

What Makes Hiring Difficult? Evidence from Linked Survey-Administrative Data

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Abstract

We use a novel firm survey linked to Danish administrative data to examine the factors that shape hiring decisions. Our analysis reveals three key findings. First, search and training frictions are as influential as labor costs in discouraging hiring despite potential needs. Second, these frictions disproportionately constrain younger and smaller firms, while firms with high-wage policies are less likely to report labor costs as an obstacle. Third, employers' beliefs play a critical role: many firms prefer hiring employed rather than unemployed workers, perceiving the latter as lower ability due to negative selection or skill depreciation. Firms holding such beliefs are also more likely to report that labor market frictions impede their hiring decisions.

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1. Introduction

While hiring plays a crucial role in determining employment and production levels, there is little evidence on how firms make their hiring decisions. Presumably, the decision to post a vacancy can be influenced by several factors, such as labor costs, uncertainty, or various forms of labor market friction. Which factors actually matter? And do they vary across firms? Despite the high stakes of these questions, how employers search and make their hiring decisions is far less understood than the determinants of workers' job search.

Recent literature has made progress in understanding some aspects of hiring behavior using vacancy data. For instance, it is well-documented that the job-filling rate for vacant positions varies with firm growth (e.g., Davis, Faberman, and Haltiwanger (2013); Bagger, Fontaine, Galenianos, and Trapeznikova (2022)). However, vacancy data are less suited to documenting how firms decide to hire, as they only record firms that have already chosen to open a vacancy.

This paper helps fill this gap by surveying Danish firms on the factors influencing their hiring decisions. Our survey collects responses from over 2,000 firms, representative of the population of firms. We ask about the relevance of several hiring obstacles that may discourage firms from hiring despite potential needs. We distinguish between skill shortages, labor costs, search time, training time, and economic uncertainty.¹ By linking the survey to administrative datasets, we associate these factors with firm characteristics (e.g., AKM wage firm effects, size, age, productivity) and examine the role of firms' beliefs. In particular, we assess whether beliefs about hiring job seekers with different employment statuses (employed vs. unemployed) are associated with the obstacles firms report.

Our findings can be summarized as follows. First, we show that search and training frictions are as important as labor costs in shaping hiring decisions. Around 70% of firms agree that a lack of qualified workers discourages them from hiring (labeled "skill shortage"). About 40% agree that job seekers demand wages higher than what the firm can offer (labeled "labor costs"). More than one-third report that search and matching frictions, as well as training requirements, discourage hiring (labeled "search time" and "training time"). Economic uncertainty is also a concern for more than a third of respondents.

¹Employers report their perceptions using a 5-point Likert scale: strongly disagree, disagree, neutral, agree, or strongly agree. The survey also includes open-ended questions to capture additional reasons.

Second, we link these factors to firm characteristics while controlling for detailed firm, market, and respondent attributes. High-wage firms (measured using an Abowd, Kramarz, and Margolis (1999) model, henceforth AKM) are less likely to consider labor costs a hiring obstacle, but they are just as likely as lower-wage firms to report skill shortages. This suggests that some labor market frictions cannot be resolved simply by raising wages. Smaller and younger firms are more affected by search and matching frictions, though they are not more constrained by labor costs than larger or older firms. These hiring frictions, which discourage young firms from expanding despite potential needs, may be particularly detrimental given their central role in job creation.

Third, we show that subjective beliefs influence hiring decisions. A quarter of employers prefer to hire employed workers, believing that skills deteriorate during unemployment. A similar share cite lower average abilities among the unemployed. Firms with such preferences are about 10 percentage points more likely to report multiple hiring obstacles, an effect comparable in size to that of wage premiums. To address concerns that differences in worker ability drive this correlation, we use an AKM model and compare worker fixed effects across employment statuses.

We find that the unemployed indeed have lower abilities on average, consistent with previous findings (e.g., Gregory, Menzio, and Wiczer (2022)). However, controlling for these differences has little quantitative impact on the estimated effect of employers' preferences, suggesting that the status of being unemployed, in addition to the underlying employee abilities, may substantially influence hiring decisions.

We conduct several checks to validate our survey and results. First, survey responses on firm size and revenue changes align with administrative data. Second, our estimates remain robust across alternative specifications, including controls for local labor market conditions, detailed industry and region categories, and job amenity proxies.

The institutional setting, economic context, and representativeness of our survey mitigate concerns that our results are specific to Denmark during the post-pandemic recovery. Danish firms face limited hiring and firing regulations, and wages are typically set at the firm level, although sectoral minimum wage floors are common for labor market entrants in some sectors. Our survey, conducted in summer 2021, captured a labor market that was tight but not historically so, providing a valuable setting with novel data.

Contribution to the Literature. Understanding the factors behind firms' hiring behavior is crucial, as most firms in the US and Europe report persistent hiring difficulties (see

Figure A.1). Such frictions are known to reduce firm growth (Signorelli and Fontaine 2024; Le Barbanchon, Ronchi, and Sauvagnat 2024; Friedrich and Zator 2024), yet the demand side of the labor market (the perspective of firms) is less well understood than the supply side. While recent studies have advanced knowledge of job seekers (e.g., Fluchtmann et al. 2022; Marinescu and Skandalis 2021), much less is known about how firms perceive and navigate obstacles to hiring.

We provide the first comprehensive descriptive analysis of factors influencing firms' hiring decisions, their variation across firm characteristics, and their dependence on firms' subjective beliefs. The key methodological innovation is that, rather than relying on vacancy data as in most existing studies,² we construct a novel firm-level survey on hiring decisions and link it to rich administrative records. This combination allows us to directly analyze important aspects of firms' hiring behavior and the constraints they face.

We make three contributions. First, we show that ex-ante and ex-post matching frictions (search and training times) are key reported constraints. This complements findings from Bergeaud, Cette, and Stary (2022), who show that French manufacturing firms perceive labor shortages as more significant than labor costs. While their analysis focuses on relative perceptions of shortages versus costs, our survey elicits firm-level assessments of the importance of different search and matching frictions, allowing us to characterize their prevalence and relative salience.

Second, we uncover substantial heterogeneity in these constraints. Search and training frictions disproportionately affect younger firms, which is especially relevant given their primary role in job creation (Sterk, Sedláček, and Pugsley 2021). We also find that firms paying higher wages to all their employees (i.e., high-wage firms) are less likely to report labor costs as an obstacle, consistent with evidence of imperfect labor market information on the firm side (e.g., Cullen, Li, and Perez-Truglia (2025), Friedrich and Zator (2024), Bertheau and Hoeck (2025)).

Third, we relate hiring obstacles to firms' subjective beliefs. Firms with a stronger preference for hiring employed workers are more likely to report multiple hiring constraints, even after controlling for worker characteristics. This finding complements and helps explain results in Faberman, Mueller, Sahin, and Topa (2022), who show that

²See Faberman (2020) for a review. For US evidence, see Davis, Faberman, and Haltiwanger (2013), Mongey and Violante (2019), and Forsythe and Weinstein (2021). For European evidence, see Carrillo-Tudela, Gartner, and Kaas (2022), Bagger, Fontaine, Galenianos, and Trapeznikova (2022), Mueller, Osterwalder, Zweimüller, and Kettemann (2024), Lochner, Merkl, Stüber, and Gürtzgen (2021), Carrillo-Tudela, Lochner, and Kaas (2023), and Hochmuth, Kohlbrecher, Merkl, and Gartner (2021).

job search by the employed is substantially more effective.

The paper is organized as follows. Section 2 describes the dataset and institutional setting. Section 3 and 4 document factors influencing hiring decisions and their variation across firm characteristics. Section 5 analyzes how these factors vary with firms' subjective beliefs. Section 6 concludes.

2. Linked Firm-Level Survey and Administrative Data

The main dataset is a large-scale survey we conducted in 2021 among private-sector firms in Denmark. We linked the survey to administrative datasets that provide detailed information on firms' financial conditions, workforce characteristics, and the labor market environments in which they operate.

2.1. Institutional Setting and Economic Context

Hiring and layoffs in Denmark are not subject to stringent regulations. The country ranks 26th out of 36 on the OECD employment protection index, with the US ranked 36th and most Western European countries having more restrictive policies. For 80% of private-sector workers, wages are set at the firm level. For the remaining 20%, actual wages are determined by industry-level collective agreements (the *normallønssystemet*), where base wages are not adjusted at the firm level (Dahl, Le Maire, and Munch 2013). Denmark has no national minimum wage, but wage floors (defined at the occupation-industry level) apply to inexperienced workers.

A potential concern is that hiring difficulties in Denmark may differ systematically from those in other countries. Figure A.1 suggests that this is not the case. The figure compares hiring difficulties in Europe and the United States and shows that these difficulties are a persistent concern across the business cycle.

We fielded our survey in June 2021, a period when both the Danish and global economies were on a recovery path (IMF 2021). Figure A.2 illustrates the evolution of labor market tightness in Denmark between 2016 and 2022. At the time of the survey, labor market tightness had returned to its pre-pandemic level.

Our survey was therefore conducted during a recovery phase following a recession, in a country with a flexible labor market. These features reduce concerns that our findings are driven by particular institutional arrangements or temporary macroeconomic conditions.

2.2. Survey Overview

An international consulting firm conducted an online survey in June 2021 by sending invitation emails to firms. The target population included all private and public limited companies in Denmark (ApS, *Anpartsselskab*, and A/S, *Aktieselskab*), excluding those in the agricultural and mining sectors. The survey remained open until early August 2021, with reminder emails sent in July.

The invitation email stated that the survey was conducted on behalf of the University of Copenhagen. It was designed to encourage participation and minimize selection bias by using clear, simple language and providing only a vague description of the survey topic. The email included key details, such as the survey deadline, its mobile-friendly format, and a statement on data protection compliance. The University of Copenhagen logo was displayed to enhance credibility. Including such information is known to improve response rates (Stantcheva 2023).

The questionnaire consisted of three parts. The first part collected background information about the respondent and the firm, including the respondent's role, knowledge of pay and employment policies, number of employees, and changes in revenue between 2019 and 2020. These questions helped confirm that respondents were knowledgeable about their firm's economic situation (see Figure A.3). This section also asked about firm characteristics unavailable in administrative datasets.

The second part focused on layoffs and wages.³ The third part, which is the primary focus of this paper, explored firms' hiring decisions (the full questionnaire is reported in Appendix B.2).⁴

2.3. Administrative Data on Firms and Workers

We link our survey to additional datasets to obtain information on firm-specific and labor market-specific characteristics. The main features of the administrative data are described below, with further details provided in Appendix B.1.

We use the dataset FIRM (*Generel firmastatistik*), which contains annual financial statements for private-sector firms (excluding the agricultural and financial sectors) up to 2020. Nonfinancial information, such as firm age and industry codes, is also extracted from this dataset. Workforce characteristics are obtained from various administrative

³Bertheau, Kudlyak, Larsen, and Bennedsen (2025) and Bertheau and Hoeck (2025) study why firms choose layoffs over wage cuts and their beliefs about wage setting.

⁴Qualitative questions used a five-category Likert scale: "Strongly agree," "Agree," "Neutral," "Disagree," and "Strongly disagree," consistent with common practice (Dillman, Smyth, and Christian 2014).

registers and aggregated at the firm level. We measure whether employees belong to a union, as well as their education level, age, sex, and job tenure.

In addition, we use a dataset indicating whether a wage floor applies to each occupation (1-digit level) by industry (3-digit level). Firms are classified as covered by wage floors when at least 50% of their employees are subject to such floors. We also measure the extent of non-wage job amenities using a mandatory employer survey (LONN, *Lønstatistikken*).

We use a dataset containing the universe of online job vacancies, aggregated at the occupation-region level. We calculate labor market tightness relevant to each firm based on its workforce composition.⁵ We measure firm-specific tightness using 2019 data due to access constraints.

2.4. Sample Characteristics

We impose the following restrictions on the sample. Firms and respondents must: i) have employed at least five employees in 2019, ii) operate in the private sector, iii) have available financial information, and iv) (for respondents) possess sufficient knowledge of the firm's human resources policies.

The objective of our study is to examine how firm characteristics relate to hiring difficulties, not the reverse. Therefore, we use administrative data from before the 2021 survey to analyze firm attributes as they existed at the time and assess how they correlate with subsequent recruitment difficulties. Additionally, we exclude respondents who answered "I only know a little about pay and employment conditions" to the question: "In the following questions, we ask about pay and employment practices. How close are you to such decisions?" The two other possible answers to this question were: "I am responsible for pay and employment conditions" and "I am not responsible, but I know about pay and employment conditions".

Table 1 reports descriptive statistics for the dataset across different samples. Column 1 shows the mean for the population of firms under study, while column 2 reports the mean for our sample. The sample slightly overrepresents larger firms (33 vs. 39 employees), older firms (18 vs. 21 years), and more productive firms (EUR 88,000 vs. EUR 95,000 value added per worker). Employee characteristics across surveyed firms are

⁵For firm j , tightness θ_j is computed as a weighted sum of occupation-specific tightness (θ_o) at the two-digit occupation level: $\theta_j = \sum_{o=1}^O w_{oj} \theta_o$, where $\theta_o = \frac{V_o}{U_o}$, with V_o and U_o denoting the number of vacant jobs and unemployed workers in occupation o , respectively. The weight $w_{oj} = \frac{N_{oj}}{N_j}$ is the share of workers in occupation o (N_{oj}) relative to the total number of workers in firm j in 2019 (N_j).

TABLE 1. Descriptive Statistics Across Samples of Firms

	Firm Population (Admin. data)	Linked Survey-Admin. (Unweighted)	Linked Survey-Admin. (Weighted)
Firm characteristics			
Number of employees	32.79	38.86	32.79
Firm age	18.05	20.70	18.05
Productivity	88.09	95.13	88.09
Wage premium	-0.01	0.00	-0.01
In manufacturing (%)	14.50	18.75	14.50
In services (%)	60.00	58.77	60.00
In other sectors (%)	25.50	22.49	25.50
In Copenhagen (%)	27.66	25.69	27.66
Covered by wage floor (%)	16.20	17.24	17.10
Employee characteristics			
Female (%)	28.63	28.39	29.06
Age	40.24	42.12	40.89
Tenure (years)	4.74	5.40	4.97
Bachelor's degree and above (%)	18.94	22.46	20.83
Unionized workers (%)	55.83	60.79	57.90
Observations	21797	2059	2059

Note: This table compares the characteristics of firms in our sample with those in the population. Column 1 reports the mean characteristics of the population (firms with at least five full-time employees in 2019 and available financial data). Columns 2 and 3 report the means for the unweighted and weighted samples, respectively. See Section 2 for details on the variables and weighting procedure.

largely similar to those in the population.

To improve representativeness, we reweight our sample using the entropy-balancing method (Hainmueller and Xu 2013), matching on firm size, firm age, industry composition, and region. Column 3 shows that in the reweighted sample, differences between the sample and the population are small. Overall, our final sample has a response rate of 9.44% (2059/21797) and is relatively representative of the population.

