Recruitment and Vacancy Durations in Germany

Steven J. Davis, Christof Röttger, Anja Warning (née Kettner), Enzo Weber

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Steven J. Davis*, Christof Röttger[#], Anja Warning (née Kettner)[#,] Enzo Weber[##]

* University of Chicago Booth School of Business, U.S.A.
[#] Institute for Employment Research, Nuremberg, Germany
[##] Institute for Employment Research, Nuremberg, and University of Regensburg, Germany

Abstract

We develop new evidence on job recruitments and vacancy durations using a rich source of data on individual hires. Our core data set contains 55,000 recruitments into vacant job positions for stratified random samples of German employers from 2000 to 2010. We have information about the employer, the job position and the newly hired worker for all recruitments – including firm size, occupation, qualification requirements, previous labour market status of the new hire, and whether the job is a new position. We measure recruitment duration and the lag from recruitment to first day of work (start lag), which sum to the full vacancy duration. In addition, we link our micro data on recruitments and new hires to additional data on contemporaneous labour market conditions at the regional, occupation and industry levels.

Our analysis finds a mean recruitment duration of 49 calendar days or 34 working days and a mean start lag of 27 calendar days and 19 working days, for a total vacancy duration of 76 calendar days and 53 working days, strongly varying between occupations. Hazard functions fit to micro data reveal longer recruitment durations in Eastern Germany and in larger firms and shorter recruitment durations under slack labour market conditions. Highly relevant for the length of the start lag is whether the hiring process goes as planned: If the recruitment duration is longer than the intended total vacancy duration, the start lag is significantly shorter, reflecting the specific efforts of employers in this case to fill the position as soon as possible. The use of Public Employment Services and the hiring of a person previously unemployed show significant effects on the start lag.

1. Introduction

The employer side of the hiring process remains understudied in empirical research and functions largely as a black box in leading theoretical models. Compared to a vast literature on the characteristics of unemployed workers, unemployment spell durations and the search activity of unemployed workers, we know little about the characteristics of vacant job positions, the factors that influence vacancy durations, and the process through which firms recruit workers. As a result, much theorizing about recruiting behaviour and the hiring process takes place with limited guidance from empirical work. Our main goal in this paper is to throw new empirical light on the hiring process and to thereby help guide the development, refinement and calibration of theoretical models.

To do so, we study job recruitments and vacancy durations in the German Job Vacancy Survey, a rich and largely untapped source of data on individual hires. Our data set covers 55,000 recruitments into vacant job positions for stratified random samples of German employers from 2000 to 2010. We have information about the employer, the job position and the newly hired worker for all recruitments – including firm size, occupation, qualification requirements, previous labour market status of the new hire, and whether the job is a new position. We measure recruitment duration and the lag from recruitment to first day of work, which sum to the full vacancy duration. In addition, we link our micro data on recruitments and new hires to data on contemporaneous labour market conditions at the regional, occupation and industry levels. For this purpose, we draw on administrative records derived from the German Federal Employment Agency and Federal Statistical Office.

Unlike previous empirical work on vacancy durations, our data allow us to distinguish the recruitment duration from the full vacancy duration, where the latter includes the start lag between the recruitment date and the first day of new work. Most previous work identifies the full vacancy duration or the recruitment duration, but not both. For example, Burdett and Cunningham (1998) analyse the determinants of vacancy durations from the start of the recruitment process until the first day of work by the new hire. Using data from the Job Openings and Labour Turnover Survey, Davis, Faberman and Haltiwanger (2013) estimate a mean "vacancy duration" in the United Sates from 2000 to 2011 of about 20 working days. However, their JOLTS-derived measure of vacancy duration corresponds to what we call the recruitment duration in this paper. Thus, the mean recruitment duration of 34 days we find for Germany is 70 percent longer than the estimated mean duration for the United States in Davis et al. (2013). Our ability to separately measure recruitment durations, start lags, and

total vacancy durations affords a fuller study of the hiring process and facilitates comparison with previous research. Other empirical studies of vacancy durations include van Ours and Ridder (1991), Holzer (1994), Barron et al. (1999) and Andrews et al. (2007).

Another advantage offered by the German Job Vacancy Survey is its information about the firm's intended vacancy duration at the outset of the recruiting process. It reflects firms' desires as well as expectations, and it reflects market pressure as well as internal organizational structures. Thus the meaning of this measure is not as clear as the reported "real" durations of recruitment and start lag, even as one might expect that intended and factual vacancy duration are related to each other.

