Recruitment Difficulties and Firms’ Growth

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Bocconi

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Motivation - U.S.

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

February survey by National Federation of Independent Business

Data: National Federation of Independent Business
Motivation - France

1 - Proportion of enterprises encountering recruitment difficulties

in %

Overall sectors
Industry
Construction industry
Services

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 ($\approx 70$ days) is associated with
   - $5\text{-}10\% \downarrow$ 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
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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:

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

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)
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

- Housekeepers
- Employees in company administration
- Gardeners, winegrowers
- Cashiers, self-service employees
- Unsk workers in maintenance
- Domestic workers
- Secretaries
- Home helpers and childminders
- Unsk workers in process industries
- Culture and sport professionals
- Maintenance technicians and adv
- IT engineers
- Sk workers forming metal
- Store adv and trade intermediaries
- Executives in banking and insurance
- Research staff
- Sk workers removing metal
- Executives in construct and public work
- Electrical and electronic technicians and adv
- Mechanical industry technicians and adv

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

Time to fill vacancies (days) vs. Share of difficult recruitments (Pole-emploi firm survey)
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Identification

- Consider following naive OLS regression firm × year level

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

- \( \delta \) biased for instance by:
  - market-level productivity or demand shock
    - direct ↑ in employment
    - ↑ labor market tightness → ↑ firm-level recruiting time
  - firm-level productivity or demand shock
    - direct ↑ in employment
    - ↑ firm-level recruitment effort → ↓ 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**: $RecTime_{kzt, -j}$
   
   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:

$$RecTime_{it} = \sum_{k} s_{ik,2009} \times RecTime_{kzt, -j}$$
Empirical design

- Panel at firm × year level

\[ \text{Perf}_{it} = \delta \text{RecTime}_{it} + \text{FirmFE}_i + \text{ComZone} \times \text{Industry} \times \text{yearFE} + \epsilon_{it} \]

- Where \( \text{Perf}_{it} \) is either employment, investment, sales or profits firm \( i \) in year \( t \)

- \( \text{RecTime} \) 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

<table>
<thead>
<tr>
<th></th>
<th>(1) Share Not Filled</th>
<th>(2) Share Not Filled</th>
<th>(3) Time to Fill</th>
<th>(4) Time to Fill</th>
</tr>
</thead>
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<tr>
<td>Share Not Filled</td>
<td>0.088*** (0.010)</td>
<td>0.069*** (0.013)</td>
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</tr>
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<td>Time to Fill</td>
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<td></td>
<td>0.091*** (0.009)</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Ind*Year</td>
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<td>R-Sq</td>
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<td>0.133</td>
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<td>0.218</td>
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</tbody>
</table>

Note: \( \sim 350 \) commuting zone, 85 2-digit occupation, and 372 3-digit industry
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## Effects on Employment

<table>
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<tr>
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<th>(1)</th>
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</thead>
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<td>-0.022***</td>
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<td>(0.004)</td>
<td>(0.005)</td>
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<td>-0.029***</td>
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# Two-Stage Least Square Effects on Employment

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<td></td>
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<td>(0.092)</td>
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<td>(0.049)</td>
<td>(0.092)</td>
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</table>

- 1 sd increase in hiring difficulties → 5-10% less employees

- Compares well with calibrated model prediction:

\[
d \log L_t = \frac{c_v}{w_t} \frac{d \tau_t}{\alpha - 1} = \frac{0.058}{-0.33} d \tau_t = -0.168d \tau
\]
Firms’ performance

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<td>(basis points)</td>
<td>(basis points)</td>
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<td>Share Not Filled</td>
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<td>-0.8**</td>
<td>-0.013*</td>
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<td>Predicted</td>
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<tr>
<td>Predicted</td>
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<td>(0.3)</td>
<td>(0.007)</td>
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<td>1 sd increase effects</td>
<td>0.075</td>
<td>0.075</td>
<td>0.20</td>
<td>0.25</td>
<td>0.3%</td>
<td>0.37%</td>
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</table>

Note: Investments and profits divided by total net assets
Robustness

- Robust to input-output linkages
- Robust to business-stealing
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## Effects on Vacancies

<table>
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<th>(1)</th>
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<tr>
<td></td>
<td>Vacancy Dummy</td>
<td>Vacancy Rate</td>
<td>Offered Jobs Rate</td>
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<tr>
<td>Share Not Filled Predicted</td>
<td>-0.012** (0.005)</td>
<td>-0.004** (0.002)</td>
<td>-0.004*** (0.002)</td>
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<td></td>
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<tr>
<td>Time to Fill Predicted</td>
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<td>-0.015*** (0.005)</td>
<td>-0.005*** (0.002)</td>
<td>-0.005*** (0.002)</td>
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<td>0.058</td>
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<td>0.061</td>
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</table>

Note: one vacancy may offer several jobs/positions

Vacancy Rate = $\frac{Vac_t}{(Vac_t + Emp_t)}$

Offered Jobs Rate = $\frac{OfferedJobs_t}{(OfferedJobs_t + Emp_t)}$
Vacancy Requirements