We validate respondents' knowledge of their firm's economic situation using two survey questions. First, we compare reported firm size (using the question: "How many employees were in the firm on May 1, 2021?") with administrative data on employees in March 2021. Figure A.3, Panel (a), shows close alignment. Second, we compare reported

revenue changes from 2019 to 2020 with financial account data, classifying firms as unchanged, increased, or decreased. Figure A.3, Panel (b), confirms consistency. These validations indicate that respondents were generally well informed about their firms, and we use additional sources to verify specific questions in subsequent sections.

2.5. Regression Models

We use ordered probit models to assess the relevance of several hiring obstacles. The dependent variable is the response to our main question: “What factors can discourage the firm from recruiting despite the potential need?”. It takes five ordered values: Strongly agree, Agree, Neutral, Disagree, and Strongly disagree:

$$y_i^* = \beta \mathbf{x}_i' + \gamma_{\text{region}} + \eta_{\text{industry}} + \varepsilon_i,$$

where the latent variable y_i^* is determined by a vector of explanatory variables \mathbf{x}_i' , regional and industry fixed effects (γ and η), and an error term ε_i . We report marginal effects (multiplied by 100) evaluated at mean covariate values, so estimates are interpreted as percentage point changes. Baseline probabilities of agreement are also reported to facilitate interpretation.

To estimate firm and worker fixed effects, we use a standard AKM model (Abowd, Kramarz, and Margolis 1999):

$$Y_{it} = X_{it}'\beta + \alpha_i + \psi_{j(i,t)} + \varepsilon_{it},$$

where Y_{it} is the log hourly wage of worker i in period t , X_{it} are exogenous covariates, α_i is the worker fixed effect, $j(i, t)$ is the employing firm, $\psi_{j(i,t)}$ is the firm fixed effect, and ε_{it} is an idiosyncratic error. X_{it} includes year dummies and quadratic and cubic age terms fully interacted with education. The model is estimated using data from 2008–2019. The firm-specific wage premium $\psi_{j(i,t)}$ (reported in Table 1) measures the proportional wage premium or discount paid by firm j , typically interpreted as reflecting rent-sharing, efficiency wages, or strategic wage posting. The worker effect α_i is interpreted as a combination of skills and other factors rewarded equally across firms.

3. The Determinants of the Hiring Decision

The decision to post a job vacancy can be influenced by labor costs, uncertainty, and various labor market frictions. This section documents the obstacles that discourage

firms from hiring despite having labor needs.

The survey question on hiring decisions is: “What factors can discourage the firm from recruiting despite the potential need?”. The questionnaire explicitly asks respondents to report perceptions for their own firm, not firms in general. Respondents evaluate five predefined factors, with an additional open-ended category for “other” factors. The categories are: The lack of qualified candidates; Job seekers want a higher wage than the firm can offer; Finding and choosing the right employee is too time-consuming; Training employees in firm-specific skills is too time-consuming; The uncertainty of economic activity.⁶ Throughout the paper, we use the term “hiring” to refer to labor-side costs of creating and filling a position, such as recruiting, screening, onboarding, and firm-specific training, rather than the full costs of firm expansion, which may also include capital or workspace adjustments not covered by our survey.⁷

This question directly relates to the canonical Diamond-Mortensen-Pissarides (DMP) model of the labor market. When the value of recruiting exceeds a threshold, firms search for workers. As Pissarides (2011) notes: “A job is an asset owned by the firm: if it is vacant it has some value because it can expect to recruit a worker and yield some profit in the future; if it is filled it is producing for profit. Vacant jobs are like nascent investment projects that have not started yielding a return yet. If their net value is positive, the firm can create them for profit; if it is negative, it is losing money from them, so it makes sense to close them down.”⁸

3.1. The Relative Importance of Different Hiring Obstacles

Figure 1 reports responses to the survey question. The most prevalent hiring obstacle is the lack of qualified candidates, cited by over 70% of firms, almost twice as many as the second most common obstacle. Other factors are also reported as significant barriers. About 40% of firms agree that job seekers’ wage expectations are too high. Around 37% report that searching for the right employee is too time-consuming, and 34% agree that training employees in firm-specific skills discourages hiring. Additionally, 37% state that uncertainty about economic activity is a deterrent. These obstacles are relevant

⁶Most of the “other” factors reported are similar to, or variants of, the five provided categories. Note that the item related to job seekers’ wage expectations refers to cases where the firm perceives a wage demand that is higher than it is willing or able to offer. This can be due, for instance, to either a lack of productivity, financial frictions, or the firm’s misperceptions.

⁷Our survey does not distinguish between external hires and recalls. If recalls are quantitatively important, measured hiring difficulties may understate frictions in the external labor market.

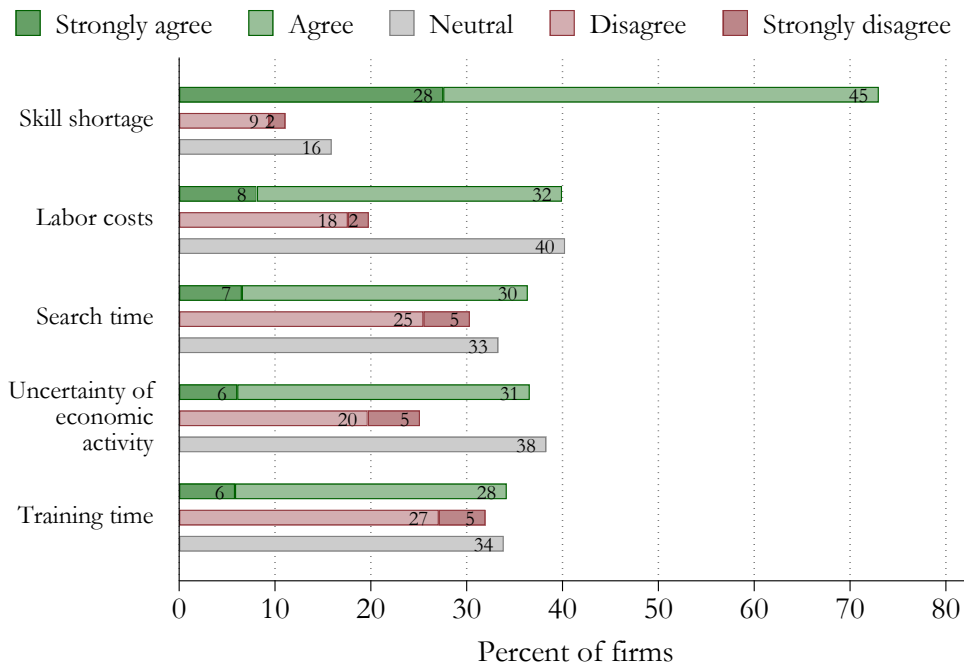
⁸However, empirical evidence about a firm’s decision to open a vacancy is rare, even though vacancy creation is key to explaining labor market fluctuations (e.g., Mercan and Schoefer (2020), Qiu (2023)).

across all sectors (see Figure A.4).

Figure 1 shows that training time for new employees is a key concern for firms. To better understand its role, we asked two additional questions. First, we asked: “When recruiting an employee, which part of the hiring process is most costly in time or money?” Firms could choose between “Search for candidates, conducting interviews” and “Training of new employees (by their manager or colleagues).” Sixty percent reported that training is more costly than search. Second, for firms that hired in 2020, we asked: “When will the newly hired employee achieve the same productivity as an average employee in a similar position? Please indicate the estimate in months.” Respondents could choose from zero to eighteen months. About 35% believe productivity is reached within three months, while 25% think it takes at least one year (results not shown).

This additional evidence supports the finding in Figure 1 that search and training frictions significantly affect firms’ hiring decisions.

FIGURE 1. Factors Altering Firms Hiring Decisions



Note: The figure reports responses to the question: "What factors can discourage the firm from recruiting despite the potential need?" The hiring obstacles are: The lack of qualified candidates (Skill shortage); Job seekers want a higher wage than the firm can offer (Labor costs); Finding and choosing the right employee is too time-consuming (Search time); Training employees in firm-specific skills is too time-consuming (Training time); The uncertainty of economic activity.

Table 2 reports the Spearman correlations between responses to the different hiring

obstacles. The strongest correlation is between search time and training time (0.59), suggesting that these two non-wage labor costs often jointly influence hiring decisions. Most other obstacles are only weakly correlated. For example, the correlation between labor costs and search or training time ranges from 0.23 to 0.27, while other correlations vary between 0.14 and 0.29.

Economic uncertainty stands out as the least related to other factors, showing no correlation with skill shortages (-0.03). Overall, Table 2 indicates that firms distinguish among the different components of hiring difficulties, and the survey responses are unlikely to be driven by a single underlying factor.

TABLE 2. Association Between Hiring Obstacles

Hiring obstacles	Skill shortage	Labor costs	Search	Training	Uncertainty
Skill shortage	1.00				
Labor costs	0.29	1.00			
Search	0.19	0.27	1.00		
Training	0.14	0.23	0.59	1.00	
Uncertainty	-0.03	0.16	0.20	0.26	1.00

Note: This table reports the correlation matrix of hiring difficulties. Hiring difficulties are the responses to the question "What factors can discourage the firm from recruiting despite the potential need?" Figure 1 shows the distribution of each response.

We next compare survey responses with *aggregate* measures of hiring difficulties. We consider two indicators: labor market tightness (defined in Section 2.5) and the percentage of unfilled vacancies ("unfilled vacancies").⁹

Table 3 reports results from univariate regressions of our hiring obstacle measures on aggregate labor market conditions. Aggregate conditions are measured at the occupational level using administrative data and linked to the survey through firms' occupational employment shares. All estimates are positive, though their magnitudes differ across factors. As expected, the skill shortage estimate is much larger than the training estimate. In contrast, none of the aggregate measures are correlated with economic uncertainty. This is reassuring, as current labor market conditions should have little effect on hiring decisions discouraged by expectations of future uncertainty. Overall, these results support that survey responses capture firms' hiring situations.

⁹Unfilled vacancies are estimated from the data source *Rekrutteringssurvey*.

TABLE 3. Hiring Obstacles and Aggregate Labor Market Conditions

Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Labor market tightness	0.09*** (0.02)	0.07*** (0.02)	0.07*** (0.02)	0.04* (0.02)	-0.01 (0.02)
<i>N</i>	2059	2059	2059	2059	2059
Unfilled vacancies	0.15*** (0.02)	0.07*** (0.02)	0.08*** (0.02)	0.05** (0.02)	-0.04 (0.02)
<i>N</i>	2029	2029	2029	2029	2029

Note: This table reports univariate OLS estimates of the relationship between hiring obstacles from our survey and aggregate labor market conditions. Aggregate conditions are measured at the occupational level using administrative data and linked to the survey through firms' occupational employment shares. These measures are standardized as Z-scores. Asterisks denote statistical significance at the 1%, 5%, and 10% levels (***, **, *), with standard errors reported in parentheses.

A potential concern is that the survey asks firms to respond to a hypothetical scenario in which they need to hire. Firms with recent hiring needs may have different experiences or concerns than those without such needs. To address this, we use another survey question asking whether firms planned to hire new employees in 2020. A total of 1,072 firms (52% of the baseline sample) answered yes.

The question does not specify whether firms successfully hired or only attempted to recruit, ensuring that all firms with hiring intentions (regardless of outcomes) are identified. Figure A.5 shows responses to the hiring difficulties question for this subsample. The results are virtually identical to those for the full sample. This finding suggests that firms with hiring plans in 2020 do not systematically differ from other firms in their responses, reducing concerns that survey answers are biased by actual hiring behavior.¹⁰

Previous studies document labor shortages across countries (e.g., Haskel and Martin 2001, Bergeaud, Cette, and Stary 2022, Terry and De Zeeuw 2018). Unlike these studies, we measure the prevalence of search and training frictions, showing that they are critical in making hiring difficult.¹¹ We also provide evidence on the time required for

¹⁰We compare our findings with predictions from a search and matching model (Appendix D). The model predicts that skill shortages, higher labor costs, longer search or training times, and greater economic uncertainty all reduce vacancy creation by lowering the expected profitability of jobs. These predictions align with our empirical results.

¹¹There is a literature measuring training requirements and their impact using data that directly elicit

new hires to reach peak productivity. We find that 25% of firms expect at least a year for new hires to match average productivity, consistent with Caplin et al. (2022) and Bertheau et al. (2022).¹²

Finally, our findings support models incorporating vacancy posting and training costs. The Diamond-Mortensen-Pissarides framework matches US labor dynamics when hiring costs include a fixed component (Pissarides 2009; Faccini and Yashiv 2022). Consistent with Den Haan, Freund, and Rendahl (2021), we also find that economic uncertainty discourages hiring.

Overall, our analysis highlights search and training frictions as central to firms' hiring decisions.

4. Hiring Obstacles, Firm and Labor Market Characteristics

The previous section documented obstacles that discourage firms from hiring despite labor needs. We now examine how these obstacles vary with firm and labor market characteristics.

4.1. Firm Characteristics

We focus on firm size, age, wage premium from an AKM model, labor productivity (value added per worker), and the firm's employment share in its local labor market. For comparability, these characteristics are standardized (Z-scores). Table 4 reports marginal effects from ordered probit models estimating the probability that firms agree or strongly agree with each hiring obstacle. The regressions include regional and industry fixed effects and control for firm performance and workforce composition. Controls include ownership type, capital stock, liquidity, revenue and employment changes, subcontracting, worker representation, educational attainment of new hires, and average employee characteristics (unionization, gender, age, tenure, education, and routine task intensity).

Hiring obstacles are more prevalent among smaller and younger firms. A one standard deviation (SD) decrease in firm size increases the probability that search time is a hiring obstacle by 2.97 percentage points (pp) and training time by 3.85 pp. Similarly,

training duration, such as O*NET. See, for instance, Feng and Graetz (2020) and Cairó and Cajner (2018).

¹²Our analysis relies on categorical firm responses to construct comparable measures of hiring frictions across firms. These measures capture the prevalence of different frictions, rather than structural estimates of search or matching parameters.

younger firms are more likely to cite these obstacles, with effects of -2.89 pp for search time and -3.51 pp for training time, even after controlling for wages and productivity. These findings align with evidence that young firms often face unique hiring challenges despite offering competitive wages.¹³

Two mechanisms may explain these patterns. First, younger firms may have limited referral networks, an important channel for attracting high-quality workers (Topa 2011; Hensvik and Skans 2016). Second, job seekers may perceive younger firms as riskier employers due to their limited track record. This uncertainty, as shown by Kim (2023), can dampen the growth of high-potential firms. Given the importance of young firms in job creation (Decker et al. 2014), policies aimed at reducing hiring frictions may be especially beneficial for this group.