The remainder of the paper proceeds as follows: Section 2 describes the Germany Job Vacancy Survey and briefly describes the administrative record sources that we exploit to construct measures of labor market conditions by occupation, industry sector and region. Section 3 defines the recruitment duration, start lag and other concepts pertaining to the actual and intended duration of the hiring process. Section 4 reports summary statistics of recruitment durations, start lags and total vacancy durations by occupation, and Section 5 considers how these measures vary at the aggregate level over time. Section 6 reports preliminary results of fitting hazard functions to the individual data on recruitments and new hires. Here we first present results on independent models of recruitment duration, start lag and vacancy duration. Secondly we show results on the estimation of the start lag. In an extended model we relate the start lag to recruitment duration and intended vacancy duration, offering interesting results on hiring efforts of employers in the case of a delayed recruitment. Section 7 offers some remarks on directions for our future research.

2. The German Job Vacancy Survey

Since 1989 the Institute for Employment Research (IAB) has been conducting a yearly representative employer survey to measure the number of job vacancies and to gather information on recruitment processes: the German Job Vacancy Survey. The written survey is conducted in the fourth quarter of each year and contains several sections (for details see Kettner/Vogler-Ludwig 2010 and Kettner et al. 2011)[1]. The section of interest for this paper is about the most recent hire into the firm, the part that is of interest in the underlying paper.

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[1] Starting in 2006 the yearly written survey has been complemented by short telephone interviews in the first, second and third quarter to gather more actual data on job vacancies during the year (not affecting the information on hires that are available from the written survey in the fourth quarter).

The survey sample is randomly selected from the business register of the Federal Employment Agency, the public labour market institution in Germany. This register contains all firms with at least one employee covered by the social insurance system.[2] The cross-sectional sample is refreshed every year and is stratified by sectors and firm size classes for Eastern and Western Germany. The selected firms receive a written questionnaire but also have the option to answer on-line by using an individual account. Different weighting schemes are applied to relate the results to the economy in total. Starting with quite a small number of questions and with about 4,100 participants in 1989, the survey was expanded significantly over the years.[3] The most recent surveys are based on about 15,000 participating firms.

In this paper we use information about the most recent case of a successful hire of a new employee into a contract covered by the social insurance system. If the firm reports at least one newly hired employee during the previous 12 months, it is asked to describe the specifics of the filled position and of the hired person as well as the process itself[4].

For the observation period of our paper, the years 2000 to 2010, valid information on a total of 55,000 hiring processes are available. Data on hiring processes include:

- General firm specific information (sector of economic activity, number of employees, employment growth, region, employee turnover rates, etc.)

- Job specific information (occupational title, required additional formal and non-formal skills, various information on working conditions)

- Information on the hired person (for instance on age, gender, previous labour market status)

- Information on the recruitment process itself (durations of the hiring process, recruitment channels, occurrence of difficulties)

We use these data for the first time in a long-term perspective. This required intensive work on the available yearly micro-databases, especially for the first years of the reference

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[2] A firm can be a private firm as well as a public administration or a non-profit. The important attribute is the presence of at least one "regular" employee who is covered by the social insurance system. This kind of (regular) employment constitutes the large majority of employment in Germany.

[3] A main extension of the survey was the implementation of short follow-up surveys in the first, second and third quarter of the year, starting in 2006. The aim was to get higher frequency data on the number of job vacancies during the year, not just for the fourth quarter. The quarterly surveys are conducted by telephone, whereas the traditional surveys in the fourth quarter are continued in written format. Only the yearly survey in the fourth quarter contains questions on details of hiring processes.

[4] Whereas small firms usually only have one hire per year (or no hire at all), larger firms fill several positions over the year with new employees. In our survey this implies that the hires of smaller firms are more equally distributed over the year, whereas the hires of larger firms are more concentrated in summer or fall. However, there is no sufficient information available about the yearly distribution of hires in the larger firms that allow making reasonable assumptions on another distribution than expressed by the case of the most recent hire used here.

period. Questions, variables and available data had to be checked year by year, many data had to be recoded and transferred into a consistent time series. As an important advantage for our research on the duration of hiring processes, the four questions on specific hiring dates have been formulated with identical wording during the whole reference period:

Firms are asked to report four exact dates (day/month/year) for the most recent hire during the previous 12 months on[5]:

- Start of search for applicants
- Decision for an applicant (date of recruitment of a selected applicant)
- Intended start of work of the newly hired employee (from the firm's perspective)
- Actual start of work of the newly hired employee

Because firms answer retrospectively, a certain degree of inaccuracy of the dates has to be taken into account: Firms are asked about the most recent hire in the previous 12 months, so the hiring could have been nearly a year ago, with the start of search for applicants even earlier. By using only the answers of firms who answered consistently to all four questions, we minimize the share of roughly estimated data resp. the degree of imprecision.

