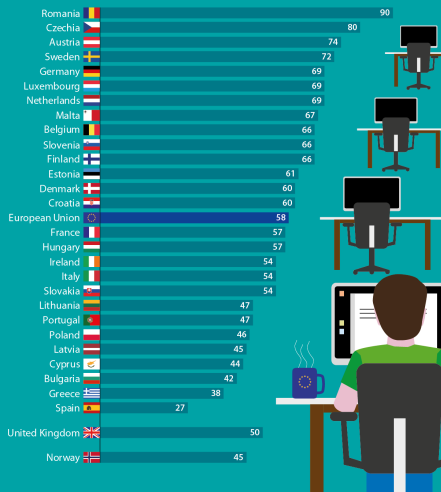
Conclusion

- ▶ Hiring difficulty hamper firms growth and profitability
- ▶ Firms adjust through various margins, changing vacancy requirements, retaining more incumbents, increasing hourly wages
- ▶ Effects are stronger for labor-intensive firms, and firms with specialised workforce.

Motivation Europe

Enterprises with hard-to-fill vacancies for ICT specialists, 2018

(% of enterprises that recruited or tried to recruit, without financial sector)

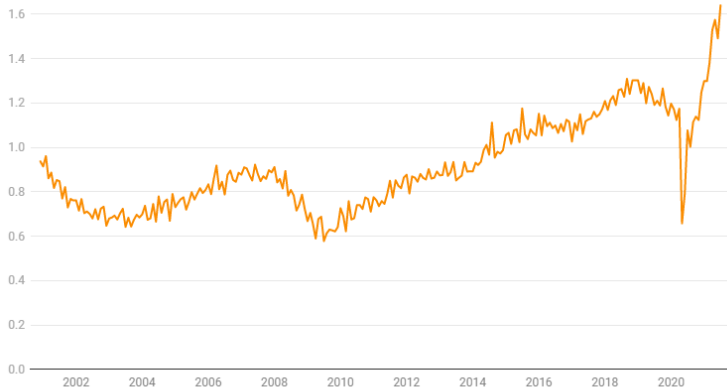


ec.europa.eu/eurostat

Motivation US JOLTS

The ratio of job openings to hires has never been higher

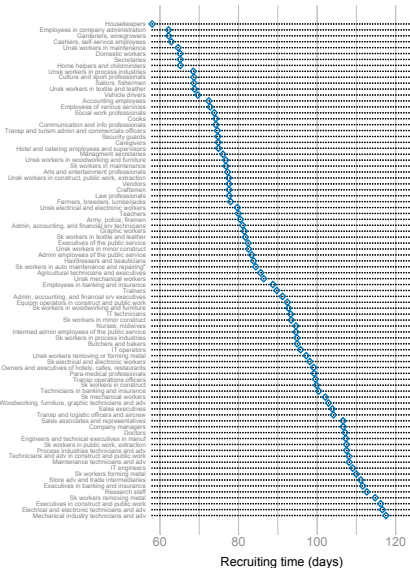
A ratio of 1 means open jobs are filled within a month on average. A higher ratio means it takes longer.



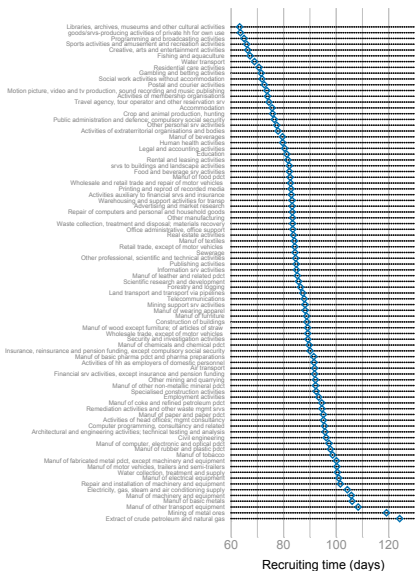
Source: [Federal Reserve Economic Data \(Job Openings and Labor Turnover Survey\)](#)