Beyond firm size and age, we also examine whether firms' wage policies mitigate hiring obstacles. In search-theoretic models, higher wages attract more job seekers, both employed and unemployed. Consistent with this prediction, Table 4 shows, conditional on a productivity level, firms with higher wage premiums are less concerned about labor costs: a one standard deviation increase in wage premium reduces the likelihood of reporting labor costs as an obstacle by 3.94 pp. However, wage premiums and productivity are not associated with other obstacles such as skill shortages, search frictions, or training time. This suggests that labor markets are not perfectly competitive and that higher wages alone cannot fully offset hiring frictions. Similar patterns appear in Table 2, which shows only a weak correlation between labor cost concerns and skill shortages. These findings relate to Mueller et al. (2024), who report a small negative correlation between vacancy duration and starting wages.¹⁴

Overall, while more productive, high-paying firms are somewhat less affected by hiring obstacles, the differences are not large enough to eliminate the impact of search and training frictions. This implies that even desirable employers face constraints that limit their ability to fill vacancies, and reducing these frictions could increase job creation.

Finally, we find that higher productivity significantly reduces the impact of economic uncertainty, lowering the probability that firms cite uncertainty as an obstacle by 5.03 pp. This aligns with Den Haan, Freund, and Rendahl (2021), who show that volatility raises the option value of waiting, discouraging low-productivity firms from posting

¹³Previous studies show that young firms are typically matched with lower-quality workers despite being high-wage firms (Babina et al. 2019; Sorenson et al. 2021).

¹⁴We show more financial variables in Table A.2 in the appendix. We find that firms with higher capital intensity or higher revenue growth rate are less likely to report hiring frictions.

TABLE 4. Factors Altering Firms Hiring Decisions and Firm Characteristics

Question: What factors can discourage the firm from recruiting despite the potential need?					
Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Size	1.25 (1.27)	-2.15 (1.31)	-2.97** (1.40)	-3.85*** (1.45)	-1.79 (1.21)
Age	-2.13* (1.19)	-1.94 (1.27)	-2.89** (1.29)	-3.51*** (1.25)	-1.66 (1.24)
Productivity	1.10 (1.20)	-3.62*** (1.32)	-0.86 (1.32)	-2.06 (1.29)	-5.03*** (1.38)
Wage premium	0.20 (1.18)	-3.94*** (1.19)	-0.93 (1.15)	0.74 (1.09)	-2.17* (1.17)
Local empl. share	-1.18 (1.55)	0.75 (1.51)	-5.43*** (1.88)	-1.06 (1.78)	-2.50** (1.18)
Wage floor	-7.39** (3.58)	-9.40** (3.93)	-0.92 (3.90)	0.02 (3.74)	4.02 (4.04)
<i>N</i>	2059	2059	2059	2059	2059
Probability	.73	.37	.35	.33	.36
Additional controls	Yes	Yes	Yes	Yes	Yes

Note: The table shows ordered probit marginal effects of firm characteristics on the probability of agreeing with different hiring obstacles. The exact wording of the hiring obstacles is reported in Section 3.1. Firm characteristics are measured using administrative data and are normalized (i.e., converted to a Z-score), except for whether the firm is covered by wage floors (indicator). Additional controls include firm, workforce, and respondent characteristics, as well as 59 industry- and 5 region-fixed effects, and firm-specific labor market tightness (see Section 2.4). Asterisks show statistical significance at the 1, 5 and 10% level (***, **, * respectively). Standard errors are in parentheses.

vacancies and thereby dampening job creation.

4.2. Labor Market Characteristics

In addition to firm characteristics, a well-established literature predicts that labor market conditions also shape hiring decisions. Monopsony theory predicts that in less competitive markets, firms face fewer hiring frictions due to reduced competition for workers (Manning 2021). We proxy monopsony power by a firm's employment share within its local labor market, defined by region¹⁵ and two-digit industry. This measure captures local labor market concentration rather than firm size or productivity.

Consistent with the theory, firms with greater monopsony power are significantly less likely to report search frictions as a hiring obstacle, with the estimate (-5.43 pp) larger in magnitude than those for firm age or size. The same pattern emerges for economic uncertainty (-2.50 pp), suggesting that a stable labor supply potentially mitigates uncertainty-related hiring concerns. However, monopsony power is not associated with lower concerns about training time or skill shortages, echoing our earlier finding that high wages do not offset these frictions.

We also examine the role of wage floors, which cover 17% of firms in our sample. Coverage reduces the probability that firms report labor costs as an obstacle by 9.40 percentage points and skill shortages by 7.39 percentage points, while having no statistically significant effect on reported search frictions. This pattern is difficult to reconcile with a strongly binding cost channel, under which higher mandated wages would be expected to increase hiring difficulties. Instead, it points to wage floors operating primarily through an information and matching channel.

In our framework (see Appendix D), wage floors affect hiring through two opposing mechanisms. A binding wage floor raises vacancy-posting costs, while an information and matching channel improves firms' position in the wage-offer distribution. The latter operates not only through workers' search intensity, but also through firms' relative position on the job ladder. By providing clearer information about prevailing market wages, wage floors can correct firms' beliefs about the wages required to attract workers, allowing firms to attract acceptable candidates even if search effort does not change.

This interpretation is consistent with recent evidence showing that hiring difficulties can also stem from misperceptions about the wage distribution besides labor costs (e.g., Cullen, Li, and Perez-Truglia 2025).¹⁶ In the Danish institutional context, wage

¹⁵We divide Denmark into five regions.

¹⁶See also Bertheau and Hoeck (2025) and Friedrich and Zator (2024).

floors apply mainly to inexperienced workers and are often close to wages that firms already pay, making them unlikely to bind strongly. Instead, they primarily function as a coordination and information device that reduces uncertainty about feasible wages and narrows wage-expectation gaps.

4.3. Job Amenities

Beyond wages and labor market conditions, job amenities may also influence hiring obstacles. Firms with unfavorable job traits could have different characteristics (e.g., low productivity), which might partly drive our previous results. To account for this, we control for the share of the firm’s wage bill devoted to non-standard working conditions. These include irregular schedules (night work, public holidays, delayed lunch, on-call duty, relocation) and irregular environments (outdoor work, extreme weather). We also measure positive non-wage amenities, labeled “employee benefits,” such as free cars, meals, lodging, multimedia, taxable health insurance, canteen arrangements, and work clothes. These variables are excluded from our main analysis because the data with such information (LONN) is available only for a subsample of firms, reducing the sample size by half.

Table A.5 reports the estimates. Non-standard work conditions are positively associated with reporting search as a hiring obstacle (2.46 pp), consistent with evidence that unfavorable job amenities reduce labor supply (Maestas et al. 2023). Despite the smaller sample, patterns across firms remain similar to our main specification: younger firms continue to report higher exposure to hiring obstacles, and higher wage premiums still reduce concerns about labor costs (-3.55 pp vs. -3.94 pp in the main results).

Overall, these findings show that our main results are unlikely to be driven by unobserved differences in job amenities, reinforcing the associations documented in Table 4.

4.4. Robustness Checks and Heterogeneity Analysis

We perform several checks to confirm that our findings are robust across specifications. Using OLS instead of ordered probit or unweighted regressions yields similar results (Table A.1 and A.3). To address concerns about the hypothetical nature of the survey question, we re-estimate the main model using only firms that planned to hire in 2020 (Table A.4). The results remain consistent despite the smaller sample.

We also examine heterogeneity in the effects across the distribution of firm charac-

teristics. For each firm, we calculate the marginal effects and average them by decile (Figure A.6). The patterns confirm our baseline findings: search and training costs are less important for larger and older firms, labor cost concerns decline with the wage premium, and both labor cost and uncertainty are less binding for high-productivity firms. Finally, search frictions and uncertainty diminish as monopsony power increases.

Overall, the impact of hiring obstacles decreases most rapidly for firms at the lower end of the distributions of size, age, productivity, wages, and labor market power, reinforcing our main conclusions.

5. Hiring Obstacles and Beliefs about Workers with Different Employment Statuses

The previous section documents the factors that influence hiring decisions and their variation across firms using firm characteristics from matched employer-employee, vacancy, and financial account data. This section complements the analysis by investigating how the hiring factors vary with the subjective beliefs of the firms, using survey data on attitudes toward hiring employed versus unemployed workers.

Our analysis builds on Faberman, Mueller, Sahin, and Topa (2022), who show that employed workers search more effectively than unemployed workers, though the reasons remain unclear. One explanation is that some firms prefer hiring from the employed.¹⁷ Such preferences may disadvantage unemployed job seekers, who account for 40% of applications in the US (Faberman et al. 2022). We proceed in three steps. First, we document firms' beliefs about unemployed and employed applicants. Second, we show that firms preferring employed workers hire more from other firms. Lastly, we link these beliefs to their reported hiring obstacles.

5.1. Firms' Beliefs About the Unemployed and the Employed

Duration dependence (i.e. the decline in reemployment prospects with unemployment length) is well documented. Two mechanisms may explain why unemployed workers are viewed less favorably: (i) negative selection, where they had lower skills before unemployment, and (ii) skill depreciation, where skills deteriorate during unemployment.

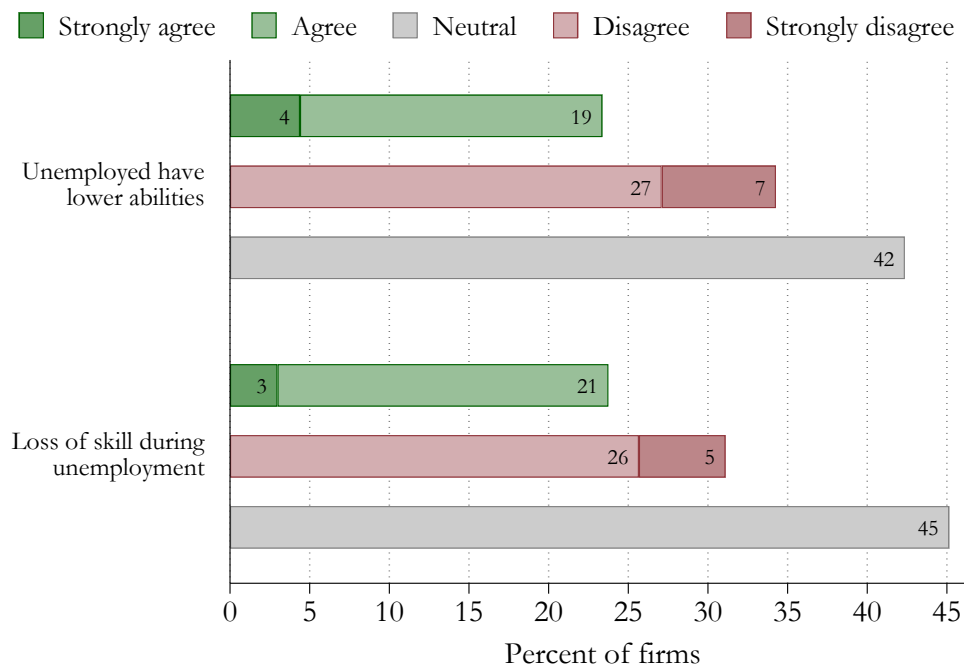
To measure these beliefs, we asked firms to state their agreement with two statements: (1) "We prefer to hire employed candidates as the unemployed lose their skills,"

¹⁷See, e.g., Kroft, Lange, and Notowidigdo (2013), Eriksson and Rooth (2014), Farber, Herbst, Silverman, and von Wachter (2019), and Cohen, Johnston, and Lindner (2025).

capturing beliefs about skill depreciation; and (2) “We prefer to hire employed candidates because unemployed workers have lower skills than those employed,” capturing beliefs about negative selection. The first belief relates to mixed evidence on skill depreciation (Cohen, Johnston, and Lindner 2025; Arellano-Bover 2022; Dinerstein, Megalokonomou, and Yannelis 2022), while the second aligns with negative selection models (Gibbons and Katz 1991).

Figure 2 summarizes the responses. We find substantial heterogeneity: 24% of firms agree that skills depreciate during unemployment, and 23% believe unemployed workers are negatively selected. These beliefs are correlated but not identical, and overall 31% of firms agree with at least one of the statements. This indicates that a sizable share of firms expresses a preference for hiring already employed workers.

FIGURE 2. Firms’ Beliefs about Hiring Already Employed over Unemployed Workers



Note: The figure shows responses to the question: Tell us your thoughts about hiring other firms’ employees. Please express your opinion on the following statements: "We prefer to hire candidates who are employed as the unemployed lose their skills" (labeled "Loss of skill during unemployment"), and "We prefer to hire candidates who are employed because unemployed workers have lower abilities than those who are employed" (labeled "Unemployed have lower abilities").

To our knowledge, evidence on firms’ perceptions of hiring employed over unemployed workers is scarce. Bewley (1999) finds that 30 out of 99 firms interviewed in

1992 in the US consider being unemployed a negative factor for job seekers. Our result, despite being from a different country setting and with a much larger sample size, is close in terms of the share of firms with similar beliefs.

Before reporting our results on firms' beliefs about the unemployed and their hiring decisions, we first investigate whether such preferences are based on objective differences in ability between the employed and the unemployed using individual-level labor market data. Worker abilities are hard to observe. We use the worker fixed effects from an AKM model as a proxy for workers' abilities.

To avoid potential bias from wage changes following an unemployment spell, we construct AKM worker fixed effects using hourly wage information from 2008 to 2019 only and do not use post-2019 wages. Employment status (employed or unemployed) is defined using a 2019 snapshot. Unemployed workers in the 2019 snapshot are required to have recent employment histories between 2015 and 2018, so their worker fixed effects are identified using wage observations close in time to the classification year.¹⁸

To quantify the difference in worker abilities, we plot the position of the worker effect percentile of the unemployed in the overall worker effect distribution. Figure A.7 reports the result. Specifically, the horizontal axis shows the percentile of the unemployed worker effects, and the vertical axis shows the corresponding percentile of the unemployed worker effects in the whole workforce. The median worker effect of the unemployed is equivalent to the 32nd percentile of all workers (both employed and unemployed). Figure A.8 shows the distribution of the worker effects by employment status. These results show that firms' preference for hiring employed over unemployed workers is not unfounded. It is consistent with the study by Mueller and Spinnewijn (2023), who show that the dynamic selection into long-term unemployment can explain half of the decline in the job finding rate, and Faberman et al. (2022), who show that 61% of the unemployed and employed wage differential can be attributed to unobserved worker heterogeneity.

In the following analysis, we include the difference in worker abilities between the two groups in our regressions. This variable is constructed using the occupational level worker effect difference, weighted by the occupation share in each firm. A more detailed explanation of how this variable is constructed can be found in Appendix C.2

¹⁸The AKM specification includes year fixed effects and flexible age controls (quadratic and cubic age terms interacted with education), so worker fixed effects capture time-invariant skill components net of life-cycle wage growth and cohort differences. Combined with the requirement that unemployed workers in 2019 have recent employment histories, this ensures that worker effects for employed and unemployed individuals are identified over comparable career stages.

5.2. Do Firms' Preferences for Employed Workers Translate into Hiring Differences?

We next examine whether firms' stated preferences for hiring employed rather than unemployed workers are reflected in their actual hiring behavior. The dependent variable is the poaching rate from our survey ("What percentage of your employees are recruited from other firms?"), and the key explanatory variables capture firms' beliefs about skill depreciation and negative selection. Panels A and B of Figure A.9 show the distribution of the poaching rate reported by firms and the poaching rate by sector, respectively. A third of the firms state that up to a fifth of the workers come from other firms, while a quarter say that at least 90% come from other firms.