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

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<td></td>
<td>Experience Required</td>
<td>Education Required</td>
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<td>Contract</td>
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<tr>
<td></td>
<td>(years)</td>
<td>(years)</td>
<td>Open ended</td>
<td>Full-time</td>
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<td>Time to Fill Predicted</td>
<td>-1.974**</td>
<td>0.023</td>
<td>-0.000</td>
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<td></td>
<td>(0.780)</td>
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<td>Dep Var Mean</td>
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## Hirings-Separations

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<td></td>
<td>Yearly hirings</td>
<td>Yearly separations</td>
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<td>-0.308** (0.125)</td>
<td>-0.263* (0.151)</td>
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<td>(1) Payroll wages (log)</td>
<td>(2) Yearly wages per worker (log)</td>
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<td>-----------------------------------</td>
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<td>Time to Fill Predicted</td>
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<td>0.017*** (0.005)</td>
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<td>Ind<em>Cz</em>Year</td>
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</tr>
<tr>
<td>Observations</td>
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</tbody>
</table>
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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.
Enterprises with hard-to-fill vacancies for ICT specialists, 2018
(% of enterprises that recruited or tried to recruit, without financial sector)

- Romania: 90%
- Czechia: 80%
- Austria: 74%
- Sweden: 72%
- Germany: 69%
- Luxembourg: 69%
- Netherlands: 69%
- Malta: 67%
- Belgium: 66%
- Slovenia: 66%
- Finland: 66%
- Estonia: 61%
- Denmark: 60%
- Croatia: 60%
- European Union: 58%
- France: 57%
- Hungary: 57%
- Ireland: 54%
- Italy: 54%
- Slovakia: 54%
- Lithuania: 47%
- Portugal: 47%
- Poland: 46%
- Latvia: 45%
- Cyprus: 44%
- Bulgaria: 42%
- Greece: 38%
- Spain: 27%
- United Kingdom: 50%
- Norway: 45%

ec.europa.eu/eurostat
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)
Average Recruiting Time by 2-digit Sectors
Recruitment success rate by 2-digit occupation (top & bottom 10)

- Housekeepers
- Gardeners, winegrowers
- Cashiers, self-service employees
- Employees in company administration
- Culture and sport professionals
- Domestic workers
- Home helpers and childminders
- Intermed admin employees of the public service
- Secretaries
- Sailors, fishermen
- Executives in construct and public work
- Sk workers forming metal
- Sk workers in public work, extraction
- Technicians and adv in construct and public work
- Sales associates and representatives
- Executives in banking and insurance
- Sk workers removing metal
- Mechanical industry technicians and adv
- Sk workers forming metal
- Mechanical industry technicians and adv
- Electrical and electronic technicians and adv
- Executives in construct and public work
- Sk workers removing metal
- Executives in construct and public work
- Sk workers forming metal
- Mechanical industry technicians and adv
- Electrical and electronic technicians and adv
Recruitment success rate by 2-digit Sectors (top & bottom 10)

- Extract of crude petroleum and natural gas
- Mining of metal ores
- Manuf of machinery and equipment
- Manuf of other transport equipment
- Repair and installation of machinery and equipment
- Manuf of fabricated metal pdct, except machinery and equipment
- Manuf of basic metals
- Manuf of tobacco
- Manuf of electrical equipment
- Employment activities
- Goods/srvs-producing activities of private hh for own use
- Social work activities without accommodation
- Travel agency, tour operator and other reservation srv
- Programming and broadcasting activities
- Residential care activities
- Postal and courier activities
- Creative, arts and entertainment activities
- Fishing and aquaculture
- Gambling and betting activities
- Sports activities and amusement and recreation activities
- Water transport
- Libraries, archives, museums and other cultural activities
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

<table>
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<tr>
<th></th>
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<th>Sd</th>
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</table>
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

Time to fill vacancies (days)
Share of difficult recruitments (Pole-emploi firm survey)
Comparison to business tendency survey (all)

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

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)

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

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 exogeneous, 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

<table>
<thead>
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<th>(1)</th>
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<td>-0.015***</td>
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## Effects on Employment Growth

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### Employment - Labor Intensive vs Not Labor Intensive

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<td>(0.006)</td>
<td>(0.007)</td>
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<td>(0.007)</td>
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</table>

- Labor intensive: emp in 2009/total asset above median
Effects on Employment by Size in 2009

Share Not Filled Predicted

Time to Fill Predicted

- Size 1-10
- Size 11-20
- Size 21-50
- Size 50+
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

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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

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 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)

<table>
<thead>
<tr>
<th>Time to Fill Predicted</th>
<th>Employment Log</th>
<th>Investment</th>
<th>Profits (ROA)</th>
<th>Log Sales Log</th>
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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)

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Note: Investments and profits divided by total net assets
Baseline for Robustness analysis

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Note: Investments and profits divided by total net assets