recode BY Vox

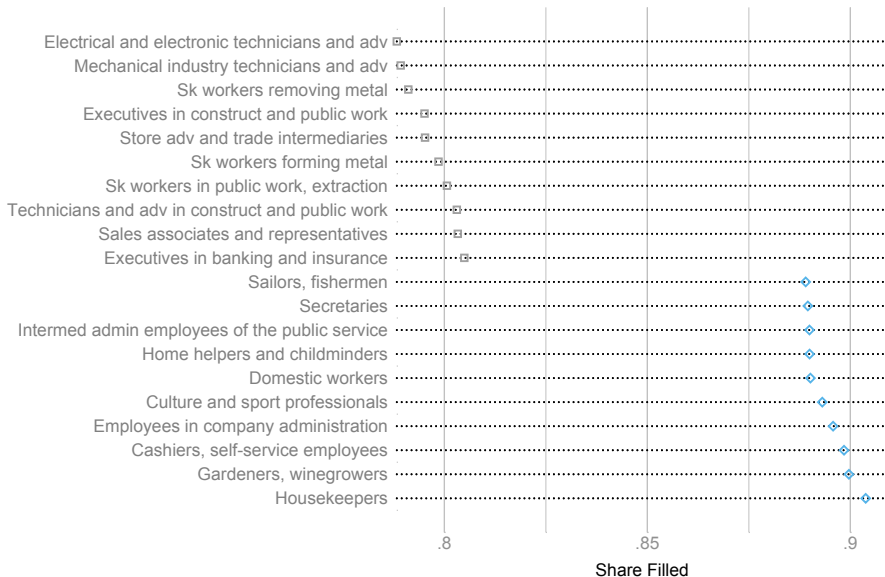
Average Recruiting Time by 2-digit Occupations



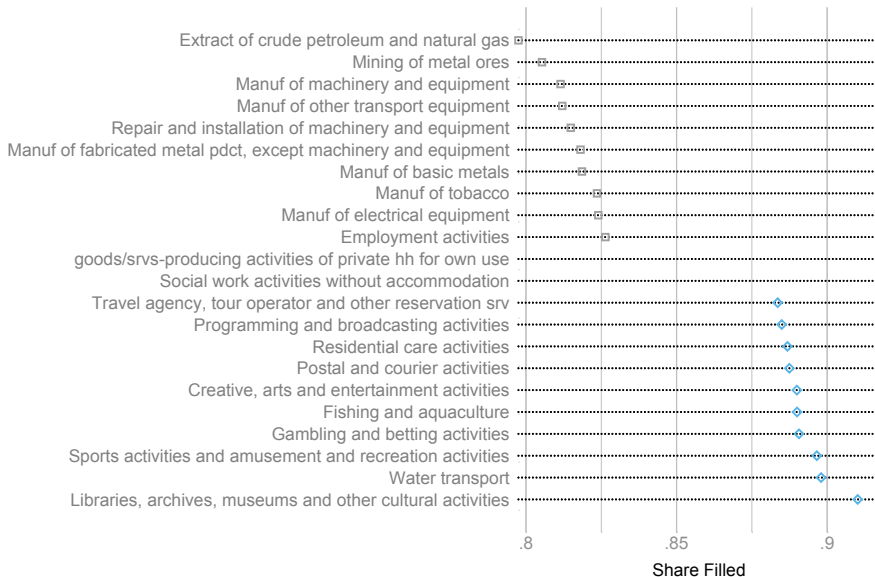
Average Recruiting Time by 2-digit Sectors



Recruitment success rate by 2-digit occupation (top & bottom 10)