To take into account the overall labour market conditions influencing the hiring processes we enriched the survey information with labour market data from administrative sources from the Federal Employment Agency and the Federal Statistical Office, for instance on unemployment rates and labour turnover rates. We did so referring to regions (federal states), occupational groups (ISCO 88) and sectors (NACE Rev. 1, not for unemployed data). These data allow us to cover the specific external labour market situation that employers face during the hiring process.

3. Hiring durations: definitions, calculations and examples

Various durations for the hiring process have been calculated out of the information on the four dates. In detail we define:

- *"Recruitment duration"* refers to the period between the start of the search and the date of recruitment. It consists of searching and screening and ends with the decision

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[5] See Annex with an exact translation of the main questions.

for a specific applicant, resp. with the recruitment date when the firm and the applicant agree on the contract and contract conditions.

- *"Start lag"* refers to the period between the date of recruitment and the factual start of work of the new employee. From the firm's perspective this is a 'waiting period', if the factual start of work is later than the intended start of work. In such a case the position stays unfilled longer than the firm had planned. If factual and intended start of work coincide, a positive start lag is not related to an unscheduled unfilled position (according to the firms planning, see "intended vacancy duration").

- *"Vacancy duration"* is the period between the start of the search and the start of working, resp. the sum of recruitment duration and start lag. It refers to the broadest concept of a hiring duration.

- *"Intended vacancy duration"* is the period between the start of the search and the intended start of work. It depends on the planning of the firm, which will be related for instance to its prior hiring experience and whether the employer has advanced notice that a vacancy needs to be filled or if it is necessary to fill it immediately (see Burdett/Cunningham 1998 for a discussion on the role of advanced notice).

- *"Hiring delay"* we define as period between the intended and the factual start of work, resp. the difference between the intended vacancy duration and the vacancy duration. If the factual duration of the hiring process fits perfectly to the original plans of the firm, the hiring delay is zero. It becomes negative if the selected person starts working earlier than it was planned. An employer might agree that the new employee starts working earlier than intended to prevent him/her from accepting another job offer. The hiring delay is positive if the actual start of work is later than the intended start of work. This becomes the case if either recruitment duration or start lag or both take longer than was expected.

From the durations based on the original dates we calculated "effective" durations by correcting for weekend days and public holidays. This approach takes into account that in Germany recruitment processes usually take place during weekdays only. Specifically, we assume that the screening and the selection c. p. will take longer, if a recruitment period includes Christmas or Easter holidays. For instance for the year 2000 the mean vacancy duration is adjusted from 79 days to 55 days; see table 1 for the mean values based on the original and the adjusted durations. Also visible in this table is the relative importance of particular periods during the whole hiring process resp. the vacancy duration: On average 34 working days are spent for the recruitment, whereas the start lag is 19 working days, about

one third of the total time. The hiring delay is on average 16 working days which means that the majority of hirings do not take place in time but later than the employer intended. While the intended duration is 37 working days on average, job filling processes in fact need about 53 days.

Table 1: Mean Recruitment and Vacancy Durations by Year

	Vacancy Duration	Recruitment Duration	Start Lag	Intended Vacancy Duration	Hiring Delay
	Mean, unadjusted				
2000	79	51	28	51	27
2001	73	45	28	47	25
2002	75	50	25	53	24
2003	67	43	24	48	18
2004	77	49	28	57	20
2005	73	45	28	56	17
2006	80	53	27	58	22
2007	78	52	26	55	24
2008	83	54	29	57	25
2009	80	52	28	55	24
2010	75	48	27	52	23
2000-2010	76	49	27	53	23
	Mean, adjusted*				
2000	55	36	19	36	19
2001	50	31	19	33	17
2002	52	35	17	36	16
2003	46	30	16	33	13
2004	54	34	20	40	14
2005	51	31	20	39	12
2006	55	37	19	40	15
2007	54	36	18	38	17
2008	58	38	20	40	17
2009	55	36	19	39	17
2010	52	34	19	37	16
2000-2010	53	34	19	37	16
*adjusted by weekends and public holidays					

Source: Authors' calculations using German Job Vacancy Survey data, using sample weights and further weighted by the employer's number of hires during the calendar year.

