The Costs of Hiring Skilled Workers*

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Abstract

This paper analyzes the structure of hiring costs for skilled workers. We use novel Swiss administrative firm-level survey data that provide direct and detailed measures of hiring costs, including recruitment and adaptation. Results show that average hiring costs range, depending on firm size, from 10 to 17 weeks of wage payments. The structure of hiring costs is convex. Marginal hiring costs increase with the number of hires and reach up to 24 weeks of wage payments. We find no evidence for a fixed cost component. Hiring costs also increase with the hiring rate (the ratio of hires and skilled workers), confirming convexity. Hiring costs generally increase with skill requirements for job applicants, and depend on macroeconomic conditions: a 1 percentage point increase in the unemployment rate reduces average hiring costs by more than 5 percent.

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1 Introduction

Firms frequently have to hire new workers, either to fill a vacancy or to expand their workforce. Finding a suitable worker who matches the job profile and other possible requirements is not an easy task, as firms are usually not in the favorable position of facing an indefinite supply of adequate candidates. In practice, to achieve a successful hire, firms need to spend considerable time and effort. They typically have to post a vacancy and then process interviews with the applicants they are interested in. While jobs with low skill requirements may be relatively easy to fill, the search effort may be much higher for more demanding positions. Moreover, a new hire may not be immediately fully productive. Adaptation to a new job in a new firm typically takes time, and a newly hired worker may also need extra training to reach full productivity. Therefore, hiring skilled workers is anything but a free lunch and may result in substantial expenditures.

The existence of such hiring costs influences a firm's demand for labor, as these costs are an important component of total labor costs. Furthermore, a firm's hiring behavior depends on the specific structure of these costs: Hiring costs may consist of both a fixed and a variable cost component, with the latter depending on the number of hires. If fixed costs are substantial and marginal hiring costs are constant or concave, the firm will find it optimal to group hires, implying lumpy adjustment over time. In contrast, if hiring costs are convex, hiring a large number of workers at once is relatively more expensive. In this case, the optimal hiring strategy for a firm is to adjust its labor demand smoothly over time.

The importance of hiring costs is reflected in a large theoretical literature. The corresponding empirical studies are mainly based on the indirect inference of labor adjustment costs based on the observation of worker flows, whereas empirical evidence based on directly observed hiring costs is very limited. Using direct measures of hiring costs, this paper sheds light on the characteristics of hiring costs, in particular their functional form with respect to the number of hires, their magnitude, and their main determinants.

For our empirical analysis, we use a large-scale representative administrative data set providing detailed measures of hiring costs for Swiss firms. One contribution to the literature is that we observe hiring costs for specific occupations. The data therefore allow us to make statements about the costs that firms incur when hiring skilled workers in a given occupation, rather than having a single measure of hiring costs across all worker categories within a firm. A second contribution to the literature is that our data provide a measure of adaptation costs, including productivity lost during the initial post-hiring period. Thus we account for workers not immediately reaching full productivity. Such information on adaptation costs has thus far not been available in a large-scale establishment data set.

Our results show that average hiring costs are substantial and range, depending on firm size, from 10 to 17 weeks of wage payments. In addition, we find that the structure of hiring costs is convex. Thus hiring more workers in a given period becomes increasingly expensive. Our estimates suggest that marginal hiring costs reach up to 24 weeks of wage payments. While we observe that large firms typically hire more workers than small firms, we find that the convex structure of hiring costs applies both for small and large firms. The division of hiring costs into its two components, recruitment and adaptation costs, yields further insights. We find that the convexity of hiring costs can be attributed mainly to recruitment costs. Adaptation costs, in turn, are characterized mainly by a linear component. Fixed costs are not an important element of hiring costs.

Furthermore, we find that hiring costs are generally higher in occupations with higher skill requirements. For example, hiring costs in engineering or information technology substantially exceed the respective costs for manual labor occupations, such as masonry. In addition, hiring costs also depend on labor market conditions. We find that firms face higher costs for recruiting new workers when skilled labor is scarce as opposed to when unemployment is high.

The paper is organized as follows: The next section provides an overview of the relevant literature. Section 3 presents alternative specifications of the hiring cost function and shows how hiring costs enter the profit maximization problem of the firm. Section 4 describes the data. Section 5 contains the empirical analysis, and section 6 concludes.

2 Related literature

The literature on labor adjustment costs can be divided roughly into two parts.[1] The first strand of the literature uses dynamic labor demand models to indirectly estimate the functional form of labor adjustment costs. The other strand studies labor adjustment costs based on direct empirical evidence. The following discussion of the literature is structured according to this distinction.

2.1 Indirect inference of labor adjustment costs

In the early literature on employment adjustment, the functional form of labor adjustment costs has often been assumed to be quadratic (see, e.g., Sargent, 1978 for a seminal contribution). This assumption was challenged by Nickell (1986), who argues that average variable costs of adjustment may not be strictly convex. Hamermesh (1989) provides empirical evidence in favor of fixed adjustment costs, and later Hamermesh (1992) estimates a model with both fixed and variable costs.[2]

In contrast to the literature studying the structure of adjustment costs, Hamermesh (1995) and Hamermesh and Pfann (1996b) consider the sources of adjustment costs. Adjustment costs are defined as gross and net costs. Gross costs are incurred when a worker is hired (or fired), whereas net costs are associated with the movement from one employment level to another. The evidence suggests that gross costs account for the larger share of total adjustment costs. Using time series data of manufacturing firms, Pfann and Palm (1993) find that hiring costs exceed firing costs for production workers, whereas the converse holds for non-production workers.

[1]Firms also face capital adjustment costs (see, e.g., Cooper and Haltiwanger, 2006 for a recent contribution). In this paper, however, the focus is solely on labor adjustment.

[2]For a survey of the early literature on the costs of labor adjustment, see Hamermesh and Pfann (1996a).

Caballero and Engel (1993) and Caballero et al. (1997) argue that adjustment costs are crucial to explaining aggregate employment fluctuations. They assume that manufacturing establishments adjust employment probabilistically, i.e., the adjustment is lumpy. Adjustment probabilities are modeled as a function of the deviation between the desired and the actual level of employment (*gap approach*).[3] King and Thomas (2006) develop a generalized partial adjustment model in which firms adjust labor in a discrete manner as a result of plant-specific fixed costs. This behavior is consistent with smooth adjustment at the aggregate level. Cooper and Willis (2009a) use a dynamic model that allows for both convex and non-convex adjustment costs. They find that a model with non-convex adjustment costs matches aggregate moments better than quadratic labor adjustment costs. Varejão and Portugal (2007) report the presence of non-convexities, estimating a duration model of employment adjustment.[4]

Merz and Yashiv (2007) let adjustment costs for labor interact with those for capital: The firm's market value is determined both by its optimal hiring and investment decisions. With aggregate time-series data for the US corporate sector, they find that a generalized convex adjustment costs function performs better than the traditional quadratic cost specification. The estimates imply marginal hiring costs, which are roughly equivalent to two-quarters of wage payments. Applying a similar procedure, Nilsen et al. (2007), using Norwegian data, estimate a q-model of labor demand and find a quadratic and a fixed component of adjustment costs. In contrast to these studies, Hall (2004) estimates Euler equations and concludes that labor adjusts freely.