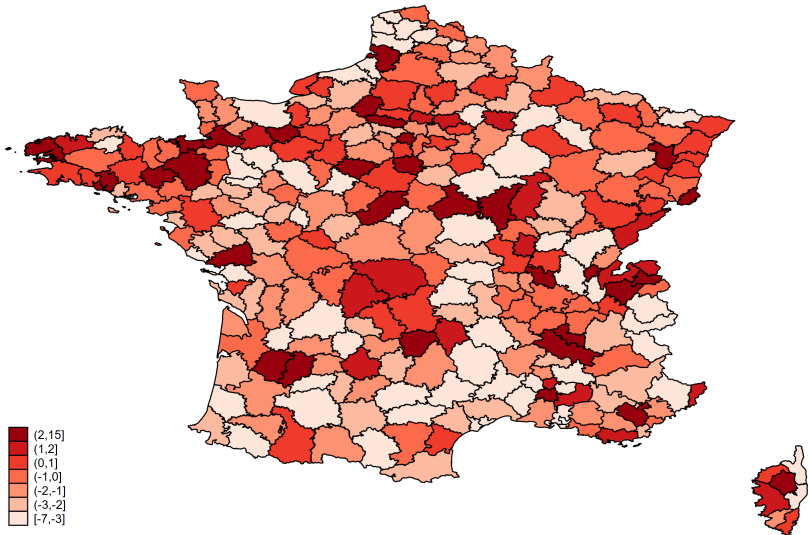


Recruitment success rate by 2-digit Sectors (top & bottom 10)



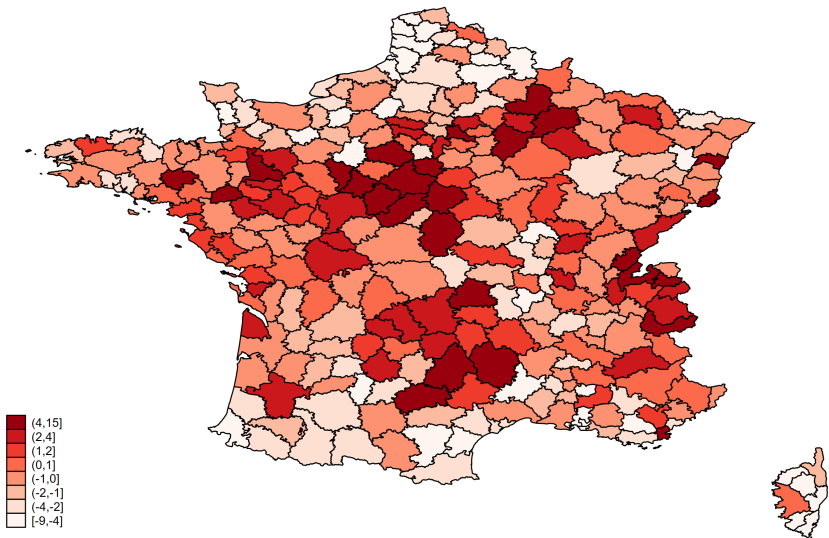
Recruiting failure rate by commuting zones (residualized)

Residualized Share Unfilled across French Local Labor Markets



Recruiting time by commuting zones (residualized)