Charts 1 and 2 show two archetypes of hiring processes, one for a hire that completes in time according to the plans of the firm, and one with a positive hiring delay. For an easy understanding we use unadjusted durations in both examples.

In the first example, a firm intends to fill a position until October 1, 2012 and starts searching on September 3, 2012. Following the screening of applicants, and on September 17 the selected applicant agrees to start working in the firm on October 1. Half of the vacancy duration (14 days) is needed for the recruitment, intended vacancy duration and vacancy duration are equal and the hiring delay is zero.

In the second example a firm also intends to fill a position until October 1, 2012 and starts searching for applicants on September 3, 2012. The search is more difficult and only on October 10, 2012 an agreement can be reached with the selected applicant, who is able to start working at the earliest on October 29. With 37 days the recruitment duration in this case is longer than the intended vacancy duration. This results in a start lag of 19 days. The firm has to wait for the new employee and the position remains unfilled for nearly one month: the employee starts working altogether 28 days later than it was originally planned by the firm, which constitutes the hiring delay.
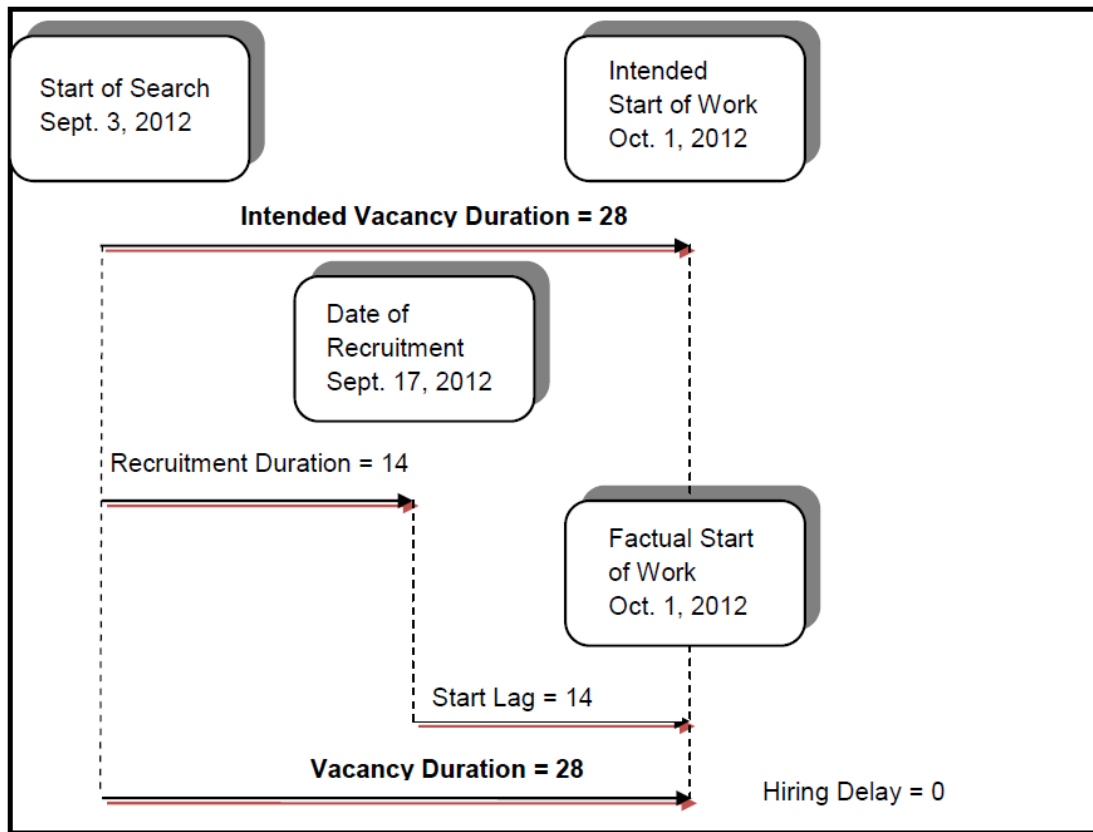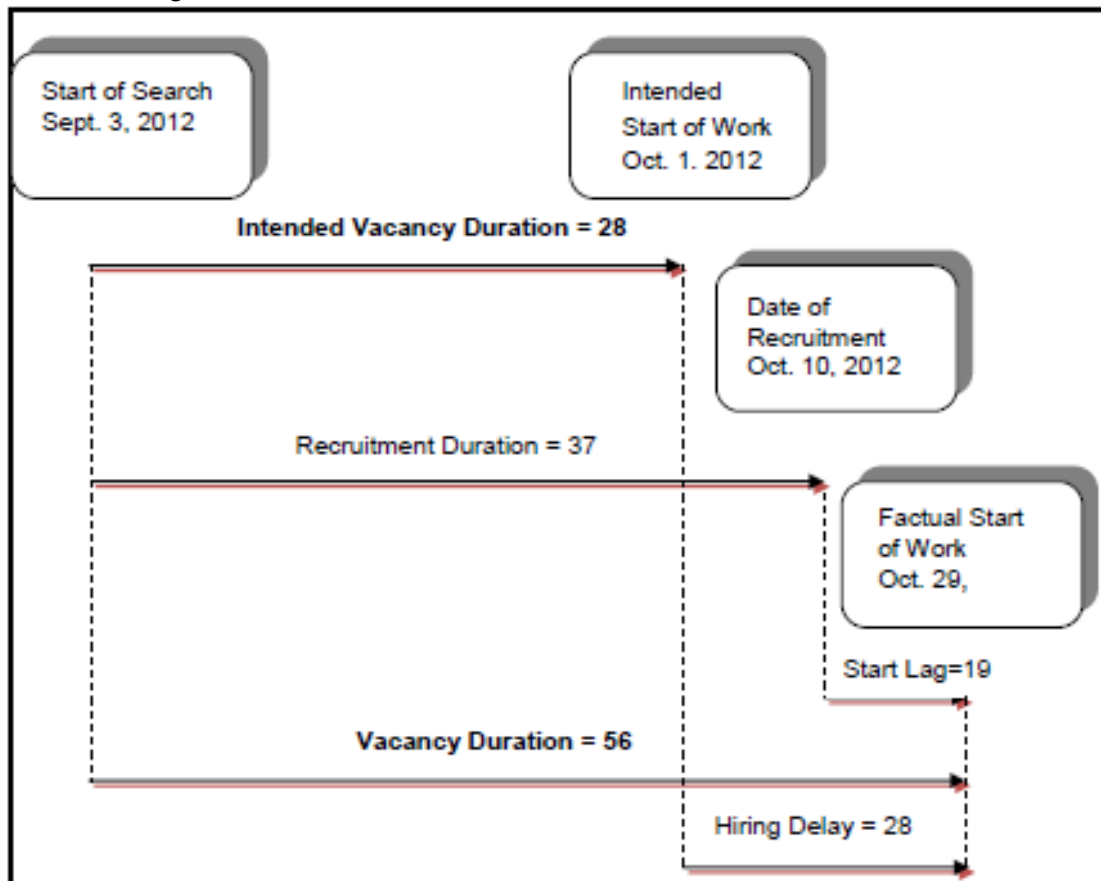
Chart 1: Hiring Scheme 1