Thus even though the literature on indirect inference of labor adjustment costs is rather large, the structure of these costs is not yet fully understood, reflected by opposing results from different studies. Making use of direct evidence on labor adjustment costs can provide a deeper understanding of how

[3]This procedure has led to a heated discussion in the literature (see Cooper and Willis, 2004; Caballero and Engel, 2004; Bayer, 2008; Cooper and Willis, 2009b).

[4]However, Ejarque and Øivind A. Nilsen (2008), using a sub-sample of the same Portuguese data, find evidence for a mainly quadratic component of adjustment costs based on a structural model of dynamic labor demand.

different components of adjustment costs affect the adjustment process and whether commonly used specifications of the functional form are justified. We review the existing evidence on direct adjustment costs in the following subsection.

2.2 Direct inference of labor adjustment costs

In an early study, Oi (1962) reports direct estimates of hiring costs, implying average hiring and training costs of roughly three weeks of wage payments. Using US data, Barron et al. (1985) find hiring costs of slightly more than a week's pay in total. Using the same data, Holzer (1990) finds that firms posting higher wages can save up to 50% of the costs associated with higher wages – a savings resulting from reduced labor turnover rates. Barron et al. (1987) point out that to avoid costly quits, large firms search more, invest more in on-the-job training, and pay higher wages.

Pfann and Verspagen (1989), using evidence from personnel interviews in large firms in the Dutch manufacturing sector, find that the size of hiring costs exceeds that of firing costs. They also find increasing marginal hiring costs only for firms that have significantly increased their labor force. Pfann (2006) models the ways in which idiosyncratic firing costs influence the firm's firing decision. He uses data with directly observable firing costs from a large Dutch firm and shows that workers with the lowest firing costs will be laid off first. Anderson (1993) analyzes the effect of the US unemployment insurance system, whereby layoffs of workers lead to increased future taxes. She finds that these measurable linear adjustment costs play an important role in dampening the firm's employment response to fluctuations in labor demand.

Abowd and Kramarz (2003) directly estimate hiring costs, using a detailed cross-sectional matched employer-employee data set for France. They find concave adjustment costs with a strong fixed component for highly skilled workers but no effect of hires on adjustment costs for other skill groups. In contrast to our data, their data contains no information on the productivity of newly hired workers, productivity that may be reduced during the adaptation period. Kramarz and Michaud (2010), using longitudinal matched employer-employee data from France, estimate the functional form of hiring costs. Their results show that hiring costs are small, with a negligible fixed component.

Manning (2006) uses survey data from British firms, which were asked to report total hiring costs in previously specified intervals. He finds evidence in favor of diseconomies of scale in recruitment.

In sum, the existing evidence on directly measured adjustment costs is limited in many respects. There are only few studies, using data from different countries and different periods, thereby making comparison more difficult. A further drawback relates to the methodology of data collection, as no common way yet exists of defining and measuring adjustment costs. While we do not have information about firing costs, we make use of unusually detailed and representative firm-level data of hiring costs. Thus our paper contributes to the understanding of the hiring component of labor adjustment costs.

3 The model

The functional form of total hiring costs is not a priori clear. In general, cost functions can consist of (*i*) purely fixed costs, (*ii*) purely variable costs, or (*iii*) a combination of both fixed and variable costs.

If we represent the hiring costs function by $C(H_t, N_t)$, where H_t denotes the number of hires per period and N_t is the employment stock, a general hiring cost function has the form

$$C(H_t, N_t) = I[H_t]C_F + f(H_t, N_t)$$

where I is an indicator function with $I = 1$ if $H > 0$ and $I = 0$ if $H = 0$. We denote the size of the fixed component of hiring costs by $C_F \geq 0$, and $f(H_t, N_t)$ indicates a generalized form of variable hiring costs.[5]

[5] Fixed costs have been the focus of a number of contributions in the labor adjustment costs literature. While some studies assume fixed costs of labor adjustment (e.g., Caballero et al., 1997), others conclude that firms face fixed adjustment costs based on the observation of worker flows, (e.g, Hamermesh, 1989, 1992, Lapatinas, 2009), or based on directly observable hiring costs (Abowd and Kramarz, 2003).

With purely variable hiring costs, the role of hiring costs in the decision-making process of the firm can be illustrated by the following intertemporal profit maximization problem, where the firm's hiring decision can be regarded as a problem of investment under uncertainty (Yashiv, 2000):[6]

$$\max_{H_t,N_t} \Pi \quad = \quad E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[F(N_{t+i}) - w_{t+i}N_{t+i} - f(H_{t+i}, N_{t+i}) \right] \right\}$$

subject to the constraint representing the law of motion for the firm's number of employees

$$N_{t+1} \quad = \quad (1 - s_t)N_t + H_t$$

where E_t denotes the expectation operator conditional on information in period t. The firm's production function $F(N)$ depends on the number of skilled workers N. The wage is denoted by w and s is the separation rate, i.e., the percentage of skilled workers that leave the firm per period, with $0 \leq s \leq 1$. β is the discount factor. We represent the costs of hiring by $f(H_{t+i}, N_{t+i})$. This function has as its arguments the number of hires H and the number of skilled workers N. We will test for various specifications of the hiring cost function in the empirical work below.

The solution to the dynamic optimization problem determines the firm's labor adjustment over time, as this process depends on the functional form of hiring costs. Convex marginal hiring costs imply that it becomes expensive for firms to recruit a large number of workers at once. In this context, a firm adjusts its labor demand slowly over time. In contrast, if the firm faces non-convex hiring costs, then the optimal response to a large productivity shock is to adjust employment immediately.

Common ways to model the costs of hiring are to specify the hiring costs function either in levels, i.e., $f(H)$ (Hamermesh and Pfann, 1996a) or

[6] In the presence of fixed hiring costs, obtaining a general solution for the path of labor demand is not possible, even if we use simplifying assumptions about the production function (Hamermesh and Pfann, 1996a).

in terms of the hiring rate H/N (Garibaldi and Moen, 2009). Using the latter specification, and taking into account that output also depends on N, hiring costs can be expressed as $C(H,N) = g(H/N) \times F(N)$, where $g(H/N)$ denotes the portion of output devoted to hiring costs.

Frequently used specifications of variable hiring costs are (*i*) linear, (*ii*) quadratic, and (*iii*) cubic. A general hiring cost function expressed in levels can then be characterized by the following polynomial function

$$f(H) = \alpha_1 H + \alpha_2 H^2 + ... + \alpha_n H^n$$

where $n > 0$ is a non-negative integer. This general form captures, e.g., a cubic (n=3), quadratic (n=2), and purely linear (n=1) specification. Similarly, expressing hiring costs in terms of the hiring rate,

$$g\left(\frac{H}{N}\right) = \beta_1 \left(\frac{H}{N}\right) + \beta_2 \left(\frac{H}{N}\right)^2 + ... + \beta_n \left(\frac{H}{N}\right)^n .$$

We test for these different specifications of hiring costs in our empirical analysis in section 5.2. Our results indicate that the hiring cost function is convex in the number of hires.

4 Data

4.1 Survey design and data

Our analysis is based on administrative data on hiring costs from two establishment level surveys conducted by the Swiss Federal Statistical Office and the Centre for Research in Economics of Education at the University of Bern in Swiss firms in 2000 and 2004.[7] The population of firms in our sample, chosen from the official Swiss Business and Enterprise Register (BER), includes all Swiss establishments except sole proprietorships and firms in the agricultural sector. Our sample includes all establishments with 50 or more employees and a stratified random sample of establishments with less than

[7]The surveys were originally conducted as part of a comprehensive cost-benefit analysis of the Swiss vocational education and training system, which is part of the official OECD statistics on private-sector expenditures on education (OECD, 2009).