We investigate whether firms' preferences for the employed over the unemployed impact their hiring behavior. The outcome variable is the poaching rate from our survey, and we use firms' preferences for hiring already employed workers as the explanatory variables. The results are shown in Table 5.

We find that preferring the employed for either reason (skill depreciation or negative selection) is associated with an increase in the poaching rate by around 10 percentage points. These results suggest that firms' preference for the employed over the unemployed does indeed affect their actual hiring behavior.

TABLE 5. Firms' Beliefs about the Unemployed and Poaching Rate

Q: What percentage of your employees are recruited from other firms?		
	(1)	(2)
Prefer to hire employed: loss of skill	10.41*** (1.95)	
Prefer to hire employed: ability		11.89*** (2.01)
<i>N</i>	2020	2020
Mean Dep. Var.	51.96	51.96
Adj.R2	0.143	0.147
Additional controls	Yes	Yes
Δ E -U abilities	Yes	Yes

Note: This table reports OLS estimates of the effect of firms' beliefs about hiring already employed workers over unemployed workers on their poaching rate. Column 1 includes the belief that skills deteriorate during unemployment, while Column 2 includes the belief that unemployed workers have lower abilities. Asterisks indicate statistical significance at the 1%, 5%, and 10% levels (***, **, *). Standard errors are reported in parentheses.

5.3. Hiring Obstacles and Firms' Beliefs about the Unemployed

Having shown that firms hold heterogeneous beliefs about job seekers and that these beliefs influence hiring behavior, we now ask whether employers who prefer to hire already employed workers face greater hiring difficulties. We hypothesize that such preferences, driven by concerns about skill depreciation or adverse selection, restrict the pool of acceptable candidates and thereby increase hiring obstacles.¹⁹

To test this, we create a dummy variable indicating whether firms agree with at least one statement expressing a preference for hiring employed workers. Table 6 reports results from specifications analogous to Table 4, controlling for firm and labor market characteristics as well as differences in worker abilities between employed and unemployed candidates. This approach reduces concerns that labor market tightness drives both preferences and obstacles.

We find that a preference for hiring candidates who are already employed is strongly associated with higher reported hiring obstacles (7.29 – 10.48 pp), with the expected exception of economic uncertainty.²⁰

TABLE 6. Factors Altering Hiring Decisions and Firms' Beliefs about the Unemployed

Question: What factors can discourage the firm from recruiting despite the potential need?					
Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Prefer hiring employed	10.48*** (2.28)	9.00*** (2.38)	7.83*** (2.30)	7.29*** (2.21)	1.75 (2.23)
<i>N</i>	2031	2031	2031	2031	2031
Probability	.73	.37	.35	.33	.36
Firm characteristics	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes
Δ E -U abilities	Yes	Yes	Yes	Yes	Yes

The table reports the marginal effects from ordered probit regressions of firms' preference for hiring employed over unemployed candidates on the probability of agreeing with different hiring obstacles. Prefer hiring employed is an indicator variable. Firm characteristics (listed in Table 4) are included as controls. Asterisks denote statistical significance at the 1%, 5%, and 10% levels (***, **, * respectively). Standard errors are reported in parentheses.

¹⁹A detailed exploration of this mechanism is beyond the scope of this paper but remains a plausible channel.

²⁰Table A.6 reports the firm characteristics included in the regression.

Our novel descriptive evidence on the firm side complements existing descriptive evidence on the worker side (Faberman et al. 2022). In particular, we find that some firms prefer to hire already employed workers. While this preference may be partly explained by differences in worker abilities between employed and unemployed job seekers, we also identify a separate role for employers' preferences. Specifically, our measure of these preferences is unrelated to firm characteristics, and the effect on hiring behavior remains after controlling for firm-level measures of worker ability differences.

Overall, our findings suggest that the composition of the job seeker pool shapes hiring decisions.²¹ While standard models predict a preference for unemployed applicants, our evidence indicates that firms' hiring behavior varies systematically with the employment status of job seekers. These patterns point to economically relevant heterogeneity between employed and unemployed workers, which we leave to future work to quantify and decompose.

6. Conclusion

This paper provides new evidence on the determinants of firms' hiring decisions using a novel survey of Danish employers linked to administrative data. We directly measure factors that discourage hiring despite labor needs and relate them to firm characteristics and beliefs.

We find three main results. First, search and training frictions, covering both search and training time, are important determinants of hiring decisions. Second, these constraints are particularly relevant for smaller and younger firms. High-wage firms are less likely to report labor costs as an obstacle but face similar search and training frictions, indicating that higher wages alone do not remove all hiring barriers. Third, subjective beliefs matter: around 30% of firms prefer hiring employed workers due to concerns about negative selection or skill depreciation among the unemployed, and these beliefs are strongly linked to multiple hiring obstacles even after controlling for worker abilities.

Overall, firms face several hiring obstacles that vary with both firm characteristics and beliefs about job seekers. By moving beyond vacancy data and directly eliciting em-

²¹The composition of the job seeker pool can also amplify macroeconomic shocks. Specifically, feedback between employed workers' search efforts and firms' vacancy creation incentives amplifies the economy's response to a negative productivity shock and generates empirically plausible declines in vacancies (see also Eeckhout and Lindenlaub 2019).

ployers' obstacles, this study complements existing evidence on the demand side of the labor market. Policies that reduce search and training costs or address misperceptions about unemployed workers could improve matching efficiency.

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Online Appendix

A. Additional Tables and Figures

A.1. Tables

TABLE A.1. Hiring Obstacles and Firm Characteristics: OLS regressions

Question: What factors can discourage the firm from recruiting despite the potential need?					
Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Size	0.03 (0.03)	-0.05** (0.03)	-0.07** (0.03)	-0.09*** (0.03)	-0.05** (0.03)
Age	-0.04 (0.03)	-0.03 (0.03)	-0.06** (0.03)	-0.07** (0.03)	-0.04 (0.03)
Productivity	0.02 (0.03)	-0.07*** (0.03)	-0.02 (0.03)	-0.05 (0.03)	-0.12*** (0.03)
Wage premium	-0.00 (0.03)	-0.07*** (0.02)	-0.02 (0.03)	0.01 (0.03)	-0.04 (0.03)
Local empl. share	-0.04 (0.03)	0.02 (0.03)	-0.09*** (0.03)	-0.02 (0.03)	-0.05** (0.02)
Wage floor	-0.19** (0.08)	-0.19** (0.08)	-0.00 (0.09)	-0.00 (0.09)	0.06 (0.09)
<i>N</i>	2059	2059	2059	2059	2059
Mean Dep. Var.	3.86	3.21	3.03	2.99	3.1
Adj.R2	0.054	0.049	0.049	0.036	0.082
Additional controls	Yes	Yes	Yes	Yes	Yes

Note: The table shows OLS estimates of agreeing with different statements related to the question: "What factors can discourage the firm from recruiting despite the potential need?" The specifications are the same as in Table 4. The scale ranges from 1 (strongly disagree) to 5 (strongly agree). Asterisks report statistical significance at the 1, 5 and 10% level (***, **, *; respectively). Standard errors are in parentheses.

TABLE A.2. Financial Factors Altering Firms Hiring Decisions and Firm Characteristics

Question: What factors can discourage the firm from recruiting despite the potential need?					
Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Size	1.25 (1.27)	-2.15 (1.31)	-2.97** (1.40)	-3.85*** (1.45)	-1.79 (1.21)
Age	-2.13* (1.19)	-1.94 (1.27)	-2.89** (1.29)	-3.51*** (1.25)	-1.66 (1.24)
Productivity	1.10 (1.20)	-3.62*** (1.32)	-0.86 (1.32)	-2.06 (1.29)	-5.03*** (1.38)
Wage premium	0.20 (1.18)	-3.94*** (1.19)	-0.93 (1.15)	0.74 (1.09)	-2.17* (1.17)
Local empl. share	-1.18 (1.55)	0.75 (1.51)	-5.43*** (1.88)	-1.06 (1.78)	-2.50** (1.18)
Wage floor	-7.39** (3.58)	-9.40** (3.93)	-0.92 (3.90)	0.02 (3.74)	4.02 (4.04)
Capital per worker	-0.99 (1.04)	1.64 (1.10)	-1.85* (1.05)	-2.41** (1.10)	-2.92** (1.26)
Revenue growth rate in 2020 (%)	-2.16* (1.29)	-0.16 (1.33)	0.41 (1.18)	-2.02* (1.18)	-0.76 (1.38)
<i>N</i>	2059	2059	2059	2059	2059
Probability	.73	.37	.35	.33	.36
Additional controls	Yes	Yes	Yes	Yes	Yes

Note: The table shows ordered probit marginal effects of firm characteristics on the probability of agreeing with different hiring obstacles. The exact wording of the hiring obstacles is reported in Section 3.1. Firm characteristics are measured using administrative data and are normalized (i.e., converted to a Z-score), except for whether the firm is covered by wage floors (indicator). Additional controls include firm, workforce, and respondent characteristics, as well as 59 industry- and 5 region-fixed effects, and firm-specific labor market tightness (see Section 2.4). Asterisks show statistical significance at the 1, 5 and 10% level (***, **, * respectively). Standard errors are in parentheses.

TABLE A.3. Hiring Obstacles and Firm Characteristics: Unweighted Sample

Question: What factors can discourage the firm from recruiting despite the potential need?					
Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Size	0.73 (1.26)	-1.82 (1.23)	-2.99** (1.27)	-3.61*** (1.31)	-1.94 (1.20)
Age	-1.90* (1.14)	-1.90 (1.20)	-3.68*** (1.21)	-3.91*** (1.17)	-1.62 (1.18)
Productivity	0.76 (1.13)	-3.05** (1.19)	-0.47 (1.22)	-1.79 (1.18)	-4.73*** (1.28)
Wage premium	-0.05 (1.12)	-4.32*** (1.08)	-0.94 (1.04)	0.69 (1.02)	-2.53** (1.10)
Local empl. share	-1.05 (1.52)	0.36 (1.41)	-4.46*** (1.72)	-0.49 (1.64)	-2.16** (1.09)
Wage floor	-5.17 (3.50)	-10.30*** (3.68)	-1.81 (3.61)	-1.90 (3.49)	2.04 (3.80)
<i>N</i>	2059	2059	2059	2059	2059
Probability	.73	.37	.35	.33	.36
Additional controls	Yes	Yes	Yes	Yes	Yes

Note: The table shows unweighted ordered probit estimates of agreeing with different statements related to the question: "What factors can discourage the firm from recruiting despite the potential need?" The specifications are the same as in Table 4. Asterisks indicate statistical significance at the 1, 5 and 10% level (***, **, *; respectively). Standard errors are in parentheses.

TABLE A.4. Hiring Obstacles and Firm Characteristics: Planned to Hire in 2020

Question: What factors can discourage the firm from recruiting despite the potential need?

Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Size	-0.62 (1.33)	-1.75 (1.79)	-3.76** (1.86)	-4.09** (1.96)	-1.22 (1.45)
Age	-2.62* (1.54)	-2.58 (1.80)	-1.22 (1.81)	-3.87** (1.79)	-2.14 (1.67)
Productivity	-0.37 (1.47)	-6.47*** (1.93)	-0.29 (1.82)	-3.57* (1.86)	-6.80*** (1.81)
Wage premium	1.94 (1.39)	-4.23*** (1.63)	-0.73 (1.48)	1.62 (1.44)	-1.19 (1.50)
Local empl. share	0.94 (1.60)	1.87 (2.56)	-2.46 (2.89)	-1.11 (2.88)	-2.89 (1.90)
Wage floor	-8.28* (4.68)	-8.40 (5.77)	-2.35 (5.75)	-0.24 (5.28)	11.61** (5.40)
<i>N</i>	1072	1072	1072	1072	1072
Probability	.73	.37	.35	.33	.36
Additional controls	Yes	Yes	Yes	Yes	Yes

Note: The table shows ordered probit marginal effects of firm characteristics on the probability of agreeing with statements about different hiring obstacles. Only firms that indicate that they planned to hire in 2020 are included in the subsample. The exact wording of the hiring obstacles is cited in Section 3.1. Firm characteristics are measured from administrative data and are normalized (i.e., converted to a Z-score), except for whether the firm is covered by wage floors (indicator). Additional controls include firm, workforce, and respondent characteristics, as well as 59 industry- and 5 region-fixed effects, and firm-specific labor market tightness (see Section 2.4). Asterisks indicate statistical significance at the 1, 5 and 10% level (***, **, * respectively). Standard errors are in parentheses.

TABLE A.5. Hiring Obstacles and Firm Characteristics: Job Amenities

Question: What factors can discourage the firm from recruiting despite the potential need?					
Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Firm Characteristics					
Size	1.41 (1.35)	-1.84 (1.38)	-1.77 (1.53)	-1.81 (1.46)	0.27 (1.32)
Age	-2.86* (1.52)	-2.56 (1.62)	-4.16** (1.70)	-5.14*** (1.61)	-1.43 (1.59)
Productivity	1.85 (1.74)	-1.78 (1.89)	-1.42 (1.79)	-4.22** (1.91)	-6.04*** (2.10)
Wage premium	-3.55** (1.80)	-4.02** (2.00)	-2.48 (1.96)	-0.85 (1.91)	-2.81 (1.82)
Local empl. share	0.68 (1.73)	1.38 (1.59)	-5.53** (2.22)	-0.51 (1.78)	-2.98** (1.47)
Wage floor	-8.50 (5.23)	-7.42 (5.31)	-3.53 (5.45)	-2.37 (5.13)	3.80 (5.56)
Job Amenities					
Non standard condition (%)	-0.37 (1.25)	-0.12 (1.12)	2.46* (1.38)	-0.30 (1.52)	-2.92** (1.38)
Employee benefit (%)	1.50 (1.41)	1.03 (1.51)	-1.21 (1.69)	1.85 (1.34)	-0.37 (1.28)
<i>N</i>	1072	1072	1072	1072	1072
Probability	.73	.37	.35	.33	.36
Additional controls	Yes	Yes	Yes	Yes	Yes

Note: The table shows the marginal effects of firm characteristics on the probability of agreeing with statements on hiring obstacles from ordered probit models. This sample only includes firms with information on non-standard employment conditions and employee benefits. The specifications are the same as in Table 4, except for two additional variables. Non-standard working conditions are the percentage of pay for non-standard working conditions, which includes irregular work schedules (such as night work, work on public holidays, delayed lunch, on-call and relocation) and irregular working conditions (such as outdoor work and extreme weather). Employee benefits are the percentage of pay for benefits, which is defined as the value of a free car, meals, lodging, multimedia, taxable health insurance and treatments, canteen arrangements, and work clothes. Asterisks indicate statistical significance at the 1, 5 and 10% level (***, **, * respectively). Standard errors are in parentheses.