Residualized Time-to-fill across French Local Labor Markets in Days



Note: failed recruitment excluded

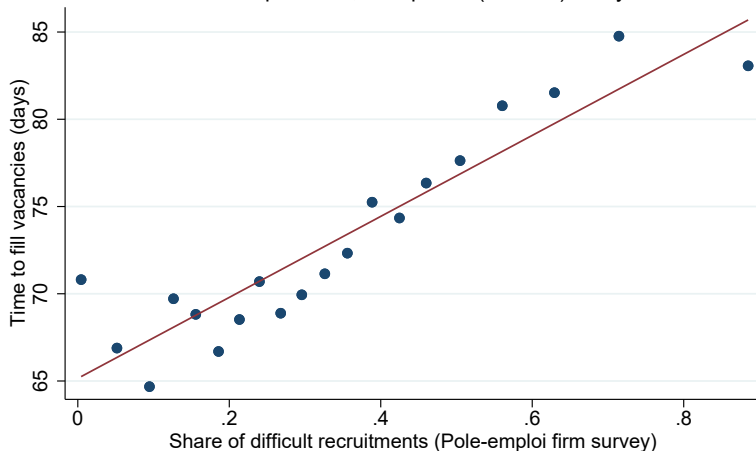
Summary statistics

	Mean	Sd	Min	Max	N
Share Filled	0.865	0.266	0.000	1.000	830716
Time to Fill	0.220	0.252	0.000	1.000	830716
Employment	23.134	288.640	1.000	102860.000	3029009
Open Vacancy	0.274	0.446	0.000	1.000	3029009
Vac Rate (DFH)	0.057	0.129	0.000	0.999	2987528
Jobs Rate (DFH)	0.060	0.134	0.000	0.999	2987528
Investment	0.039	0.077	0.000	0.724	2963041
Profits	0.066	0.259	-3.507	1.287	2962950
Log Sales	6.659	1.487	0.000	10.189	3028696

Comparison to PES workforce survey

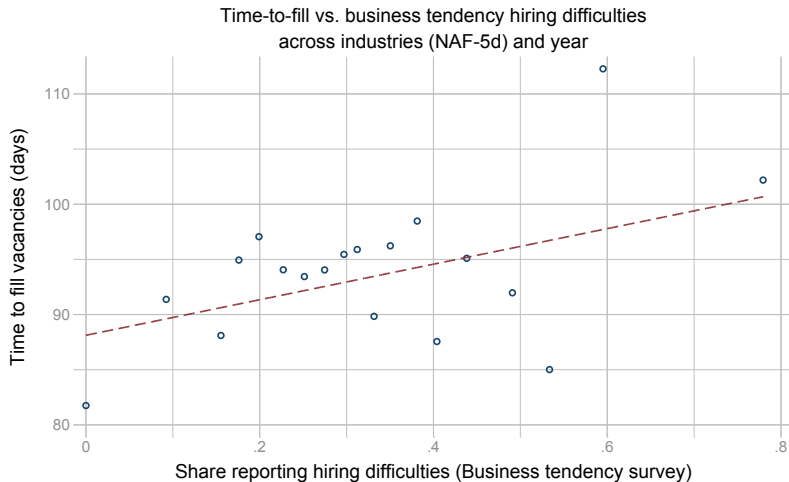
Time-to-fill vs. firm-survey hiring difficulties

Across department, occupation (FAP-5d) and year



Note: weight by no of recruitments, restricted to 2015-2017

Comparison to business tendency survey (all)



note: Weighted by number of firms, restricted to manufacturing

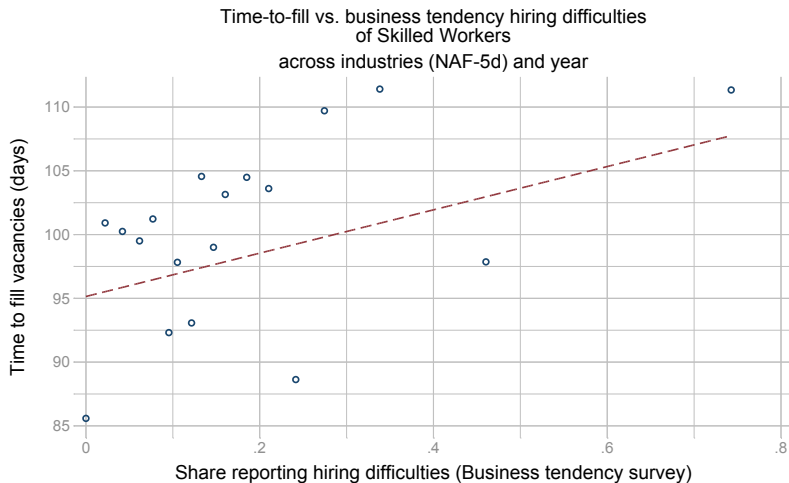
Comparison to business tendency survey (executives)