50 employees.[8] This procedure accounts for 87% of Swiss establishments employing less than 10 workers and only 2.4% of all establishments occupying 50 or more workers (Swiss Federal Statistical Office, 2007). Therefore, a random sampling independent of firm size might have resulted in too few observations of large firms. However, including these firms is important, as they employ 53.4% of the Swiss labor force.

The Federal Statistical Office sent a paper-based questionnaire to the selected firms. With respect to hiring costs, firms were asked several questions about their hiring activities over the previous three years, i.e., September 30, 1998, to September 30, 2000, for the first cross-section and September 30, 2002, to September 30, 2004, for the second cross-section. Among other questions, firms were asked about the number of applicants, number of hires, advertising costs, time spent on interviews, training costs, and reduced productivity of newly hired workers during the adaptation period (appendix A contains the questionnaire).

The management or the human resources department filled out the questionnaires. Firms were asked to fill out hiring costs for a specific occupation, a particularly important point when hiring costs differ significantly among occupations (as was the case). Firms had to report hiring costs for an occupation that the Statistical Office chose for its relative importance to the firm.[9] This method ensures that we generally observe hiring costs in those occupations that are most important for the firms (i.e., usually occupations in which the number of new hires is largest). However, we also have information on hiring costs in occupations that are less important to a firm or uncommon in the industry to which a firm belongs. Thus our data provide a complete picture of hiring costs in a given occupation.

[8]The sample has been stratified by firm size and the two-digit-industry level, which corresponds to the nomenclature of economic activities in the European Community (NACE). Sampling weights have been computed by the Swiss Federal Statistical Office to account for both non-response and the stratified structure of the sample. Further details on the sampling procedure and the construction of the survey weights appear in Potterat (2006).

[9]For example, if a firm employs 3 workers in occupation A and 1 worker in occupation B, then this firm was asked to fill out the questionnaire for occupation A with a probability of 75%.

For the empirical analysis, we pool our two cross-sectional data sets to obtain information on hiring costs, with a total of 4032 firms that have hired skilled workers within the previous three years. Our data correspond to workers who have obtained a vocational degree at the upper secondary level. Therefore, our findings cannot be projected on hiring costs for management, employees with a tertiary degree, or unskilled workers. However, as our data represent roughly two thirds of the Swiss workforce, we can infer hiring costs for the majority of workers in Switzerland.

4.2 Calculation of hiring costs

The calculation of hiring costs for firm i consists of two parts, (i) the costs of recruiting a worker, subsequently denoted by r_i, and (ii) the costs associated with reduced productivity, as well as training during the adaptation period, subsequently denoted by a_i.

First, recruitment costs can be written as

$$r_i = v_i + J_i c_{ai} + e_i$$

where v_i are the costs for posting a vacancy, J_i is the number of applicants per vacancy that are invited for an interview, and c_{ai} denotes the costs of conducting a single interview (time spent to interview an applicant multiplied by the wage of those conducting the interview). Furthermore, the costs for external advisors or placement agencies are denoted by e_i.

Second, some costs arise because a newly appointed skilled worker will not immediately reach full productivity. Firms were asked for how many days d_{ai} a newly hired worker is less productive than an average skilled worker within the firm. The relative productivity is denoted by p_i. A newly hired worker may initially be less productive for several reasons. One possible explanation is firm-specific human capital, which first has to be accrued before a worker can be fully productive, such as becoming acquainted with the firm culture, production processes, and colleagues. Other possible reasons for lower productivity include newly hired workers receiving training away from the workplace. This kind of training is costly to the firm in two ways: first, the firm incurs daily wage costs w_{di} per worker during the number of training days d_{ti} and, second, direct training costs c_{ti} exist for internal or external training personnel, travel costs, or course fees. As a result, adaptation costs a_i can be written as

$$a_i = d_{ai}(1 - p_i)w_i + d_{ti}w_i + c_{ti}$$

Overall hiring costs to fill a vacancy in firm i are then given by

$$C_i = r_i + a_i$$

In contrast to directly asking firms about total hiring costs, we break down the different components of these costs so that they are calculated in exactly the same way for every firm. This approach makes the comparison of hiring costs across different firms more reliable. While we cannot rule out the presence of measurement error, our results are not biased if measurement error is "classical", i.e., the error is independent of the true value of the underlying variable. Furthermore, measurement error does also not lead to biased results if the individuals responding to the survey provide a best estimate from their information set (Hyslop and Imbens, 2001).

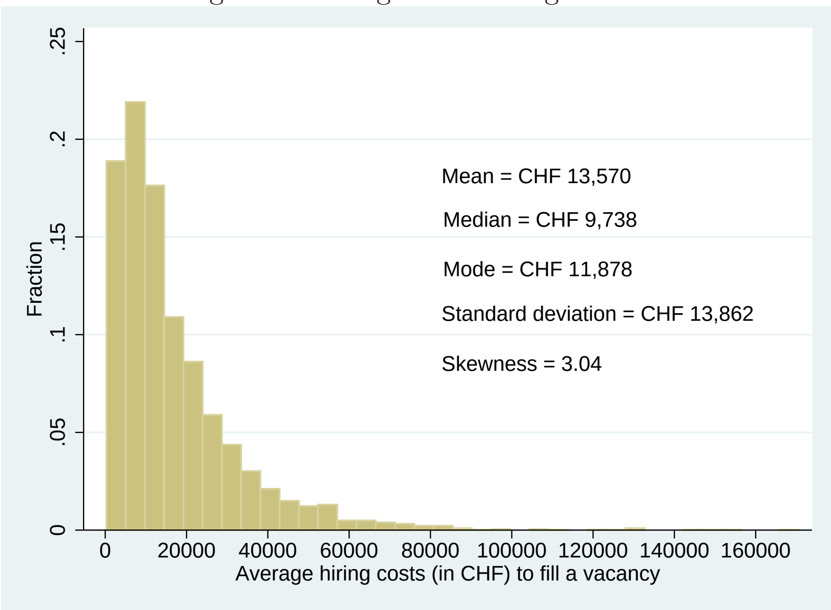
4.3 Descriptive Statistics

On average, firms hire 2.8 workers in the assigned occupation within a three-year period (table 1). The average yearly hiring rate (new hires/number of workers) corresponds to 23.6%, but varies with firm size. Large firms have a lower hiring rate than small firms, as a firm's growth rate typically decreases with firm size and larger firms also face lower separation rates.

Average hiring costs C to fill a vacancy are equal to CHF 13,500 (during both periods of observation, one CHF was roughly equal to 0.65 €). Considerable variation exists among firms, as maximum hiring costs are above CHF 170,000, which equals about two years of a worker's salary, while minimum hiring costs for some firms are practically zero.[10] Adaptation costs, on average, account for about 70% of total hiring costs, mainly due to costs

[10] The model of Mortensen (2003) predicts marginal hiring costs of two years of (median) wage payments in Denmark.

Figure 1: Histogram of hiring costs C



associated with lower productivity during the adaptation period. The remaining share of hiring costs can be attributed to recruitment costs, about half of which are caused by processing interviews with job applicants. While a single interview costs on average only about CHF 400, total interview costs are considerably higher, because on average a firm interviews about five applicants per vacancy.[11]

Figure 1 shows a histogram of the hiring costs that a firm has to incur to fill a vacancy. The distribution of C is skewed to the right with about 50% of the observations between CHF 5,000 and 17,000.