Chart 2: Hiring Scheme 2:

4. Hiring durations by occupational groups

Tables 2 and 3 describe the average durations of the several phases of the hiring process separated by occupational groups. Similar to the results by Burdett/Cunningham (1998), vacancy durations differ greatly across occupation. Average vacancy durations for the reference period vary between occupational groups (33 groups according to ISCO 88) from 17 days for helpers without detailed specification to 86 days for engineers, chemists, physicists and mathematicians (see table 2). Average intended vacancy durations are shorter in all occupational groups, but the degree of divergence between the firms' plans and hiring reality – and therefore the relative importance of unfilled vacancies – differ. On the one hand unfilled vacancies might indicate labour market tightness and imply additional costs for the firms and for the economy as a whole. On the other hand the huge discrepancies between the plans of the firms and the factual duration until a new employee starts working point to an unrealistic personnel planning in many firms.

A look at the average recruitment duration and the average start lag demonstrates the importance of analyses by occupations, as Table 3 shows. A very different composition of the vacancy duration becomes visible, resulting from different shares of recruitment duration and start lag in the total duration of the hiring process. There are occupations with short recruitment durations and start lags, such as the helpers without detailed specification, an occupation requiring low skills only and an occupation with a comparably large labour supply among the unemployed. To hire miners, extraction and building trade workers, firms need a comparably long time (53 days) to find a suitable candidate, whereas it takes on average only 12 days until the selected person starts working. Engineers, chemists, physicists and mathematicians show the same recruitment duration, but the average start lag, 33 days, is nearly three times as long as for the miners.

Table 2: Vacancy duration and intended vacancy duration by occupation, 2000-2010

	Vacancy Duration (adjusted)				Intended Vacancy Duration (adjusted)			
	Percentiles				Percentiles			
	10	50 (Median)	90	Mean	10	50 (Median)	90	Mean
1 Farmers, fishery workers, gardeners, animal keepers and related occupations	10	45	107	55	4	21	66	32
2 Miners, extraction and building trade workers	22	31	125	64	7	31	113	56
3 Stone cutters and carvers, Manufacturers of building materials	11	33	97	39	0	22	81	32
4 Ceramists, glaziers	2	22	66	38	2	22	45	27
5 Occupations in chemistry and plastics	7	33	114	45	8	21	66	33
6 Typesetters, printers, bookbinders	10	41	89	48	6	23	64	31
7 Wood turners, carpenters, basket makers	7	34	49	30	0	22	44	23
8 Metal moulders, machinists, welders, blacksmiths, precision workers	3	34	105	49	0	21	65	29
9 Mechanical engineers, installers, metal constructors, vehicle builders, tool makers, precision engineers	5	32	97	43	0	20	64	27
10 Electricians	14	36	105	49	2	22	65	32
11 Assemblers, metal workers	1	10	50	21	0	10	32	15
12 Sewing workers, tailors, weavers, textile finishers	10	34	128	52	0	22	128	43
13 Tanners, shoemakers, leather workers	12	27	55	36	0	22	43	24
14 Bakers, confectioners, cooks, butchers, beverages manufacturers, tobacco manufacturers	3	24	87	39	0	21	65	29
15 Structural engineering workers, civil engineering workers	4	21	83	32	0	14	45	21
16 Interior decorators	4	22	82	34	0	14	45	22
17 Wood processors, plastic processors	5	34	78	45	4	23	75	32
18 Painters, varnishers	3	20	103	34	0	14	60	24
19 Occupations in goods controlling and shipping	8	31	90	39	2	21	44	25
20 Helpers without detailed specification	2	10	38	17	0	8	23	13
21 Machine and equipment operator and other related occupations	5	26	84	37	1	20	49	24
22 Engineers, chemists, physicists, mathematics	22	72	163	86	8	43	102	52
23 Technicians, draftsmen	20	50	129	64	7	35	88	43
24 Merchants for goods, sales representative	14	44	125	59	9	31	107	43
25 Merchants for services and related occupational fields	21	63	144	71	9	43	106	52
26 Occupations in traffic, communication traffic, storekeeping and transporting	6	23	81	36	1	20	60	26
27 Entrepreneurs, consultants, representatives, merchants, commercial and secretarial workers	14	45	117	60	6	38	84	42
28 Guards, attorneys, enforcement officers	9	40	88	46	9	23	70	36
29 Librarians, interpreters, journalists, artists	22	71	123	78	13	43	93	50
30 Doctors, pharmacists, therapists, nurses, assistants in health	20	46	123	62	11	43	88	46
31 Teachers, social workers, educators, pastoral workers, scientists-not mentioned before	19	49	119	62	9	38	91	45
32 Hair dressers, beauticians, innkeepers, flight attendants, hoteliers, cleaners	8	26	91	42	0	21	65	28
33 Family workers except for agricultural sector, workers without defined occupational field yet	10	43	115	52	0	23	66	35