TABLE A.6. Hiring Obstacles, Firm Characteristics and Firm Preferences

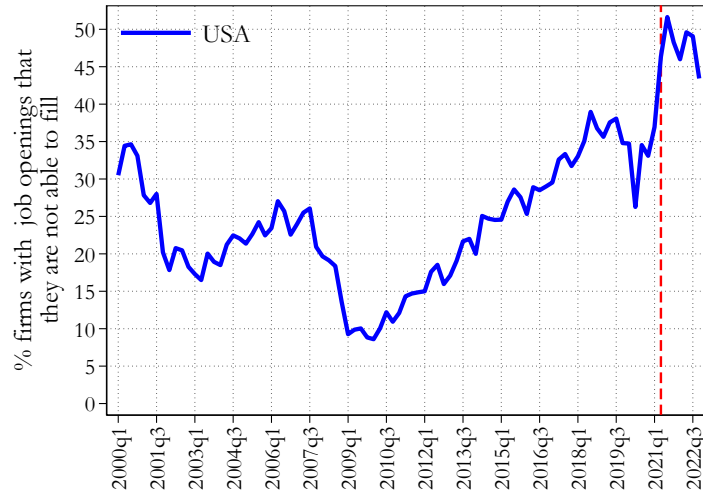
Question: What factors can discourage the firm from recruiting despite the potential need?					
Hiring obstacles:	Skill shortage (1)	Labor costs (2)	Search (3)	Training (4)	Uncertainty (5)
Prefer hiring employed	10.48*** (2.28)	9.00*** (2.38)	7.83*** (2.30)	7.29*** (2.21)	1.75 (2.23)
Firm Characteristics					
Size	1.56 (1.25)	-1.83 (1.31)	-2.63* (1.39)	-3.54** (1.44)	-1.74 (1.21)
Age	-2.41** (1.20)	-2.08 (1.28)	-3.14** (1.31)	-3.69*** (1.28)	-1.95 (1.25)
Productivity	0.82 (1.18)	-3.76*** (1.36)	-1.18 (1.34)	-2.19* (1.30)	-5.14*** (1.41)
Wage premium	0.15 (1.19)	-4.19*** (1.21)	-0.84 (1.17)	0.61 (1.11)	-2.42** (1.18)
Local empl. share	-1.23 (1.57)	0.55 (1.52)	-5.51*** (1.85)	-1.35 (1.73)	-2.41** (1.18)
Wage floor	-5.95* (3.58)	-8.81** (3.97)	-0.08 (3.98)	1.38 (3.81)	5.31 (4.07)
<i>N</i>	2031	2031	2031	2031	2031
Probability	.73	.37	.35	.33	.36
Additional controls	Yes	Yes	Yes	Yes	Yes
Δ E-U abilities	Yes	Yes	Yes	Yes	Yes

Note: The table reports ordered probit marginal effects of firm characteristics and firms' preference for hiring employed over unemployed candidates on the probability of agreeing with statements about different hiring obstacles. The specification is identical to that in Table 6, but here we additionally report the estimates for firm characteristics. Asterisks indicate statistical significance at the 1, 5 and 10% level (***, **, * respectively). Standard errors are in parentheses.

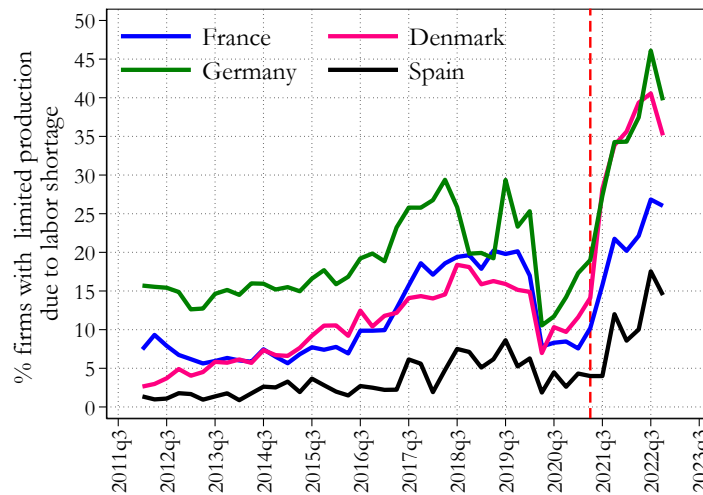
A.2. Figures

FIGURE A.1. The Prevalence of Hiring Difficulties Across Countries

Panel (a): Evidence from the United States

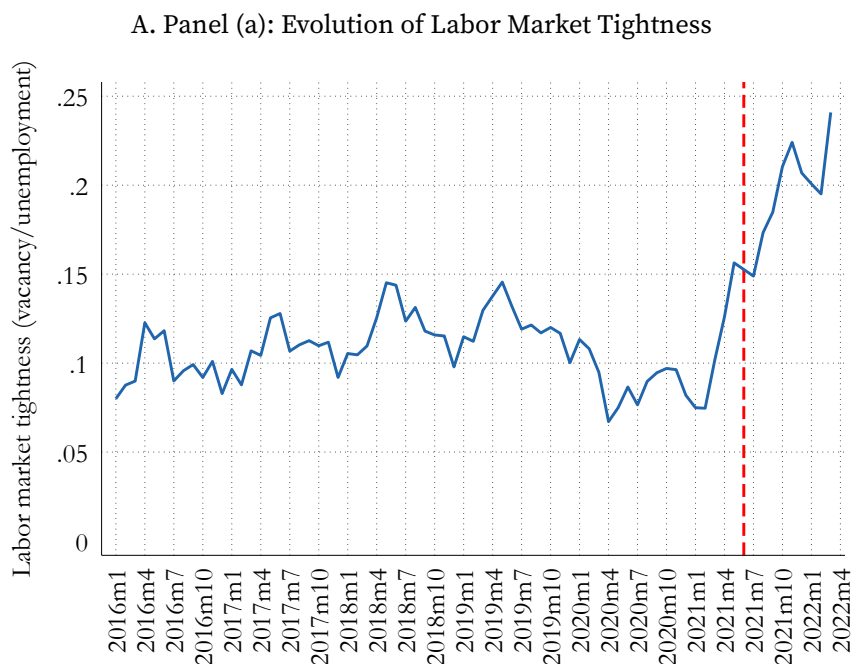


Panel (b): Evidence from Selected European Countries



Note: The dotted red line indicates the time (June 2021) when the survey was conducted. Panel (a) reports the response to the question: Do you have any job openings that you are not able to fill right now? Source: Small Business Economic Trends, NFIB. Panel (b) reports the percentage of firms with limited production due shortage of labor in selected European countries. The question is: What main factors are currently limiting your production? Possible responses are: none, insufficient demand, shortage of labor force, shortage of material and/or equipment, financial constraints, other factors. Source: Business Survey from the DG-ECFIN 2022, i.e., the European Commission Department for Economic and Financial Affairs.

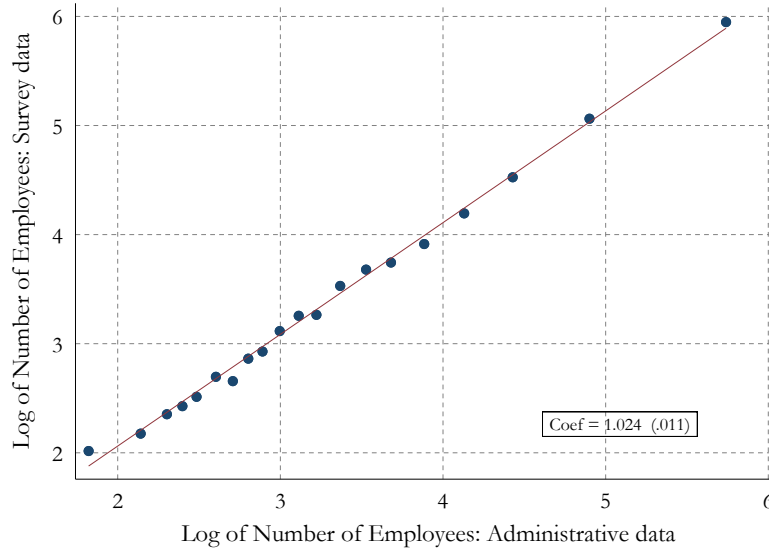
FIGURE A.2. Economic Context around the time of the Survey Implementation



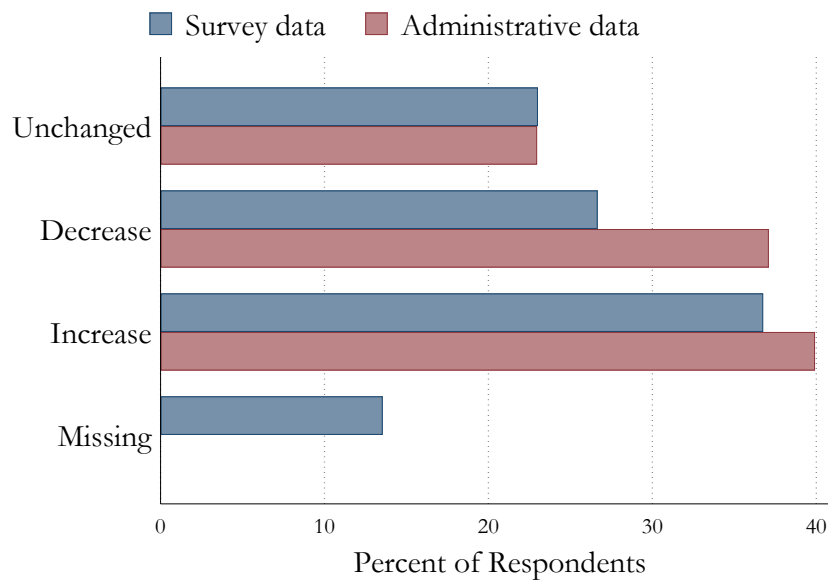
Note: This figure reports the number of vacant positions over the number of unemployed workers in Denmark. The dotted red line indicates the time (June 2021) when the survey was conducted. Source: STAR.

FIGURE A.3. Comparison of Survey and Administrative data

A. Panel (a): Number of Employees

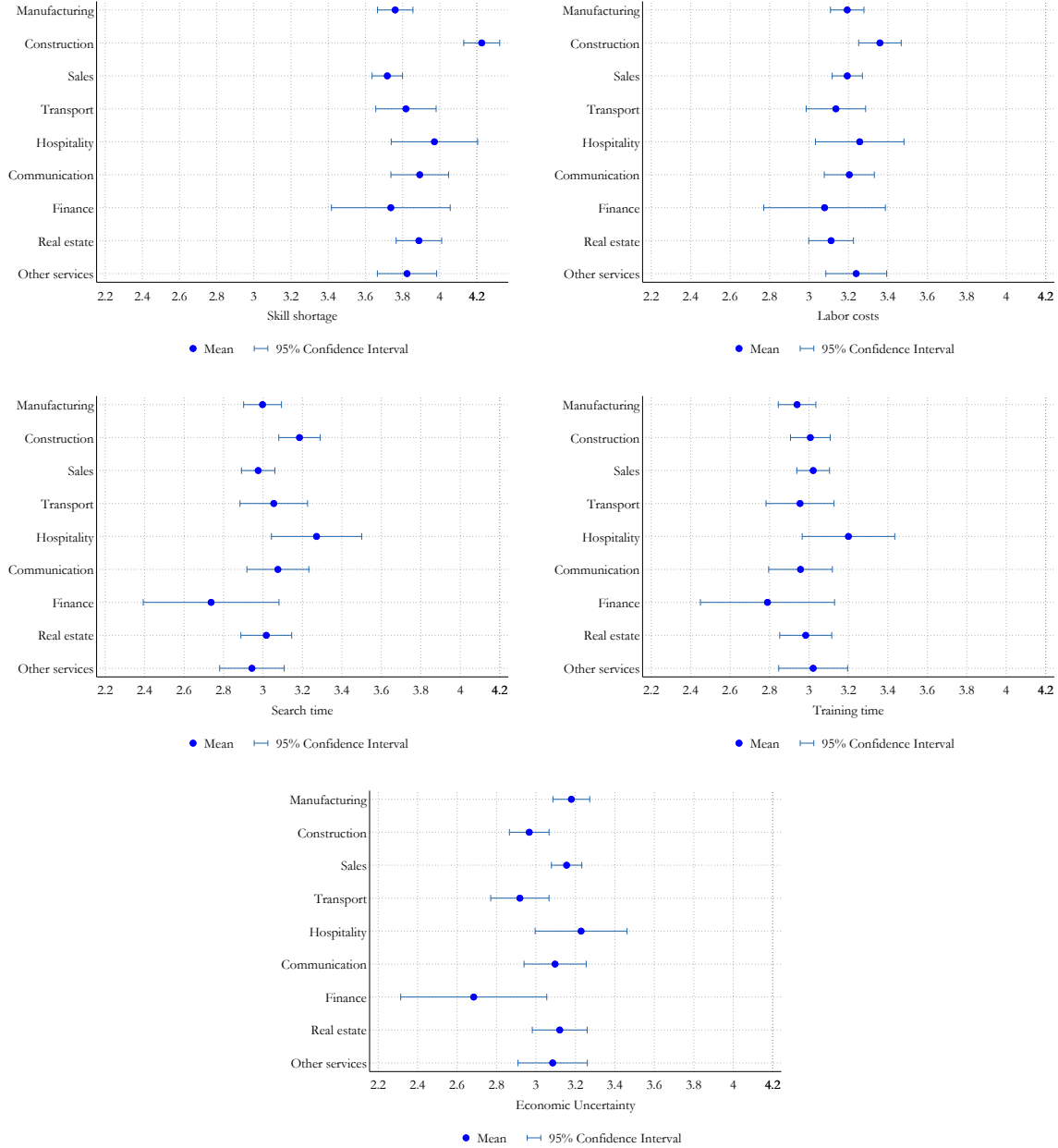


B. Panel (b): Revenue change



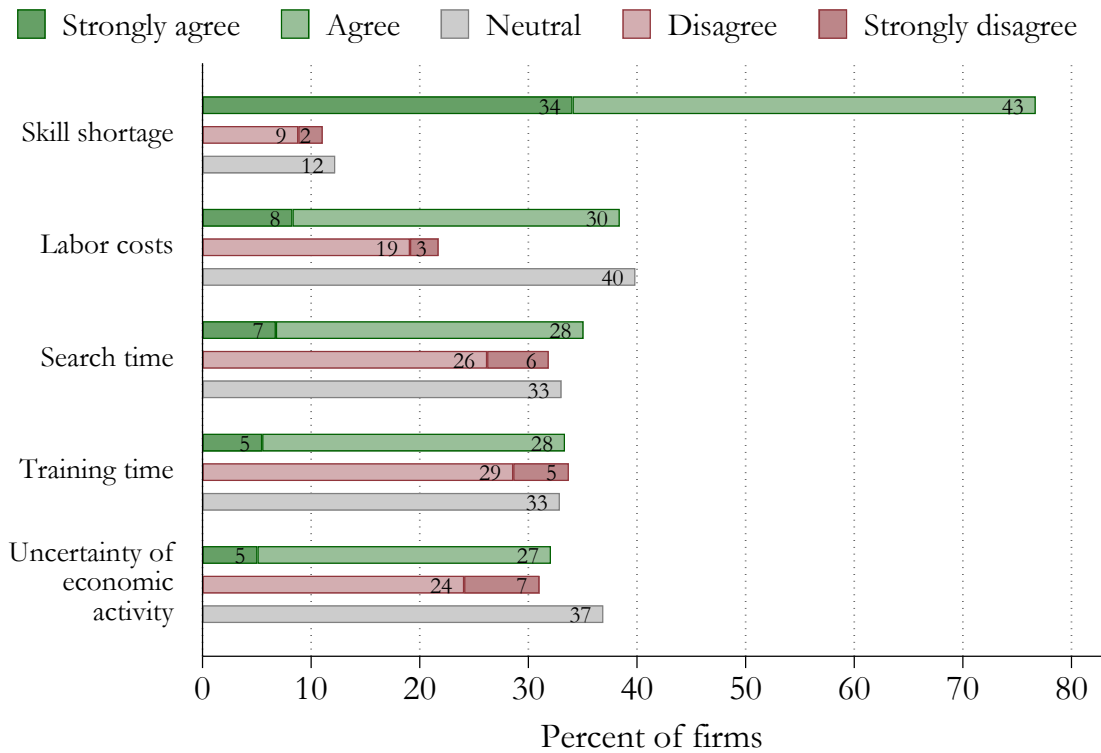
Note: Panel (a) compares the survey question, "How many employees were there in the company on May 1, 2021?" to the number of employees in March 2021 in the matched employer-employee dataset (BFL). Both variables are in logs and are winsorized. Panel (b) compares revenue changes from 2019 to 2020, in the survey and in the firm's financial data (FIRM).