[11]This figure is similar to the findings of Barron et al. (1985) for the US; they report 6.3 interviewed applicants on average to fill a vacancy.

Table 1: Descriptive statistics

	Number of employees				
	1-9	10-49	50-99	100+	Total
Number of new hires H (in previous 3 years)	1.915	3.643	6.680	8.900	2.794
Number of skilled workers N	2.761	8.041	19.180	37.287	5.888
Yearly hiring rate $\bar{H}/N$	0.263	0.197	0.157	0.139	0.236
Number of workers other than N	1.908	11.495	50.424	202.828	12.166
Yearly separation rate s	0.141	0.120	0.114	0.107	0.133
Costs for job postings v in CHF	724.1	1570.6	2300.1	3235.0	1103.0
Costs for interview per applicant c_a in CHF	317.2	504.7	564.9	769.6	394.7
No. of interviewed applicants J	4.7	4.9	4.7	5.4	4.8
Personnel costs for interviews Jc_a in CHF	1602.9	2560.4	2784.7	4388.2	2009.2
Costs for external advisors e in CHF	246.2	584.4	1124.8	1515.9	413.7
Recruitment costs $r = v + Jc_a + e$ in CHF	2743.9	5225.1	7852.0	10328.9	3877.6
Standard error of mean	124.0	187	383	345.0	93.0
Standard deviation	4762.0	6061.7	10012.8	9847.9	5893.9
Median	1549.7	3406.7	3683.7	7132.1	2013.9
Adaptation period d_a in days	81.2	77.0	81.8	82.3	80.0
Decline in productivity $(1-p)$(in %)	28.2	30.3	30.5	32.6	29.0
Daily wage cost w of skilled worker in CHF	337.9	364.8	378.0	394.4	349.0
Training courses d_t in days	1.4	1.7	2.6	2.5	1.6
Direct training costs c_t in CHF	454.4	627.0	1030.3	1302.2	550.0
Adaptation costs $a = d_a(1-p)w + d_t w + c_t$	9097.6	10406.5	11875.1	12736.2	9688.2
Standard error of mean	270.0	365.0	508.0	389.0	173.0
Standard deviation	10386.9	11847.4	13261.0	11103.5	11005.0
Median	6330.0	6613.6	8347.9	8868.8	6589.3
Average hiring costs C in CHF	11847.3	15633.0	19727.4	23065.1	13569.9
Standard error of mean	325.0	455.0	720.0	588.0	218.0
Standard deviation	12500.1	14781.2	18806.9	16779.5	13861.8
Median	8408.0	11727.0	12574.1	18278.4	9737.7
Weekly wage payments for skilled workers in CHF	1146.59	1230.62	1303.32	1328.86	1182.30
Average hiring costs C in weeks of wages	10.10	12.30	14.62	16.96	12.92
Observations	1481	1054	682	815	4032

Table 2: Average interview time per job-applicant (in hours)

Employees	1-9	10-49	50-99	100+
Management	2.6	4.0	3.9	5.2
Skilled workers with vocational degree	3.1	4.7	5.0	6.6
Workers with no vocational degree	0.6	0.7	0.9	1.0
Total interview time	6.4	9.4	9.8	12.9
Observations	1481	1054	682	815

Table 3: Median hourly wages of interviewers (in CHF)

Employees	1-9	10-49	50-99	100+
Management	56.3	64.4	68.9	73.3
Skilled workers with vocational degree	39.7	42.9	44.5	46.7
Workers with no vocational degree	29.3	31.4	31.8	32.2
Observations	1481	1054	682	815

While overall averages give a first indication about hiring costs, we need to explore the data in more detail. First, Table 1 presents the descriptive statistics by firm size categories. Total hiring costs C are increasing rather strongly in firm size. Very small firms with fewer than 10 employees spend on average 10 weeks of wage payments to fill a vacancy, while large firms with 100 or more employees have to bear hiring costs that are almost 17 weeks of wage payments.

Recruitment costs r also increase strongly in firm size. Firms with 100 and more employees face recruitment costs that are on average almost four times higher than those of the smallest firms. This difference is mainly due to higher costs for posting vacancies and higher per-applicant interview costs. Larger firms spend more time interviewing applicants (Table 2) and workers conducting interviews also earn higher wages (Table 3).[12] While larger firms spend significantly more time interviewing job-applicants, they interview

[12] These results are different from Barron et al. (1985), who find that larger firms interview more applicants to fill a vacancy, but do not exert more effort. While the authors are surprised by this finding, they argue that large firms can screen applicants more efficiently due to specialization gains.

Table 4: Hiring costs in weeks of wage payments

	Hiring costs in weeks of wage payments				Share of	Share of
	Mean	Std. err.	Median	Total (per year)	recruitment costs	adaptation costs
Sector:						
Construction	6.977	0.298	4.910	7.453	26%	74%
Industrial	12.859	0.313	9.951	14.366	29%	71%
Services	11.623	0.22	8.942	12.155	29%	71%
Occupations:						
Automation technician	24.545	2.085	20.206	25.613	23%	77%
IT specialist	21.721	1.362	18.403	25.919	23%	77%
Polymechanics technician	16.603	0.727	13.83	22.230	23%	77%
Administrative assistant	14.996	0.349	11.875	17.501	31%	69%
Electronics technician	13.846	1.064	10.465	13.179	45%	55%
Hairdresser	13.687	2.474	8.941	10.451	17%	83%
Electrician	10.811	1.071	5.899	17.426	26%	74%
Sales clerk	10.309	0.886	7.424	10.884	29%	71%
Car mechanic	10.168	1.184	7.585	8.136	21%	79%
Cashier	10.047	0.727	7.853	12.962	21%	79%
Draftsman	8.208	0.514	7.035	6.282	28%	72%
Mason	6.283	0.443	4.536	8.390	29%	71%
Joiner	6.271	0.512	5.144	5.450	22%	78%
Cook	6.557	0.336	5.281	5.258	42%	58%
Medical assistant	5.342	0.646	3.911	3.066	24%	76%

only slightly more applicants to fill a vacancy. A longer interview time may reflect that larger firms select their applicants more carefully. Furthermore, large firms rely more often on external advisors or headhunters compared to small firms.

While recruitment costs differ substantially by firm size, adaptation costs increase only slightly for larger firms (Table 1). During the adaptation period, newly hired workers are not yet fully productive for about 80 days. During this time, the average productivity-loss compared to an average skilled worker within a firm is about 30%.

Average hiring costs also differ substantially with respect to the sector and the occupation in which a worker is hired (Table 4). In general, there appears to be a pattern in the sense that hiring costs are higher in occupations or sectors that are typically associated with higher skill requirements. This is reflected by the fact that the four occupations with the highest hiring costs require four years of education. In contrast, occupations with low hiring costs typically require only three years of education. Hiring costs in engineering or information technology, for example, substantially exceed the respective costs for manual labor occupations, such as mason or joiner. A further explanation of this finding is that workers in engineering and information technology have been relatively scarce in recent years, which increases the required search effort for firms to fill a vacancy. In addition, workers in such occupations often carry out more complex tasks that may differ between firms. Thus hiring workers for such positions may also increase adaptation costs.

The respective shares of the recruitment and adaptation costs do not differ much between sectors and occupations, suggesting that high recruitment costs often go hand in hand with high adaptation costs, and vice versa.