Source: Authors' calculations on German Job Vacancy Survey data, weighted

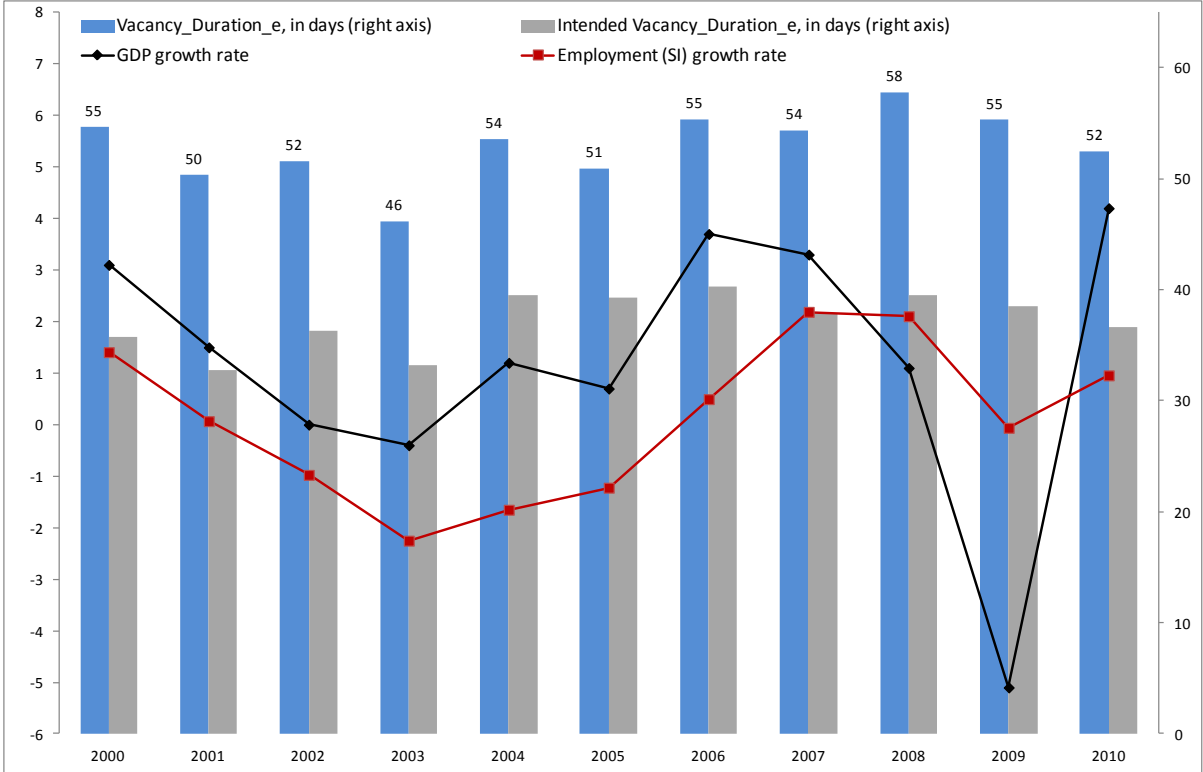## Table 3: Recruitment duration and start lag by occupation, 2000-2010

	Recruitment Duration (adjusted)				Start Lag (adjusted)			
	Percentiles				Percentiles			
	10	50 (Median)	90	Mean	10	50 (Median)	90	Mean
1 Farmers, fishery workers, gardeners, animal keepers and related occupations	4	29	83	41	1	8	32	14
2 Miners, extraction and building trade workers	10	11	122	53	3	10	21	12
3 Stone cutters and carvers, Manufacturers of building materials	0	19	64	26	0	7	28	12
4 Ceramists, glaziers	0	8	55	26	1	13	22	12
5 Occupations in chemistry and plastics	0	17	75	30	1	9	42	15
6 Typesetters, printers, bookbinders	2	22	70	31	2	12	42	17
7 Wood turners, carpenters, basket makers	5	14	41	22	1	5	21	8
8 Metal moulders, machinists, welders, blacksmiths, precision workers	0	22	81	36	0	6	38	12
9 Mechanical engineers, installers, metal constructors, vehicle builders, tool makers, precision engineers	1	17	65	28	1	9	37	15
10 Electricians	5	21	66	34	1	12	35	15
11 Assemblers, metal workers	0	7	32	15	1	2	18	7
12 Sewing workers, tailors, weavers, textile finishers	3	18	83	35	1	9	39	18
13 Tanners, shoemakers, leather workers	3	16	55	21	1	10	23	14
14 Bakers, confectioners, cooks, butchers, beverages manufacturers, tobacco manufacturers	0	17	63	27	0	7	31	13
15 Structural engineering workers, civil engineering workers	0	13	66	24	0	3	23	8
16 Interior decorators	0	11	58	24	0	6	23	10
17 Wood processors, plastic processors	0	22	56	28	0	12	44	16
18 Painters, varnishers	0	15	64	24	0	4	22	10
19 Occupations in goods controlling and shipping	2	21	53	24	1	8	37	15
20 Helpers without detailed specification	0	5	24	11	0	2	15	6
21 Machine and equipment operator and other related occupations	2	18	64	25	1	7	29	12
22 Engineers, chemists, physicists, mathematics	8	41	125	53	6	23	66	33
23 Technicians, draftsmen	6	32	85	42	3	17	47	23
24 Merchants for goods, sales representative	5	26	91	39	3	13	43	20
25 Merchants for services and related occupational fields	8	28	98	42	2	21	64	29
26 Occupations in traffic, communication traffic, storekeeping and transporting	1	15	74	26	1	6	23	10
27 Entrepreneurs, consultants, representatives, merchants, commercial and secretarial workers	5	28	83	38	2	16	45	22
28 Guards, attorneys, enforcement officers	3	20	63	29	2	9	40	17
29 Librarians, interpreters, journalists, artists	10	40	84	47	5	22	79	31
30 Doctors, pharmacists, therapists, nurses, assistants in health	5	25	74	35	4	20	55	27
31 Teachers, social workers, educators, pastoral workers, scientists-not mentioned before	7	27	88	38	2	16	49	23
32 Hair dressers, beauticians, innkeepers, flight attendants, hoteliers, cleaners	1	17	72	29	1	8	27	13
33 Family workers except for agricultural sector, workers without defined occupational field yet	6	22	72	33	1	11	45	19