Time-to-fill vs. business tendency hiring difficulties
of Executives
across industries (NAF-5d) and year



note: Weighted by number of firms, restricted to manufacturing

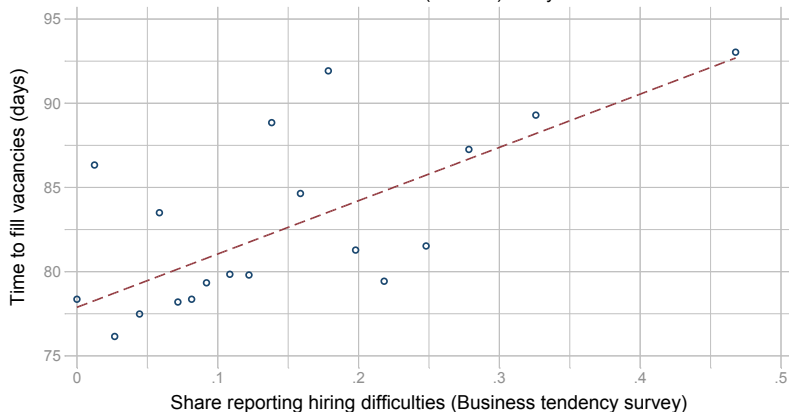
Comparison to business tendency survey (high skill)



note: Weighted by number of firms, restricted to manufacturing

Comparison to business tendency survey (high skill)

Time-to-fill vs. business tendency hiring difficulties
of Unskilled Workers
across industries (NAF-5d) and year



note: Weighted by number of firms, restricted to manufacturing

Empirical design: assumption discussions

- ▶ Key comparison: firms X and Y in same industry and commuting zone with firm X employing more occupation A workers at baseline; shocks on recruiting time for occupation A in other industries; how does employment of firm X change wrt firm Y?
- ▶ Identification robust to endogeneity of shifts: baseline shares are exogenous, i.e. not correlated to firm-specific productivity shock simultaneous to occupation-specific shocks (Goldsmith-Pinkham et al 2020)
- ▶ Identification robust to endogeneity of shares: shocks are exogenous

OLS Effects on Employment

	(1)	(2)	(3)	(4)
	Log Employment - OLS			
Share Not Filled	-0.014*** (0.002)	-0.015*** (0.002)		
Time to Fill			-0.016*** (0.002)	-0.017*** (0.002)
Firm FE	Yes	Yes	Yes	Yes
Ind*Year	Yes	No	Yes	No
Cz*Year	Yes	No	Yes	No
Ind*Cz*Year	No	Yes	No	Yes
Observations	668652	668652	668652	668652

Effects on Employment Growth

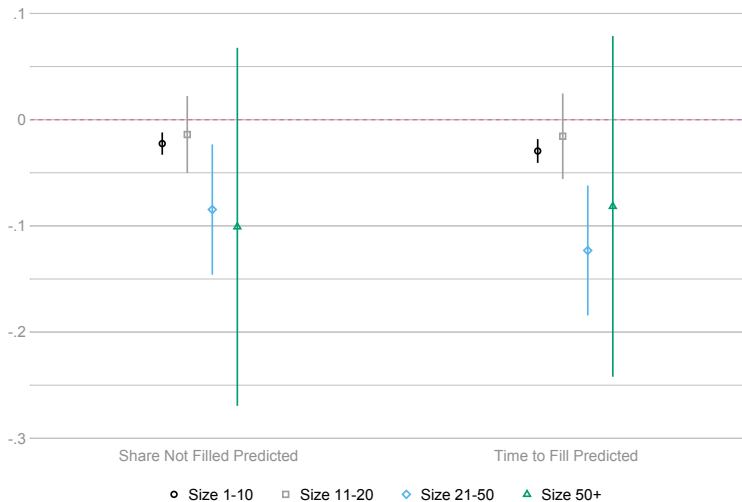
	(1)	(2)	(3)	(4)
	Delta Log Employment		Employment Growth	
Share Not Filled Predicted	-0.004 (0.003)		-0.007 (0.005)	
Time to Fill Predicted		-0.004 (0.004)		-0.006 (0.005)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	2579014	2579014	2579014	2579014