5 Econometric models and empirical analysis

In this section, we provide empirical estimates of the functional form of hiring costs C with respect to the number of hires H. First, we estimate a bivariate nonparametric regression without making any assumptions about the functional form of C. Doing so provides first insights into the relationship between hiring costs and the number of hires and motivates the parametric specification of the multivariate regression model.

5.1 Nonparametric analysis

In this subsection, we estimate the functional form of average hiring costs, using local polynomial regression estimators. The regression model is of the form

$$y_i = m(x_i) + \varepsilon_i, \qquad i = 1, ..., N$$

In our case, y_i denotes hiring costs and x_i denotes the number of hires. We are interested in the functional form $m(x)$, which is linear in the neighborhood of x_0, such that $m(x) = a_0 + b_0(x - x_0)$ in the neighborhood of x_0. The local linear regression estimator minimizes

$$\sum_{i=1}^{N} K\left(\frac{x_i - x_0}{h}\right)(y_i - a_0 - b_0(x_i - x_0))^2,$$

w.r.t. to the parameters a_0 and b_0, where K denotes the Kernel weighting function. As a result, $\hat{m}(x) = \hat{a}_0 + \hat{b}_0(x - x_0)$ in the neighborhood of x_0.

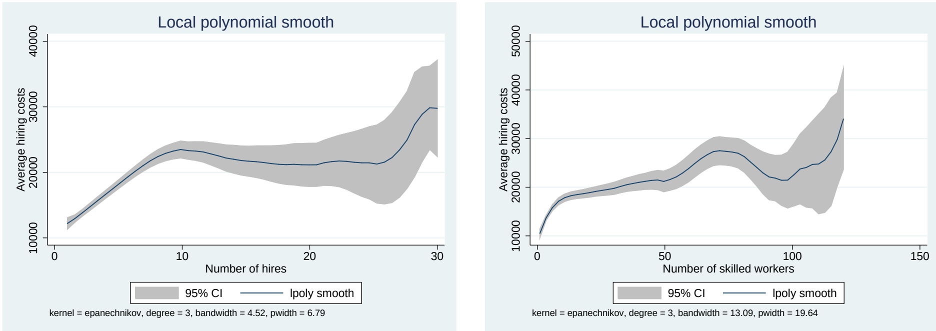
We have applied an Epanechnikov Kernel with third degree polynomial in the regressions displayed in Figures 2-4.

Empirically, we find that average hiring costs C for filling a vacancy are increasing in the number of hires H. While hiring costs remain relatively stable between 10 and 25 hires, costs eventually increase again for high values of H, as shown in Figure 2(a).[13] Increasing average costs in turn imply that marginal and total hiring costs are convex.

Average hiring costs also increase in the number of skilled workers N, as reflected in Figure 2(b). However, as large firms typically hire more new workers, carrying out a multivariate analysis is necessary for separating the effects of H and N on C. The following section provides this analysis. For better understanding of how the number of hires H and the number of skilled

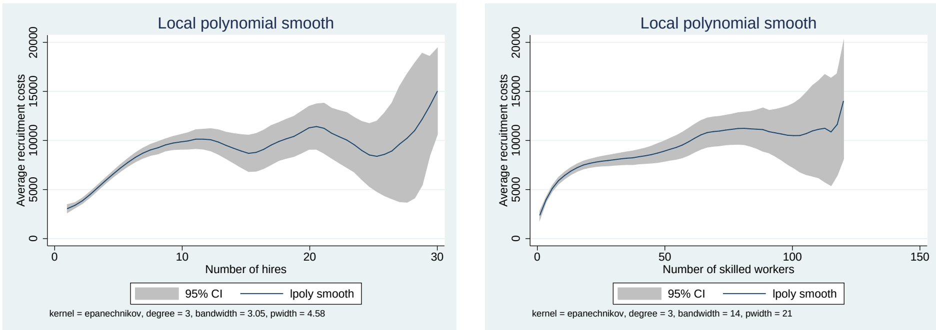
[13] Ninety-five percent of the firms have a value of $H < 10$.

Figure 2: Average hiring costs



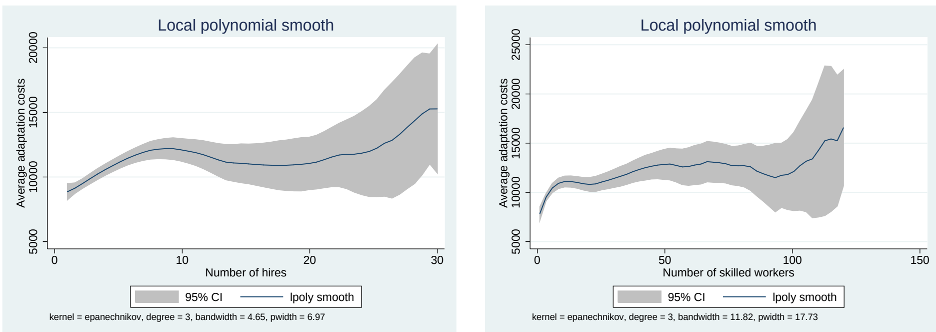
(a) Hires (b) Skilled workers

Figure 3: Average recruitment costs



(a) Hires (b) Skilled workers

Figure 4: Average adaptation costs



(a) Hires (b) Skilled workers

workers N employed by a firm affect average hiring costs C, we also estimate the non-parametric regressions for the different components of hiring costs.

Figure 3(a) shows that the effect of the number of hires on average recruitment costs is similar to the effect on overall hiring costs, i.e., average recruitment costs increase in the number of hires. The same holds true for the effect of the number of skilled workers N on recruitment costs: Firms with a higher N face higher recruitment costs, as Figure 3(b) shows.

In contrast to recruitment costs, adaptation costs are less affected by either the number of hires or the number of skilled workers. Nevertheless, adaptation costs are significantly increasing at low numbers of H and N, while not increasing as much for higher values of H and N (see fig. 4 (a) and fig. 4 (b)).

5.2 Parametric analysis

5.2.1 Hiring costs and number of hires

We now test the various specifications of the total hiring costs function, as discussed in section 3. Total hiring costs are given by

$$C_T = \alpha_0 + \alpha_1 H + \alpha_2 H^2 + ... + \alpha_n H^n \tag{1}$$

where α_0 corresponds to the fixed costs component of hiring costs.

Given our data, we estimate average hiring costs of the form

$$C = \frac{C_T}{H} = a_0 \frac{1}{H} + a_1 + a_2 H + ... + a_n H^{n-1} + \upsilon \tag{2}$$

To test for the presence of fixed costs, we therefore have to consider the coefficient a_0 on the regressor $\frac{1}{H}$. The results in models (1)-(3) in Table 5 suggest that fixed costs are not an important component of hiring costs in our data. The coefficient a_0 is non-positive and not statistically different from zero throughout the various model specifications. Therefore, we further estimate different regression models without explicitly allowing for fixed costs.