FIGURE A.4. Hiring Obstacles by Sector



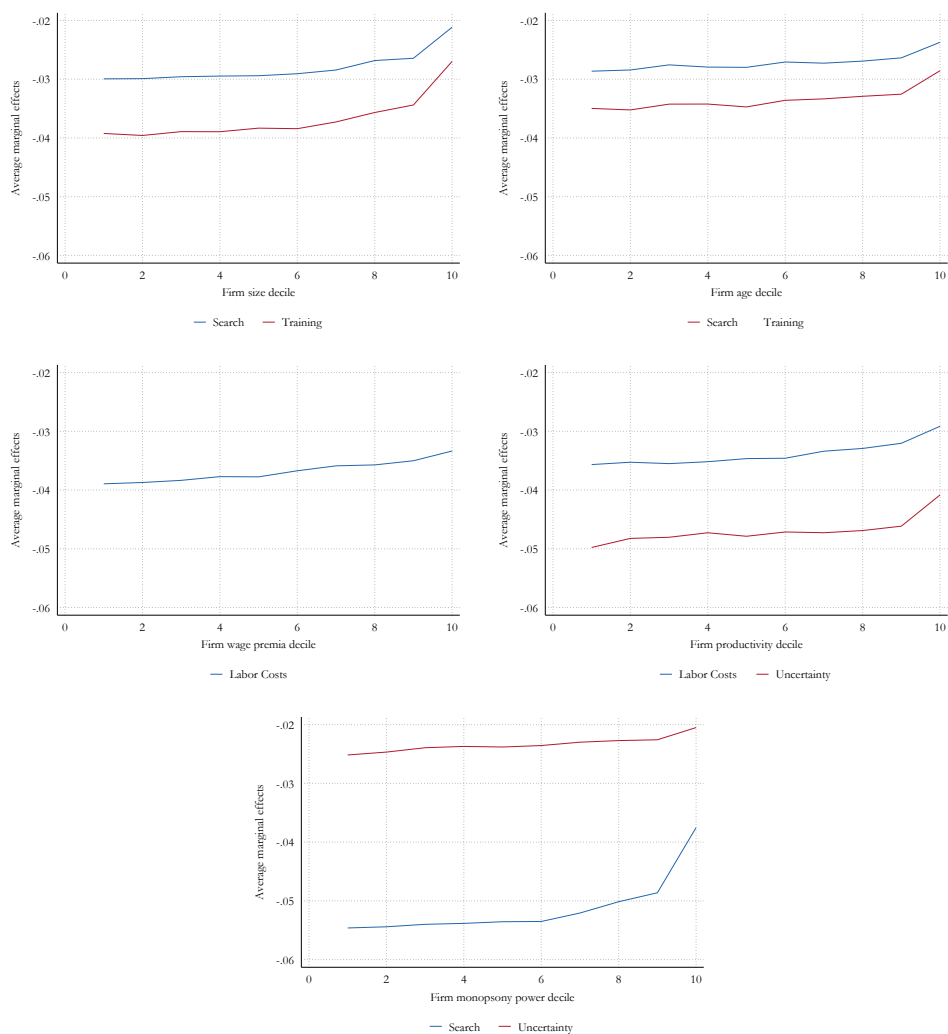
Note: These figures show how hiring obstacles (skill shortage, labor costs, search time, training time, economic uncertainty) vary by industry. The scale ranges from 1 to 5, where 5 stands for "strongly agree" and 1 stands for "strongly disagree". We report the mean responses and the 95 percent confidence intervals for each industry.

FIGURE A.5. Hiring Obstacles for Firms that Planned to Hire in 2020



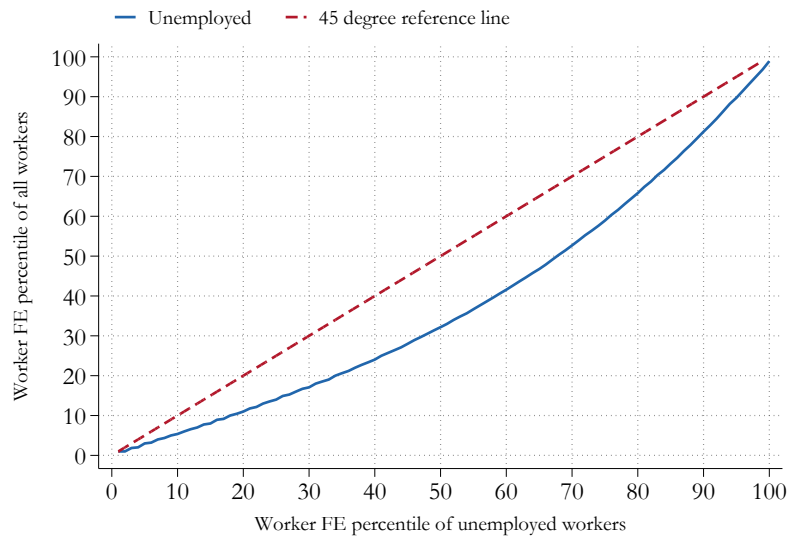
Note: The figure reports responses to the question: What factors can discourage the firm from recruiting despite the potential need? The hiring obstacles are: The lack of qualified candidates (Skill shortage); Job seekers want a higher wage than the firm can offer (Labor costs); Finding and choosing the right employee is too time-consuming (Search time); Training employees in firm-specific skills is too time-consuming (Training time); The uncertainty of economic activity. Only firms that indicate that they planned to hire in 2020 after the pandemic started are included in the sample.

FIGURE A.6. Hiring Obstacles By Decile of Firm Characteristics



Note: These figures report the average marginal effects of firm size, age, wage premium, productivity and labor market power on firms' probability of agreeing with statements about hiring difficulties. Only statements that are strongly correlated with the specific firm characteristics are included(see Table 4). The marginal effects are the average marginal effects (evaluated at the observational level) of each decile.

FIGURE A.7. Comparing Abilities of the Employed and Unemployed



Note: The solid blue line shows the relationship between the percentile of the unemployed worker effect and its corresponding percentile in the overall worker effect distribution.

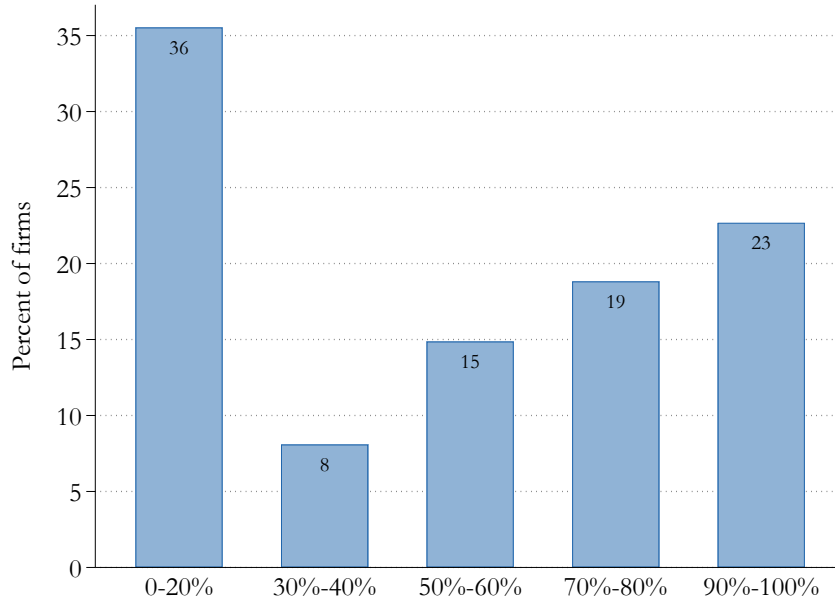
FIGURE A.8. Distribution of Worker Effect by Employment Status



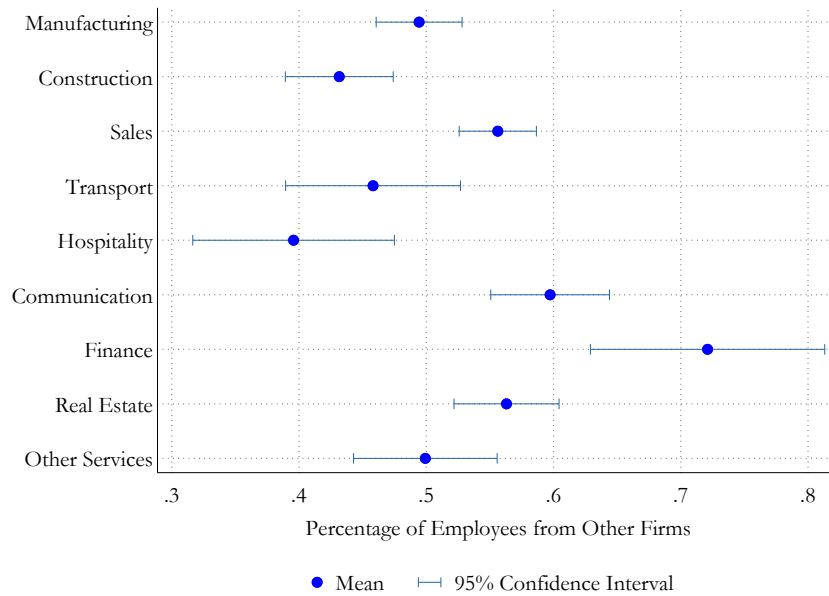
Note: This figure shows the kernel distribution for employed and unemployed workers. Employment status is based on administrative registers. Figure A.7 reports the relationship between the percentile of the unemployed worker effect and the percentile of the worker effect of all workers.

FIGURE A.9. Percentage of Employees Hired from Other Firms

Panel (a): All firms



Panel (B): By sector



Note: The figure reports responses to the question: "What percentage of your employees are recruited from other firms?" The respondents have the following options: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%. Panel (b) splits the sample into nine sectors.

B. Additional Information on Data

B.1. Information about Administrative and Survey Data Linked to Our Survey

Most datasets can be obtained by contacting the Research service (*Forskningsservice*) of Denmark Statistics (DST henceforth). The administrative datasets come from various sources gathered by the National Statistics Agency (Statistics Denmark), the National Employment Policy Agency (STAR), and the largest employer association in Denmark (DA). To our knowledge, datasets provided by DST do not contain a DOI number, complicating replicability. The datasets that are used are recorded at a yearly frequency. Establishment identifiers are available, but our analysis focuses on the legal unit firm identifier (CVR number) as our survey asks questions about firms' practices. Individual identifiers are anonymized social security numbers (PNR number). The identifiers do not change over time. Below, we provide information about the different sources we use in this paper.

Information about workers. We use several datasets to collect information about workers. The first dataset is called IDAP (*IDA persondata*). IDAP contains information about the total population in Denmark. The status information for individuals mainly refers to the end of the year (31 December). From this dataset, we retrieve information about workers' age, gender, and socioeconomic status. The social economic status information allows us to delete self-employed, apprentices, and students to estimate the AKM model. It also enables classifying workers as employed or unemployed. The second dataset is called IDAN (*IDA ansættelser*). From this dataset, we retrieve information about occupation, earnings, hours worked, and firm identifier. Recall that hours worked are defined as paid hours (at the worker-firm frequency) that include contractual and overtime hours. Earnings are defined as the near-universe of taxable income. We use information from this dataset to define the dominant job and estimate the AKM model. Occupation classification follows the ISCO classification at 6-digit frequency.

Information about firms. We use the General Company Statistics called the FIRM dataset, which annually lists active companies in Denmark. FIRM is built from several Statistics Denmark registers. FIRM covers economic and employment information about all sectors and industries. Active companies are defined as companies with at least 0.5 full-time hours of work. The firm identifier is the CVR number, the legal firm identifier

in Denmark. We use this dataset to retrieve information about the industry classification (NACE) and the regional classification (NUTS).

The register that is used in FIRM for the value-added variable is the Accounts statistics for the Non-Agricultural Private Sector (Regnskabsstatistikken for private byerhverv), abbreviated APB.²² APB only includes market activity and does not contain agriculture, fishing, ports, banks, insurance, public housing companies, or public administration. There is a data break in 2014 in the population of firms included in APB. Since 2014, firms in utilities, regional and long-distance trains, and radio and TV stations have been included. Value added is defined using several items from the income statement (*Resultatopgørelse*). These items are: sales and other operating income - cost of materials and equipment - costs of energy and subcontractors - rent paid - payments to temporary workers and operational leasing of goods, and ordinary write-offs and other external charges.

Poaching rate. We use the BFL register to construct the poaching rate. BFL is a matched employer-employee data recording, at monthly frequency, the start and end dates of a job spell, as long as occupation codes, total earnings, and total hours worked in a given establishment. We measure $Poaching_j = \frac{H_{jt}^{EE}}{H_{jt}}$ where j is a firm and H^{EE} is the number of new hires coming from other firms, and H is all new hires (excluding recalls) by the firm. This definition is standard in the literature, see, e.g, Bagger and Lentz (2019).

B.2. The Survey Questionnaire

This section reports the questions from our survey we use in this paper. While some phrases can seem uncommon in English, they are perfectly understandable in Danish. Key phrases and Danish words are reported in parenthesis in Danish.

Background question.

- What is your role in the company?
 - Owner manager
 - Director without ownership
 - Board member without ownership

²²This register is itself built from several sources: questionnaires, official annual accounts submitted in XBRL format to the Danish Business Authority (*Erhvervsstyrelsen*), the Danish Tax Authority (SKAT), Denmark's Statistics Business Register, and the Danish Medicines Agency (*Lægemiddelstyrelsen*).