Employment - Labor Intensive vs Not Labor Intensive

	(1)	(2)	(3)	(4)
	Labor Intensive		Not Labor Intensive	
Share Not Filled Predicted	-0.028*** (0.006)		-0.010 (0.007)	
Time to Fill Predicted		-0.037*** (0.007)		-0.016** (0.007)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	1217001	1217001	1254940	1254940

- Labor intensive: emp in 2009/total asset above median

Effects on Employment by Size in 2009



Extra heterogeneity analysis

- ▶ no significant differential impact by age
- ▶ no significant differential impact by tradable vs. non tradable industries

Effects on Employment - Tradable vs Nontradable

	(1)	(2)	(3)	(4)
	Tradable		Nontradable	
Share Not Filled Predicted	-0.021*		-0.021***	
	(0.011)		(0.005)	
Time to Fill Predicted		-0.024*		-0.029***
		(0.013)		(0.006)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	276008	276008	2338327	2338327

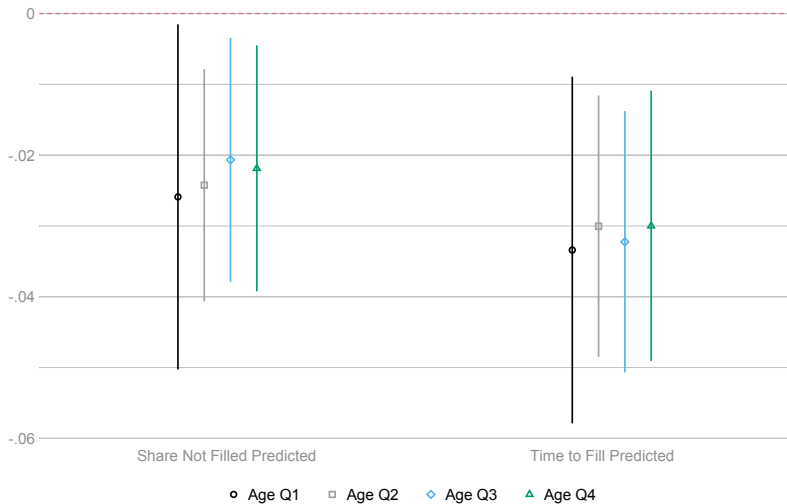
Tradable sectors are agriculture, forestry, and fishing (A); mining and quarrying (B); and manufacturing (C) (Besley et al, 2021).

Effects on Employment - Tradable vs Nontradable

	(1)	(2)	(3)	(4)
	Tradable		Nontradable	
Share Not Filled Predicted	-0.029** (0.013)		-0.020*** (0.005)	
Time to Fill Predicted		-0.034** (0.015)		-0.028*** (0.005)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	346972	346972	2266773	2266773