We further analyze the importance of a linear component in hiring costs. Empirically testing for significance of the coefficient a_1 in equation (3) shows

Table 5: Average hiring costs regressions on number of hires

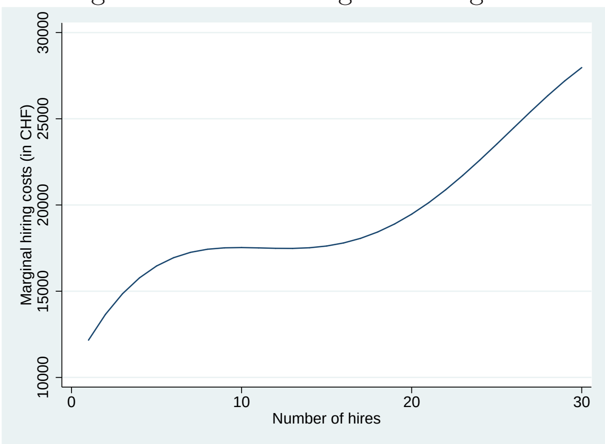
Dependent variable:	With fixed component			Without fixed component		
Hiring costs	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{1}{H}$	-1375.422	-1534.335	-1499.105			
	(1731.429)	(2034.848)	(1681.647)			
1	11460.800	11315.88	11860.260	9531.283	9672.903	10335.720
	(1917.752)	2411.659	(2514.177)	(611.669)	(710.713)	(1747.610)
Number of new hires H	1492.986	1005.145	634.464	1714.699	1390.463	1009.904
	(480.327)	(677.482)	(533.278)	(275.327)	(348.177)	(285.730)
H^2	-42.413	-34.986	-21.368	-50.774	-51.969	-37.891
	(20.426)	(29.477)	(23.704)	(13.592)	(17.278)	(14.876)
$H^3 \cdot 10^3$	317.767	320.379	204.525	391.179	492.413	371.755
	(183.829)	(280.563)	(227.988)	(131.259)	(194.885)	(171.387)
Number of skilled workers N		304.704	41.005		311.145	47.809
		(95.511)	(76.355)		(95.905)	(76.864)
$H \cdot N$		-25.792	-5.525		-29.003	-8.682
		(9.334)	(7.387)		(8.913)	(7.147)
$H^2 \cdot N$		0.844	0.284		0.995	0.432
		(0.311)	(0.251)		(0.281)	(0.232)
$H^3 \cdot N \cdot 10^3$		-7.132	-2.980		-8.665	-4.475
		(2.925)	(2.393)		(2.690)	(2.269)
Employees other than N		28.934	15.037		28.617	14.739
		(7.843)	(7.620)		(7.838)	(7.610)
$H\cdot$(Employees other than N)		-1.463	-0.734		-1.465	-0.738
		(0.533)	(0.477)		(0.537)	(0.477)
Daily wage of a skilled worker			59.198			59.330
			(5.833)			(5.837)
Aggregate regional income $\cdot 10^3$			67.075			66.740
			(27.522)			(27.489)
Regional unemployment rate			-755.2981			-760.621
			(265.712)			(265.970)
Industry controls	No	No	Yes	No	No	Yes
Job controls	No	No	Yes	No	No	Yes
R^2	0.037	0.0513	0.307	0.034	0.051	0.307
Observations	4032	4032	4032	4032	4032	4032

Robust standard errors in parentheses.

that the linear component is indeed positive and significantly different from zero (table 5, last three columns).

To test whether total hiring costs have a quadratic component, we consider the coefficient a_2 on new hires H. The results show that average hiring costs are indeed significantly increasing in the number of hires, implying that the total hiring costs function has a quadratic component. Furthermore, we include H^2 and H^3 in our regression models, which are each significant at the 5% level.[14]

Figure 5: Plot of marginal hiring costs



Our tests with respect to the functional form of total hiring costs indicate the importance of higher-order terms of H, suggesting that total hiring costs feature a linear, a quadratic, a cubic, and even a fourth-order component. Based on our preferred regression specification in model (6), plotting marginal hiring costs shows that the total hiring costs are convex (fig. 5).

[14] As we use cross-sectional data for our analysis, the estimations are based on variance *across* firms. Ideally, we would test variations in the number of hires *within* firms to account for unobserved heterogeneity. Nevertheless, while most firms in our data are observed for only one period, we can identify a small sub-sample of 142 firms reporting hiring costs for the same occupation in both periods. We can therefore estimate first differences of hiring costs, thereby eliminating unobserved firm-specific effects. The results are in line with the estimates previously reported, i.e., hiring costs feature a quadratic and a cubic component. Results are available upon request.

Marginal costs first increase sharply, then remain more or less constant and eventually increase again. Hiring the first worker costs CHF 12,000; then marginal hiring costs increase steadily to CHF 17,500 for hiring 10 additional workers and remain more or less at that level up to 15 new hires. Hiring more than 15 workers then becomes increasingly more expensive, as marginal hiring costs eventually reach CHF 28,000 (the equivalent of 24 weeks' pay) for hiring 30 additional workers. As average hiring costs amount to CHF 13,500, our results show that marginal hiring costs for the 30th hire are more than twice as high. Comparing the costs of hiring the 1st to the 10th worker shows that marginal hiring costs increase by almost 45%. Thus our results imply a rather strong degree of convexity of hiring costs.

The results further show that marginal hiring costs are higher for large firms. We find that the interaction terms of hiring costs with the number of skilled workers N, and the number of other employees are negative and significant at the 10% level. The coefficients of the interaction terms ($H \cdot N$, $H^2 \cdot N$, $H^3 \cdot N$) always have the opposite sign of the coefficients of the number of hires (H, H^2, and H^3). Thus we can say that hiring costs generally increase with the number of hires but that the effect is weaker for larger firms. This finding indicates that large firms find it easier to hire many new workers within one period compared to smaller firms, thereby reducing the degree of convexity in the structure of hiring costs. We account for this finding more directly in the next subsection, where we run regressions on hiring rates (H/N), rather than on the level of hiring H. The effects of the number of employees are lower when we include the wage costs as an additional control variable, reflecting that firm size effects are partly driven by large firms paying higher wages. Wages affect hiring costs through both recruitment and adaptation: higher wages reduce search effort but may increase interview costs, as high wages for skilled workers often accompanies high wages of those conducting job interviews. Moreover, higher wages directly increase adaptation costs during the period when new hires are not yet fully productive. The result show that the overall effect of wages on hiring costs is positive.

The economic environment is likely to affect hiring costs as well. For example, in a period of economic boom, finding suitable skilled workers on the labor market might be more difficult and hence more costly. To control for the economic situation, we include the regional unemployment rate in our estimations. The coefficient can be interpreted as the effect of the unemployment rate on marginal hiring costs. A 1% point increase in the regional unemployment rate reduces average hiring costs by CHF 760, i.e., a decrease of more than 5%. We also added the aggregate per capita income of the region in which the firm is operating. The coefficient is positive and significant, indicating that skilled labor may be more scarce in such regions. We have also included regional indicators for the different language regions in Switzerland. However, after controlling for the regional unemployment rate and per capita income, we find no significant differences in hiring costs across these regions.

In sum, our results highlight the convexity of hiring costs. Furthermore, hiring costs are positively related to firm size and wages, and to the firm's economic environment.

We test for the functional form of recruitment costs related to the number of hires as we did for hiring costs. The results in Table 6 show that the linear component of recruitment costs is much smaller compared to overall hiring costs. After we include all control variables in model (6), the linear component of H is not statistically different from zero, whereas the higher-order terms of H remain significant.

The results for the adaptation costs summarized in Table 7 indicate a substantial and significant linear component of almost 8 weeks of wage payments, while the effects of higher order terms of hires on total adaptation costs are significant only at the 10% level. This finding suggests that adaptation costs are predominantly linear in the number of hires.