TABLE A.7. Definition of Variables

Variable:	Definition and construction:	Dataset:	Variable name:
<i>Firm characteristics</i>			
Firm size	Number of employees (full-time equivalent, FTE)	BFL	AJO_LOENTTIMER
Firm age	Number of years since firm creation	FIRM	JUR_FRA_DATO
Productivity	Value added per firm size	FIRM	
Wage premiums	AKM firm fixed effects	IDAN	
Local. emp. share	Firm's employment divided by total employment within a given region-industry	FIRM	GF_ANSATTE
Wage floors	=1 if at least 50% of employees are subject to a wage floor set at the industry-occupation level in the firm	DA	---
Industry	59 industries codes (2-digit NACE)	FIRM	GF_NACE2_DB07
Region	5 Danish regions codes (2-digit NUTS)	FIRM	JUR_BEL_REGION_KODE
Job growth	Net job creation rate from 2019 to 2020	BFL	AJO_LOENTTIMER
Capital stock	Fixed assets (e.g, buildings, machines, patents)	FIRM	GF_AAT
Revenue growth	Revenue growth from 2019 to 2020	FIRM	GF_OMS
Routine task index	$RTI_k = \ln(T_k^R) - \ln(T_k^M) - \ln(T_k^A)$	O*NET	
Poaching rate	Fraction of new hires with less than two weeks of non-employment spells between two firms	BFL	
<i>Workforce characteristics</i>			
Education	% of workers with at least a bachelor's degree	UDDA	HFAUDD
Female	% of females in the firm	IDAP	KON
Unionization	% unionized workers in the firm	IND	FAGFKD
Age	Mean age in the firm	IDAP	ALDERNOV
Tenure	Mean tenure in the firm	IDAN	ANSAAR
Benefits	Percentage of salary paid as personal benefits (e.g, car, meals, accommodation)	LONN	PERSGODE_PRAE
Non-standard work conditions	Percentage of salary paid as compensation for non-standard conditions (e.g, outside working hours)	LONN	GENE_PRAE
<i>Labor market characteristics</i>			
$\Delta E - U$	Diff. in AKM worker fixed effects among employed and unemployed: $\Delta_{E-U,j} = \sum_{o=1}^O w_{oj} (\bar{\alpha}_o^E - \bar{\alpha}_o^U)$	IDAN	ANSAAR
Tightness	Firm-level labor market tightness: $\theta_j = \sum_{o=1}^O w_{oj} \theta_o$ with $\theta_o = \#V_o/\#U_o$ and $w_{oj} = N_{oj}/N_j$	STAR	---
Unfilled vacancies	Similar to θ_j , but use % of unfilled vacancies in an occupation instead of θ_o	Rekrutteringssurvey	

Note: The table reports the administrative datasets and the variables that we use as the firm characteristics and additional controls in our estimates. All variables are measured in 2019 unless otherwise specified.

- Owner without being a board member
- Other

All categories but "Other" are combined in this question to create the variable "Manager respondents".

- Does a person or family have 50% or more of the ownership?
 - Yes
 - No
 - Do not know

The category "Yes" in this question corresponds to the variable "Family-owned firm".

- How many employees were there in the company on May 1, 2021? Note: Include all employees, including full-time, part-time, furloughed and employees on apprenticeships and parental leave. Give your best estimate.

- -----

- How much did revenue (*omsætningen*) change in 2020 compared to 2019? Note: If you do not know the exact change, give your best estimate.
 - Reduced by 100 percent
 - Reduced (indicate the percentage): -----
 - Unchanged
 - Increased (indicate the percentage): -----
 - Increased by 100 percent or more

- Is the company primarily a subcontractor (*underleverandør*) to other companies?
 - Yes, for 90 percent or more of the revenue
 - Yes, for 50 percent to 89 percent of the revenue
 - Yes, for 25 percent to 49 percent of the revenue
 - Yes, for 10 percent to 24 percent of the revenue
 - Yes, for less than 10 percent of the revenue
 - No
 - Do not know

The categories "Yes, for 90 percent or more of the revenue" and "Yes, for 50 percent to 89 percent of the revenue" in this question corresponds to the variable "Subcontractor".

- In the following questions, we ask about pay (*løn*)²³ and hiring practices (*ansættelsespraksis*). How close are you to such decisions?

²³In Danish, the word *løn* is usually translated as salary, pay or wages. The definition in the dictionary ordnet.dk is "payment that an employee receives for working".

- I am responsible for pay and employment conditions
 - I am not responsible, but I know about pay and employment conditions
 - I only know a little about pay and employment conditions
- Do you think that this company offers lower or higher salaries than competing companies in your industry? Competing companies are other employers that hire people with the same skills in your region. If you are not sure, please come up with an estimate.
 - Much lower
 - Lower
 - About the same
 - Higher
 - Much higher

Hiring question.

- What percentage of your employees are recruited from other firms? Recruited employees from other firms means people who were already employed and not unemployed or had not just entered the labor market. If you are not sure, come up with your best guess.
 - 0% from other firms
 - 10%
 - 20%
 - 30%
 - 40%
 - 50%
 - 60%
 - 70%
 - 80%
 - 90%
 - 100%, all from other firms
- Tell us your thoughts about hiring other firms' employees. Please express your opinion on the following statements. Respondents have five options (strongly agree, agree, neutral, disagree, and strongly disagree).
 - We do not necessarily prefer candidates who are employed, as there is still a

- need for company-specific qualities and training.
 - We do not necessarily prefer candidates who are employed as we are in doubt as to why an applicant wants to change jobs.
 - We prefer to hire candidates who are employed as unemployed workers lose their skills.
 - We prefer to hire candidates who are employed because unemployment workers have lower abilities than those who are employed.
 - Other, please write.
- When recruiting an employee, which part of the hiring process is most costly in time or money?
 - Search for candidates, conducting interviews
 - Briefing of new employees (either through his / her manager or colleagues)
- What factors can discourage the firm from recruiting despite the potential need? Please express your opinion on the following statements. Respondents have five options (strongly agree, agree, neutral, disagree, and strongly disagree).
 - The lack of qualified candidates.
 - Candidates typically want a higher salary than what the firm can offer.
 - Finding and choosing the right employee is too time consuming
 - Training (*Orientering og træning*) with company-specific skills (*evner*) and knowledge (*viden*) takes too much time
 - The uncertainty of economic activity
 - Other, please write.
- When will the newly hired employee achieve/have achieved the same productivity as an average employee in a similar position? Please indicate the estimate in months. The possible options are from within one month up to 18 months (or more).

FIGURE A.10. Invitation Letter to Participate in the Survey



Att.: Den administrerende direktør

Hvordan kommer dit firma styrket ud af krisen?

Rambøll gennemfører på vegne af Københavns Universitet en spørgeskemaundersøgelse, der skal belyse, hvordan virksomheder kan komme styrket ud af Covid19-krisen. Vi spørger om hvad du/I har gjort for at komme igennem krisen og hvilke overvejelser du gør om tiden efter Covid19.

Projektet gennemføres under ledelsen af Niels Bohr Professor Morten Bennedsen, Økonomisk Institut, og er støttet af blandt andet Industriens Fond og det Samfundsvidenskabelige Forskningsråd.

Hvis du ønsker det, vil du efter undersøgelsens afslutning modtage en anonymiseret benchmarkingsrapport, hvor du kan se dine besvarelser op mod fordelingen af andre besvarelser. Vi overholder naturligvis alle databeskyttelsesreglerne.

Det tager ca. 20 minutter at udfylde spørgeskemaet. Undervejs kan du lukke skemaet og senere genoptage besvarelsen via linket, som du har modtaget her. Husk derfor at gemme denne invitation, til du har afsluttet din besvarelse.

Sådan gør du

Spørgeskemaet besvares elektronisk via internettet. Du kan svare på alle computere, tablets (f.eks. iPad m.m.) og smartphones. Du får adgang til dit personlige spørgeskema ved at klikke på nedenstående link:
<https://surveys.ramboll.com/answer?key=ZNEVCQ9MSJ1Y>

Vi vil bede dig besvare spørgeskemaet senest **den 27. juni 2021**.

Du er sikret fortrolighed

Dine svar behandles fortroligt af Rambøll og vil kun fremgå i anonymiseret form. Du kan få mere information om behandling af personoplysninger i forbindelse med undersøgelsen på forsiden af spørgeskemaet.

Kontakt

Hvis du har yderligere spørgsmål, er du velkommen til at kontakte Rambøll på e-mail: skemasupport@ramboll.com eller tlf. 6915 8076 på hverdage i tidsrummet kl. 8.00-16.00.

På forhånd tak for din deltagelse!

Med venlig hilsen
Rambøll og
Københavns Universitet

Note: The figure shows the invitation letter that firms received in an email asking them to participate in the survey. See an English translation of the letter below.

Att: The Administrative Director

How does your company come out of the crisis stronger?

On behalf of the University of Copenhagen, Rambøll is carrying out a survey to shed light on how firms can emerge stronger from the COVID19 crisis. We ask what you/you and others have done to get through the crisis and what thoughts you have about the time after COVID19.

The project is carried out under the leadership of Niels Bohr Professor Morten Bennedsen, Department of Economics, University of Copenhagen, and is supported by, among others Industriens Fond and the Social Science Research Council.

If you participate in the survey, we will offer you an anonymized benchmarking report that shows your responses against the distribution of the other responses. We naturally comply with all data protection regulations.

It takes approximately 20 minutes to complete the questionnaire. You can close the form and resume it later by again clicking on the link below. Therefore, please remember to save this invitation until you have completed the survey.

Here's how you do it

The questionnaire is answered electronically via the Internet. You can complete the questionnaire on any computer, tablet (e.g. iPad, etc.) or smartphone. To access your personal questionnaire, click on the link below: [LINK](#)

We ask that you complete the questionnaire no later than 27 June 2021.

You are guaranteed confidentiality

Your answers are treated confidentially by Rambøll and will only appear in anonymized form. You can find more information about the treatment of personal data in connection with the survey on the front page of the questionnaire.

Contact

If you have further questions, please feel free to contact Rambøll by e-mail: skemasupport@ramboll.com or tel. 6915 8076 on weekdays between 8.00-16.00.

Thank you in advance for your participation

Yours sincerely

Rambøll and University of Copenhagen

C. Further Results on Firms' Beliefs About Unemployed Workers

C.1. Measuring Abilities of Employed and Unemployed Workers

We use matched employer–employee data to proxy worker ability with AKM worker fixed effects. The specification includes year dummies and quadratic and cubic age terms interacted with education, so worker effects capture skills and other factors equally rewarded across firms while controlling for cohort differences.

Employment status is defined using administrative records for 2019. For unemployed workers, ability is measured using their worker effect prior to the last unemployment spell. To limit bias from earlier unemployment, we restrict the sample to unemployed workers with at least one employment spell since 2015, following Schmieder, von Wachter, and Heining (2023) and Bertheau, Acabbi, Barcelo, Gulyas, Lombardi, and Saggio (2023).

To quantify ability differences, we compare the distributions of worker effects for employed and unemployed workers. Figure A.7 plots the percentile of unemployed workers' effects against their position in the overall distribution. The median unemployed worker corresponds to the 32nd percentile of the full workforce, suggesting that firms' preferences for hiring employed workers partly reflect objective ability differences.

C.2. Association Between Firms' Preferences and Objective Measures

We regress firms' stated preference for hiring employed over unemployed workers on an objective measure of ability differences, controlling for firm and labor market characteristics. The ability difference is defined as:

$$\Delta_{E-U,j} = \sum_{o=1}^O w_{oj} (\bar{\alpha}_o^E - \bar{\alpha}_o^U),$$

where $\bar{\alpha}_o^E$ and $\bar{\alpha}_o^U$ are the mean AKM worker effects for employed and unemployed workers in occupation o , and w_{oj} is the occupation share in firm j .

Table A.8 shows that this objective benchmark strongly predicts firms' preferences. Without additional controls, a one–standard deviation increase in relative ability raises the probability that a firm prefers to hire employed workers by 2.49 percentage points (mean = 30.7%). Adding controls (including five local labor market and 59 industry fixed effects) raises the effect to 3.29 pp. These findings indicate that firms' beliefs align

closely with objective ability differences.

Table A.8, column 3 to 6, separates the two motives for preferring employed workers: skill depreciation and negative selection. The effect in column 1 and 2 is mainly driven by the belief that unemployed workers have lower skills, while we find no significant effect for skill depreciation. This is reassuring, since the negative selection of unemployed workers is the margin that should correlate most with objective benchmarks of unemployed workers' abilities measured using AKM worker effects.

Overall, the results are consistent with Mueller and Spinnewijn (2023), who attribute half of the decline in job-finding rates to dynamic selection into long-term unemployment, and with Faberman et al. (2022), who show that 61% of the unemployed–employed wage gap is explained by unobserved heterogeneity.

TABLE A.8. Firms' Beliefs about Abilities of Unemployed and Firm Characteristics

	Preferring hiring employed		Negatively selected		Skill depreciation	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ E-U abilities	2.49** (1.06)	3.29** (1.32)	2.14** (0.95)	3.71*** (1.15)	1.41 (0.97)	1.57 (1.21)
Labor market tightness	3.28*** (1.17)	0.20 (1.51)	3.75*** (1.12)	0.01 (1.43)	3.00*** (1.11)	1.40 (1.41)
Size	-1.67 (1.03)	-2.14* (1.13)	-0.84 (0.87)	-1.31 (1.00)	-1.22 (0.96)	-2.13** (1.02)
Age	1.08 (1.12)	0.77 (1.39)	0.27 (0.98)	0.34 (1.22)	1.68 (1.04)	1.07 (1.29)
Productivity	0.89 (1.15)	1.34 (1.28)	0.75 (1.03)	1.49 (1.16)	1.62 (1.06)	2.03* (1.17)
Wage premium	0.65 (1.18)	0.16 (1.22)	0.67 (1.05)	-0.37 (1.10)	-0.38 (1.08)	-0.53 (1.14)
Local empl. share	0.36 (1.15)	1.29 (1.58)	0.03 (1.04)	-0.36 (1.49)	0.90 (1.16)	3.14** (1.35)
Wage floor	-2.28 (2.87)	-3.32 (3.99)	-2.27 (2.52)	-3.43 (3.53)	-0.38 (2.64)	-0.72 (3.67)
Respondent: Owner	13.01*** (2.24)	12.75*** (2.39)	12.85*** (2.00)	12.58*** (2.12)	9.18*** (2.07)	8.73*** (2.23)
<i>N</i>	2031	2031	2031	2031	2031	2031
Mean Dep. Var.	30.7	30.7	22.6	22.6	23.5	23.5
Adj.R2	0.027	0.047	0.033	0.067	0.017	0.028
Additional controls	No	Yes	No	Yes	No	Yes

Note: The table reports estimates from linear probability models where the dependent variable captures firms' preference for hiring already employed workers over unemployed workers. Columns (1) and (2) replicate the estimates from Table ???. Columns (3) and (4) use a dependent variable indicating a preference for employed workers driven by concerns about the negative selection of unemployed workers' abilities. Columns (5) and (6) use a dependent variable indicating a preference for employed workers due to concerns about skill depreciation during unemployment. The set of additional controls is identical to that in Table 4. Asterisks denote statistical significance at the 1, 5, and 10% level (***, **, * respectively). Standard errors are in parentheses.