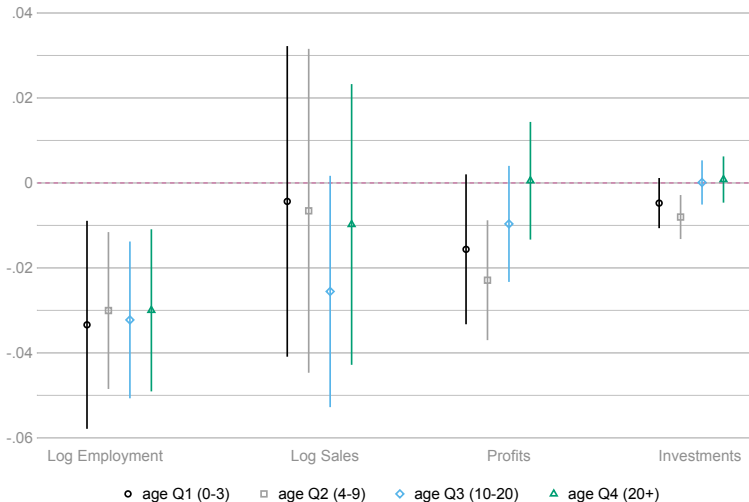
tradable sectors are agriculture, forestry, and fishing (A); mining and quarrying (B); manufacturing (C); and information and communication (J) (Mian and Sufi, 2014).

Effects on Employment by Firms Age

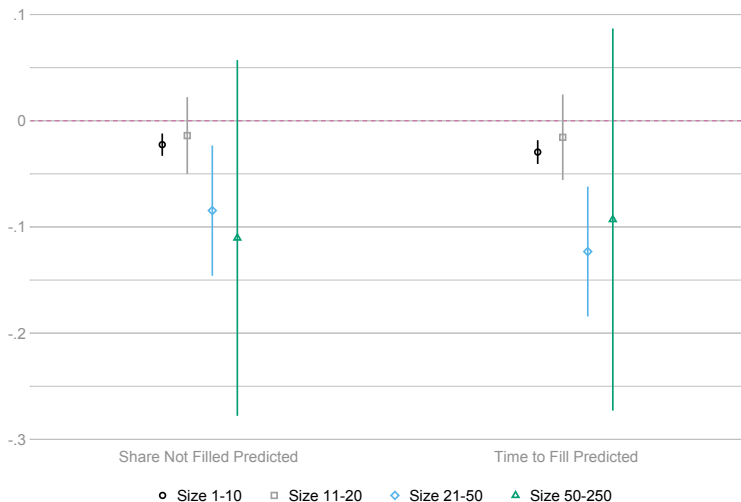


Age Q1: [0,3] years old in 2019; Q2: [4,9]; Q3: [10,20]; Q4: >20

Heterogeneous Effects by age in 2009



Effects on Employment by Size excluding large firms



exclude the 250+ category, which makes up approx 1% of tot obs/firms.

Robustness to Input-Output linkages

We exclude from time-to-fill computation the industries linked to the firms industry through input-output matrix (more than 1% market share)

	(1)	(2)	(3)	(4)
	Employment Log	Investment	Profits (ROA)	Log Sales Log
Time to Fill Predicted	-0.020*** (0.005)	-0.003*** (0.001)	-0.008*** (0.003)	-0.006 (0.006)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	2554492	2554492	2554492	2554492
Dep Var Mean		0.038	0.069	

Note: Investments and profits divided by total net assets

Robustness to Input-Output linkages

We exclude from unfilled shares computation the industries linked to the firms industry through input-output matrix (more than 1% market share)

	(1)	(2)	(3)	(4)
	Employment Log	Investment	Profits (ROA)	Log Sales
Share Not Filled Predicted	-0.013*** (0.004)	-0.002*** (0.001)	-0.006*** (0.002)	-0.006 (0.005)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	2613634	2554492	2554492	2613634
Dep Var Mean		0.038	0.069	

Note: Investments and profits divided by total net assets

Baseline for Robustness analysis

	(1)	(2)	(3)	(4)
	Employment Log	Investment	Profits (ROA)	Log Sales Log
Time to Fill Predicted	-0.022*** (0.005)	-0.003** (0.001)	-0.010*** (0.003)	-0.015** (0.007)
Firm FE	Yes	Yes	Yes	Yes
Ind*Cz*Year	Yes	Yes	Yes	Yes
Observations	2616644	2558587	2558493	2616344
Dep Var Mean		0.038	0.069	

Note: Investments and profits divided by total net assets