Thus we conclude that the convexity of hiring costs arises mainly because of the convex structure of recruitment costs. In contrast, the degree of convexity in adaptation costs is less pronounced. Convex recruitment costs intuitively arise if finding a large number of suitable workers in a given period becomes increasingly difficult. Adaptation costs, however, only marginally depend on the number of hires.

Table 6: Average recruitment costs regressions on number of hires

Dependent variable:	With fixed component			Without fixed component		
Recruitment costs	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{1}{H}$	15.322	-371.731	-246.860			
	(759.004)	(844.921)	(759.566)			
1	1729.857	2070.308	1456.476	1930.257	1493.015	1205.427
	(920.291)	(1071.190)	(1278.543)	(285.471)	(792.562)	(830.903)
Number of new hires H	1040.686	655.885	536.437	1037.734	749.238	598.261
	(236.413)	(284.561)	(252.152)	(125.878)	(138.416)	(127.169)
H^2	-29.919	-19.686	-14.973	-29.805	-23.800	-17.694
	(9.954)	(12.801)	(11.514)	(6.276)	(7.722)	(7.493)
$H^3 \cdot 10^3$	227.491	136.868	99.537	226.498	178.547	127.076
	(90.043)	(123.734)	(113.816)	(61.502)	(86.768)	(86.830)
Number of skilled workers N		146.998	92.878		148.558	93.998
		(41.127)	(36.233)		(40.460)	(35.675)
$H \cdot N$		-10.597	-6.275		-11.375	-6.794
		(4.404)	(4.043)		(3.917)	(3.667)
$H^2 \cdot N$		0.326	0.202		0.363	0.227
		(0.151)	(0.143)		(0.128)	(0.126)
$H^3 \cdot N \cdot 10^3$		-2.452	-1.547		-2.824	-1.793
		(1.417)	(1.357)		(1.241)	(1.239)
Employees other than N		18.943	14.213		18.866	14.164
		(4.103)	(3.492)		(4.093)	(3.480)
$H\cdot$(Employees other than N)		-0.887	-0.712		-0.888	-0.713
		(0.321)	(0.277)		(0.322)	(0.277)
Daily wage of a skilled worker			16.293			16.314
			(2.141)			(2.142)
Aggregate regional income $\cdot 10^3$			36.377			36.321
			(9.600)			(9.601)
Regional unemployment rate			-233.8914			-234.768
			(101.771)			(101.996)
Industry controls	No	No	Yes	No	No	Yes
Job controls	No	No	Yes	No	No	Yes
R^2	0.074	0.100	0.218	0.070	0.100	0.218
Observations	4032	4032	4032	4032	4032	4032

Robust standard errors in parentheses.

Table 7: Average adaptation costs regressions on number of hires

Dependent variable:	With fixed component			Without fixed component		
Adaptation costs	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{1}{H}$	-1401.982	-1176.247	-1267.433			
	(1347.381)	(1626.311)	(1395.289)			
1	9737.338	9254.851	10412.250	8376.500	7995.316	9123.312
	(1418.722)	(1869.098)	(2059.389)	(507.589)	(582.103)	(1535.661)
Number of new hires H	450.282	345.757	94.171	720.436	641.148	411.590
	(346.274)	(530.302)	(433.257)	(207.611)	(277.880)	(235.090)
H^2	-12.428	-15.185	-6.268	-22.854	-28.204	-20.238
	(14.138)	(22.689)	(18.726)	(9.535)	(13.427)	(11.626)
$H^3 \cdot 10^3$	89.775	182.689	104.063	180.608	314.573	245.449
	(124.593)	(218.909)	(180.447)	(89.357)	(153.216)	(133.742)
Number of skilled workers N		158.036	-51.561		162.974	-45.809
		(77.235)	(67.467)		(77.980)	(68.301)
$H \cdot N$		-15.209	0.739		-17.670	-1.930
		(7.366)	(6.079)		(7.207)	(6.080)
$H^2 \cdot N$		0.517	0.082		0.633	0.206
		(0.242)	(0.194)		(0.224)	(0.184)
$H^3 \cdot N \cdot 10^3$		-4.680	-1.433		-5.856	-2.697
		(2.246)	(1.789)		(2.089)	(1.732)
Employees other than N		10.015	0.837		9.772	0.585
		(5.583)	(6.425)		(5.569)	(6.402)
$H\cdot$(Employees other than N)		-0.575	-0.022		-0.577	-0.025
		(0.308)	(0.342)		(0.311)	(0.342)
Daily wage of a skilled worker			42.908			43.020
			(4.995)			(5.000)
Aggregate regional income $\cdot 10^3$			30.745			30.461
			(25.265)			(25.234)
Regional unemployment rate			-522.2508			-526.751
			(231.097)			(231.467)
Industry controls	No	No	Yes	No	No	Yes
Job controls	No	No	Yes	No	No	Yes
R^2	0.010	0.014	0.235	0.010	0.014	0.235
Observations	4032	4032	4032	4032	4032	4032

Robust standard errors in parentheses.

5.2.2 Hiring costs and hiring rates

We now turn to the analysis of the effects of hiring rates on hiring costs. Typically, larger firms also hire more workers. One way of accounting for this tendency is to focus on the hiring rate (H/N) rather than on the absolute number of hires H, as in the previous section.

Modeling hiring costs in terms of the hiring rate, we can express total hiring costs as the share of output that a firm invests in hiring new workers. Formally, $C_T = g(H/N) \times F(N)$, where $g(H/N)$ denotes the portion of output paid for hiring costs and $F(N)$ is output.

In our empirical analysis, we test for the importance of higher order terms of the hiring rate, assuming that $g(\frac{H}{N}) = \left[\alpha_1(\frac{H}{N}) + \alpha_2(\frac{H}{N})^2 + ... + \alpha_n(\frac{H}{N})^n\right]$.

Assuming a fourth-order polynomial function, total hiring costs can be expressed as

$$C_T \quad = \quad F(N)\left[\alpha_1\left(\frac{H}{N}\right) + \alpha_2\left(\frac{H}{N}\right)^2 + \alpha_3\left(\frac{H}{N}\right)^3 + \alpha_4\left(\frac{H}{N}\right)^4\right]$$

yielding marginal hiring costs

$$MC \quad = \quad \frac{F(N)}{N}\left[\alpha_1 + 2\alpha_2\left(\frac{H}{N}\right) + 3\alpha_3\left(\frac{H}{N}\right)^2 + 4\alpha_4\left(\frac{H}{N}\right)^3\right]$$

In our data, we observe the firm's average hiring costs, which can be expressed as

$$C \quad = \quad \frac{F(N)}{N}\left[\alpha_1 + \alpha_2\left(\frac{H}{N}\right) + \alpha_3\left(\frac{H}{N}\right)^2 + \alpha_4\left(\frac{H}{N}\right)^3\right]$$

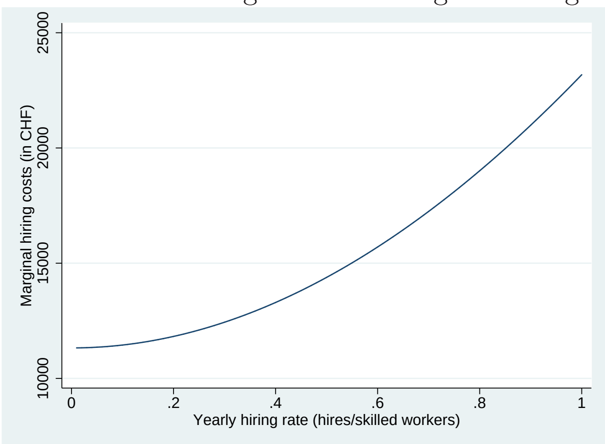
Since we have no information on the firm's output $F(N)$ in our data, we estimate

$$C = \beta_0 + \beta_1\left(\frac{H}{N}\right) + \beta_2\left(\frac{H}{N}\right)^2 + \beta_3\left(\frac{H}{N}\right)^3 + \nu$$

Assuming that the per capita output $\frac{F(N)}{N}$ is independent of the hiring rate $\frac{H}{N}$ (conditional on observable firm characteristics), it follows that α_1 corresponds to $\beta_0/\frac{F(N)}{N}$ in the specification above. Similarly, $\alpha_2 \equiv \beta_1/\frac{F(N)}{N}$, $\alpha_3 \equiv \beta_2/\frac{F(N)}{N}$, and $\alpha_4 \equiv \beta_3/\frac{F(N)}{N}$.