D. Search And Matching Model

The following model illustrates the empirical results we derive in our analysis. The model is a search and matching model that is similar in many aspects to that developed in Cahuc, Carcillo, and Le Barbanchon (2019). We assume that time is discrete and that firms produce differentiated products using labor as the only input factor in the production function. In period t the firm produces using the production function $A_t \frac{L_t^{1+\alpha}}{1+\alpha}$, where A_t is productivity in period t , L_t is labor in the same period and α combines both the labor elasticity of the production and the price elasticity of the production function.

For simplicity, we keep separation and the wage decisions exogenous. Posting vacancies costs c units of output per period. An exogenous fraction of workers, q_{t-1} , leaves the firm and firms post vacancies. After that, workers are hired. The matching function is:

$$M = \bar{m}(V_t)^{1-\mu}(s(w_t)U_{t-1})^\mu,$$

where $s(w_t)$ is the search intensity, positively dependent on the wage, w_t , that is, $s'(w_t) > 0$. V_t is the number of vacancies in period t and U_{t-1} is the number of unemployed workers in period $t - 1$. In addition to capturing overall search effort, $s(w_t)$, also reflects the composition and targeting of applicants, insofar as higher wages or clearer wage information improve the firm's position in the job-offer distribution and attract more suitable candidates conditional on total search. Matching for the firm happens with probability $m_t(\theta_t) = \bar{m}\theta_t^{-\mu}$, where $\bar{m} > 0$ and $\theta_t = V_t/(s(w_t)U_{t-1})$ is labor market tightness. The job remains vacant at the rate $1 - m_t(\theta_t)$. Finally, production takes place.

The value of the firm is:²⁴

$$\Pi(A_t, w_t, m_t, q_{t-1}, L_{t-1}) = \max_{V_t} A_t \frac{L_t^{1+\alpha}}{1+\alpha} - w_t L_t - cV_t + \beta \Pi(A_{t+1}, w_{t+1}, m_{t+1}, q_t, L_t),$$

subject to the evolution of employment

$$L_t = (1 - q_{t-1})L_{t-1} + m_t(\theta_t)V_t.$$

Consider two different states of nature, A_B when there is a boom, and A_R during a recession, hence $A_B > A_R$. The transition probability from state A_B to state A_R is denoted e_B , while the transition probability from state A_R to state A_B is denoted e_R . The separation rates may differ across states, and therefore we denote q_j , $j = B, R$:

²⁴The detailed solution of the firm's problem is available upon request.

$$\Pi^B(L_{t-1}) = \max_{V_t} \left[A_B \frac{L_t^{1+\alpha}}{1+\alpha} - w_B L_t - cV_t + \beta \left(e_B \Pi^R(L_t) + (1 - e_B) \Pi^B(L_t) \right) \right],$$

$$\Pi^R(L_{t-1}) = \max_{V_t} \left[A_R \frac{L_t^{1+\alpha}}{1+\alpha} - w_R L_t - cV_t + \beta \left(e_R \Pi^B(L_t) + (1 - e_R) \Pi^R(L_t) \right) \right],$$

subject to the evolution of employment

$$L_t = (1 - q_j) L_{t-1} + m_t V_t, \quad j = B, R,$$

where q_j is the separation rate and we let $q_R > q_B$.

After several manipulations, the first-order conditions in steady state are ²⁵

$$(A.1) \quad A_B L_B^\alpha = w_B - \beta e_B (1 - q_R) \frac{c}{\bar{m}} \theta_R^\mu + \frac{c}{\bar{m}} \theta_B^\mu (1 - \beta(1 - e_B)(1 - q_B)),$$

$$(A.2) \quad A_R L_R^\alpha = w_R - \beta e_R (1 - q_B) \frac{c}{\bar{m}} \theta_B^\mu + \frac{c}{\bar{m}} \theta_R^\mu (1 - \beta(1 - e_R)(1 - q_R)),$$

And in the steady state we have:

$$(A.3) \quad q_j L_j = m_j V_j = \bar{m} \theta_j^{-\mu} \frac{V_t}{s(w_j) U_j} s(w_j) U_j = \bar{m} \theta_j^{1-\mu} s(w_j) (1 - L_j), \quad j = B, R.$$

Hence, the equations, A.1-A.3 determine labor market tightness and labor demand in booms and recessions θ_B , θ_R , L_B , and L_R . We assume that parameter values are such that labor market tightness is higher in a boom than in a recession, $\theta_B > \theta_R$ corresponding to higher employment, which is consistent with the data.

Comparative statics in a Recession. We consider how labor demand and labor market tightness are affected by the variables considered in Figure 1 and Table 4. We assume that this is in a recession state (R).

²⁵Note that we disregard the transition periods between states. This gives two levels of employment, L_B and L_R ; and 2 levels of labor market tightness, θ_B and θ_R .

First, we consider the impact of skill shortage on labor supply. We illustrate this effect by letting the productivity of workers fall corresponding to a lower productivity of the workers firms potentially hire, $\Delta A_R < 0$.

After several steps²⁶ we obtain:

$$(A.4) \quad dA_R L_R^\alpha + A_R \alpha L_R^{\alpha-1} \frac{dL_R}{d\theta_R} d\theta_R = \frac{c}{\bar{m}} \mu \theta_R^{\mu-1} d\theta_R (1 - \beta(1 - e_R)(1 - q_R)),$$

$$(A.5) \quad \frac{\theta_R}{L_R} \frac{dL_R}{d\theta_R} = \frac{\theta_R (1 - \mu) \bar{m} \theta_R^{1-\mu} s(w_R) (1 - L_R)}{L_R \theta_R (q_R + \bar{m} \theta_R^{1-\mu} s(w_R))} = \frac{(1 - L_R) (1 - \mu) \bar{m} \theta_R^{1-\mu} s(w_R)}{L_R (q_R + \bar{m} \theta_R^{1-\mu} s(w_R))} < 1$$

as $\frac{(1-L_R)}{L_R} < 1$ and $\frac{(1-\mu)\bar{m}\theta_R^{1-\mu}s(w_R)}{(q_R+\bar{m}\theta_R^{1-\mu}s(w_R))} < 1$.

$$(A.6) \quad \frac{d\theta_R}{dA_R} \Delta A_R = \frac{L_R^\alpha \theta_R}{\left(A_R L_R^\alpha \left(\mu - \alpha \frac{\theta_R}{L_R} \frac{dL_R}{d\theta_R} \right) + \mu (-w_R + \beta e_R (1 - q_B) \frac{c}{\bar{m}} \theta_B^\mu) \right)} \Delta A_R < 0,$$

where the denominator is likely to be positive if $\mu > \alpha$, therefore, $\frac{dL_R}{dA_R} \Delta A_R < 0$ and $\frac{d\theta_R}{dA_R} \Delta A_R < 0$. The expected sign is therefore negative, which is consistent with the findings in Figure 1 and Table 4. Hence, skill shortage implies fewer vacancies supplied and lower employment.

Second, we consider the labor costs as an impediment to hiring workers, which corresponds to a higher wage, which we observe in the second row in Figure 1. The impact on labor market tightness and employment is from differentiating equation (A.2) and (A.3) with respect to θ_R , L_R and w_R :

$$(A.7) \quad A_R L_R^{\alpha-1} \frac{dL_R}{d\theta_R} d\theta_R = dw_R + \frac{c}{\bar{m}} \mu \theta_R^{\mu-1} d\theta_R (1 - \beta(1 - e_R)(1 - q_R)),$$

$$(A.8) \quad \left(q_R + \bar{m} \theta_j^{1-\mu} s(w_R) \right) dL_R = (1 - \mu) \bar{m} \theta_j^{1-\mu} s(w_R) (1 - L_j) d\theta_R + \bar{m} \theta_j^{1-\mu} (1 - L_j) s'(w_R) dw_R$$

Solving this system of equations, we obtain:

²⁶That is, differentiation (A.2) and (A.3) with respect to θ_R , L_R and A_R , and using equation (A.5) in (A.4).

$$\frac{dL_R}{dw_R} = \frac{-(1-\mu)\bar{m}\theta_R^{-\mu}s(w_R)(1-L_R) + c\mu\theta_R^{\mu-1}d\theta_R(1-\beta(1-e_R)(1-q_R))\theta_R^{1-\mu}(1-L_R)s'(w_R)}{-A_R\alpha L_R^{\alpha-1}(1-\mu)\bar{m}\theta_R^{-\mu}s(w_R)(1-L_R) + \frac{c}{\bar{m}}\mu\theta_R^{\mu-1}d\theta_R(1-\beta(1-e_R)(1-q_R))\left(q_R + \bar{m}\theta_R^{1-\mu}s(w_R)\right)}$$

$$\frac{d\theta_R}{dw_R} = \frac{A_R\alpha L_R^{\alpha-1}\bar{m}\theta_R^{1-\mu}(1-L_R)s'(w_R) - q_R - \bar{m}\theta_R^{1-\mu}s(w_R)}{-A_R\alpha L_R^{\alpha-1}(1-\mu)\bar{m}\theta_R^{-\mu}s(w_R)(1-L_R) + \frac{c}{\bar{m}}\mu\theta_R^{\mu-1}d\theta_R(1-\beta(1-e_R)(1-q_R))\left(q_R + \bar{m}\theta_R^{1-\mu}s(w_R)\right)}$$

where the signs are indeterminate. Higher labor costs have ambiguous effects: directly reducing hiring but potentially increasing search intensity and thus labor market tightness and employment, as the direct effect is negative, but search increases with higher wages and therefore labor market tightness and employment may increase or fall.

Third, the third row in Figure 1, the impact of search time, can be considered through a change in the match efficiency parameter \bar{m} . We differentiate with respect to θ_R , L_R and \bar{m} . First, we obtain from equation (A.2) after using the equation to show:

$$(A.9) \quad A_R\alpha L_R^{\alpha-1}dL_R - \frac{c}{\bar{m}}\mu\theta_R^{\mu-1}(1-\beta(1-e_R)(1-q_R))d\theta_R = -\frac{1}{\bar{m}}(A_R L_R^\alpha - w_R)d\bar{m}.$$

Then differentiating equation (A.3) gives

$$(A.10) \quad \left(q_R + \bar{m}\theta_R^{1-\mu}s(w_R)\right)dL_R - \bar{m}(1-\mu)\theta_R^{-\mu}s(w_R)(1-L_R)d\theta_R = d\bar{m}\theta_R^{1-\mu}s(w_R)(1-L_R).$$

These two equations have to be determined simultaneously, and since the determinant most likely is positive if search time increases, that is, $\Delta\bar{m} < 0$, then we obtain

$$\frac{dL_R}{d\bar{m}}\Delta\bar{m} = \frac{(A_R L_R^\alpha - w_R)(1-\mu)\theta_R^{-\mu}s(w_R)(1-L_R) + \frac{c}{\bar{m}}\mu\theta_R^{\mu-1}(1-\beta(1-e_R)(1-q_R))\theta_R^{1-\mu}s(w_R)(1-L_R)}{-A_R\alpha L_R^{\alpha-1}\bar{m}(1-\mu)\theta_R^{-\mu}s(w_R)(1-L_R) + \frac{c}{\bar{m}}\mu\theta_R^{\mu-1}(1-\beta(1-e_R)(1-q_R))\left(q_R + \bar{m}\theta_R^{1-\mu}s(w_R)\right)}\Delta\bar{m}$$

$$\frac{d\theta_R}{d\bar{m}}\Delta\bar{m} = \frac{A_R\alpha L_R^{\alpha-1}\theta_R^{1-\mu}s(w_R)(1-L_R) + \frac{1}{\bar{m}}(A_R L_R^\alpha - w_R)\left(q_R + \bar{m}\theta_R^{1-\mu}s(w_R)\right)}{-A_R\alpha L_R^{\alpha-1}\bar{m}(1-\mu)\theta_R^{-\mu}s(w_R)(1-L_R) + \frac{c}{\bar{m}}\mu\theta_R^{\mu-1}(1-\beta(1-e_R)(1-q_R))\left(q_R + \bar{m}\theta_R^{1-\mu}s(w_R)\right)}\Delta\bar{m}$$

which have negative signs if the denominator is positive. Longer search times (reduced matching efficiency) unambiguously reduce employment and vacancies.

Fourth, the fourth row in Figure 1, increased uncertainty, we can illustrate by a reduction in the transition from a recession into a boom, that is, e_R falls, which means that the duration of a recession, $1/e_R$, increases. We differentiate the first order condition in the recession state and get:

$$(A.11) \quad -A_R \alpha L_R^{-\alpha-1} \frac{dL_R}{d\theta_R} d\theta_R = \frac{c}{\bar{m}} \mu \theta_R^{\mu-1} d\theta_R (1 - \beta(1 - e_R)(1 - q_R)) - \frac{c}{\bar{m}} \beta ((1 - q_B) \theta_B^\mu - \theta_R^\mu (1 - q_R)) de_R,$$

and then use equation (A.5) to get:

$$(A.12) \quad \frac{d\theta_R}{de_R} \Delta e_R = \frac{\frac{c}{\bar{m}} \beta (-(1 - q_B) \theta_B^\mu + \theta_R^\mu (1 - q_R)) \theta_R}{\left(A_R L_R^\alpha \left(\mu - \alpha \frac{\theta_R}{L_R} \frac{dL_R}{d\theta_R} \right) + \mu (-w_R + \beta e_R (1 - q_B) \frac{c}{\bar{m}} \theta_B^\mu) \right)} \Delta e_R < 0,$$

which is negative as $(1 - q_B) \theta_B^\mu > \theta_R^\mu (1 - q_R)$. Increased uncertainty (lower e_R , longer recession) reduces hiring and employment.

Finally, we consider the impact of longer training time. We illustrate this by considering the impact of a higher c . We differentiate equation (A.2) and use it again to substitute to simplify to obtain:

$$(A.13) \quad A_R \alpha L_R^{\alpha-1} \frac{dL_R}{d\theta_R} d\theta_R = \frac{c}{\bar{m}} \mu \theta_R^{\mu-1} d\theta_R (1 - \beta(1 - e_R)(1 - q_R)) + \frac{1}{\bar{m}} (A_R L_R^\alpha - w_R) dc,$$

and then use equation (A.5) to obtain if $\Delta c > 0$:

$$(A.14) \quad \frac{d\theta_R}{dc} \Delta c = - \frac{\frac{1}{\bar{m}} (A_R L_R^\alpha - w_R) \theta_R}{\left(\mu (A_R L_R^\alpha - w_R + \beta e_R (1 - q_B) \frac{c}{\bar{m}} \theta_B^\mu) - \alpha A_R L_R^\alpha \frac{\theta_R}{L_R} \frac{dL_R}{d\theta_R} \right)} \Delta c < 0$$

Increased training costs clearly decrease hiring and employment: $\frac{dL_R}{dc} \Delta c < 0$ and $\frac{d\theta_R}{dc} \Delta c < 0$.

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