Our results in Table 8 show that the hiring rate is positively associated with hiring costs, even though the coefficient is only marginally significant at the 10 percent level (model 1). A positive coefficient of the hiring rate implies that firms hiring more workers relative to their level of employment incur higher average hiring costs, resulting in a convex structure of hiring costs. As in the previous subsection, we include higher-order terms to test for a more general functional form of the hiring cost function. We find that the quadratic and the cubic term of the hiring rate are statistically significant, whereas the linear term becomes insignificant (model 2). Figure 6 shows the relation between the hiring rate and marginal hiring costs.

Figure 6: Plot of hiring rate and marginal hiring costs



In line with our previous results, the plot in Figure 6 shows that the structure of hiring costs is convex. Marginal hiring costs range from 10 to 19 weeks of wage payments.

Table 8: Average hiring costs regressions on hiring rates

Dependent variable	Hiring costs		Recruitment costs		Adaptation costs	
	(1)	(2)	(3)	(4)	(5)	(6)
1	10,626.570	11,157.78	1883.943	2223.438	8735.124	8925.108
	(1667.861)	(1665.290)	(806.351)	(800.042)	(1403.525)	(1412.494)
Hiring rate	4521.433	350.285	1016.160	-1590.291	3506.752	1955.461
	(2726.256)	(2968.697)	(1142.320)	(1311.054)	(2345.775)	(2522.188)
Hiring rate^2		4213.642		2586.974		1613.274
		(1821.799)		(853.317)		(1430.391)
Hiring rate^3		-196.056		-109.104		-86.365
		(104.537)		(46.911)		(79.534)
Regional unemployment rate	-761.077	-767.809	-232.626	-236.672	-529.401	-532.067
	(266.822)	(267.336)	(102.810)	(103.156)	(231.960)	(232.130)
Aggregate regional income	0.071	0.068	0.039	0.038	0.031	0.030
	(0.028)	(0.028)	(0.010)	(0.010)	(0.025)	(0.025)
Establishment size: 10-49 employees	2423.614	1898.516	1997.142	1666.187	430.846	238.400
	(584.625)	(635.545)	(252.439)	(268.824)	(490.349)	(518.880)
Establishment size: 50-99 employees	4345.958	3410.314	3984.214	3375.056	365.797	42.397
	(1278.851)	(1361.955)	(868.879)	(916.695)	(878.402)	(915.586)
Establishment size: 100+ employees	6025.544	5024.017	6069.562	5423.042	-39.157	-390.879
	(1091.184)	(1150.927)	(638.001)	(656.741)	(871.385)	(928.179)
Daily wage of skilled worker	59.205	59.327	15.971	16.049	43.236	43.279
	(6.013)	(6.019)	(2.188)	(2.188)	(5.131)	(5.136)
Year of survey (2000=1)	791.474	778.350	24.282	16.986	768.927	763.137
	(679.511)	(678.932)	(265.139)	(264.199)	(594.119)	(594.347)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
Occupation controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4032	4032	4032	4032	4032	4032

Robust standard errors in parentheses.

Regressing hiring rates separately on recruitment and adaptation costs, we find that the convex structure arises mainly due to recruitment costs, where both the quadratic and the cubic term are statistically significant (table 8, model 4). While the hiring rate has a positive association with adaptation costs, effects are not statistically significant at the 10 percent level (table 8, models 5,6).

Furthermore, we find that the aggregate regional income is associated with increased hiring costs, whereas a higher unemployment rate decreases hiring costs. Finally, we find that larger firms incur higher hiring costs, which can be explained by longer average interview times in large firms (table 2).

Summing up, we find a positive association of the hiring rate and hiring costs, which implies a convex structure of hiring costs, a finding in line with our results from the previous section.

6 Conclusions

In this paper, we analyze the structure of a firm's hiring costs. We use administrative firm-level survey data providing direct measures of hiring costs in Switzerland. These costs include recruitment and adaptation costs. Recruitment costs reflect the firm's effort to find a suitable worker, whereas adaptation costs are associated with reduced productivity, and training expenditures for newly hired workers.

Our empirical results show that the structure of hiring costs is convex. We find no evidence for a fixed component of hiring costs. The magnitude of average hiring costs ranges, depending on firm size, from 10 to 17 weeks of wage payments. Marginal hiring costs, in turn, can reach up to 24 weeks of wage payments. As a general pattern, we find that hiring costs are more pronounced for jobs with higher skill requirements. In addition, macroeconomic conditions, such as the unemployment rate, significantly affect the costs of hiring skilled workers.

Knowledge about the structure of hiring costs is critical for understanding the firm's hiring behavior. Firms may find it optimal to group hirings in the presence of non-convexities in hiring costs, while a smooth adjustment path is appropriate in a setting with convex hiring costs. As our analysis is based on two independent cross-sectional data sets, we cannot in general control for unobserved heterogeneity. However, we find support for our results based on estimating first-differences for a sub-sample of firms that can be observed in both periods. Nonetheless, future research based on large-scale panel data with detailed information on hiring costs will be necessary for gaining further insights into the structure of hiring costs and their implications for a firm's dynamic labor demand.

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A Survey questions on the firm's hiring behavior

1. How many employees have been hired in your establishment in the last three years within the corresponding occupation?

2. How high are average advertising costs (newspaper advertisements, requests from employment agencies, internal job advertisements, etc.) to fill a vacancy in the corresponding occupation?

3. How many applicants are usually invited for an job interview in order to successfully fill a vacancy in the corresponding occupation?

4. How high to you estimate the average time spent (in hours) per applicant in total (preparation of the interview, conduct the interview, reflection time, administrative effort) for those employees who take part in the interview process of a new applicant?
   Please specify by worker category (if applicable): (a) Management, (b) Skilled workers with vocational degree (administrative/technical/ social/crafts), (c) Unskilled workers

5. How high are the costs for services of external placement agencies to successfully fill a vacancy (if applicable).

6. How much time does it take for a newly hired skilled worker to reach the same productivity level as an average skilled worker in your establishment in the corresponding occupation (in months)?

7. During this adaptation time, how much lower is the productivity of a newly hired worker compared to an average skilled worker in the corresponding occupation (in percent)?

8. Do newly hired workers participate in special training courses during the adaptation time in order to adjust to the new job? If yes, for how many days on average? How much are the cost borne by the firm (per day of training, including travel costs)?