Source: Authors' calculations on German Job Vacancy Survey data, weighted

5   The German labour market and hiring durations between the years 2000 and 2010

The observation period covers several macroeconomic situations in the German economy: Starting with quite favourable economic growth rates around 2000 the economy went into a recession that lasted until 2005, gave way to a strong recovery in 2006/2007 and finally had to deal with the effects of the international financial crisis. Additionally remarkable changes in German labour market policy, the so-called Hartz-reforms, were implemented in 2003 and 2005. They significantly influenced the behaviour of job seekers and employees regarding their willingness to compromise and significantly improved the matching efficiency (Rebien/Kettner 2011, Klinger/Rothe 2012).

Chart 3: Vacancy duration, intended vacancy duration, GDP and employment, 2000-2010

Sources: Hiring durations: German Job Vacancy Survey, weighted, GDP: Federal Statistical Office, Employment: Federal Employment Agency

Chart 3 presents the overall economic development by the course of GDP and employment. It also contains the average (adjusted) vacancy duration and the intended vacancy duration. At least in some periods the durations are changing in the same direction as GDP and employment, but the picture remains unclear. Upon first glance, the durations do not appear to be related to the Hartz reforms. One would assume decreasing durations because of

a higher matching efficiency, but as the picture shows the longest duration occurred in 2008, already three years after the implementation of the fourth stage of the Hart reforms in 2005 (Hartz IV).

Thus, we seek to dig further into the driving forces of average durations and will analyse how they have changed with different labour market situations. Our dataset gives us the opportunity to analyse at the micro level to what extent firm and job specific factors, the firm's individual hiring behaviour (intensity and efficiency) and external labour market conditions have a significant influence on the duration between the start of search for an applicant and the start of work of the new employee. We assume that the durations of different phases during the whole hiring process are not influenced by identical factors, resp. the influencing factors will vary in their strength of influence during different stages in the hiring process. While firm specific factors, firm specific behaviour and job specifics should be most relevant for recruitment duration (searching, screening, selecting), a start lag will be determined by external factors such as the behaviour of the new employee and the time he/she needs to resign from the previous job, to change residence, etc. Additionally a start lag might depend on the length of the recruitment duration. If recruitment takes longer than the firm initially had planned for the whole vacancy duration (recruitment duration > intended vacancy duration), the employer might put pressure on the newly hired person to start working as soon as possible or even choose the applicant depending on her/his willingness and ability to start working immediately after the recruitment decision. Whereas unemployed applicants will be available soon, employed job seekers will usually take longer to change their job.

The mean hiring delay measured as the divergence between the plans of the firms and the reality of the hiring processes is shown in Chart 4. As one would assume, the delay is shorter in weak economic times, marked by a low number of vacancies and a high number of unemployed, such as in the years 2003 to 2005. Shorter delay implies relatively lower costs of hiring, whereas hiring becomes more cost intensive (including recruitment efforts and waiting time) when the labour market becomes tighter. However, during a strong economic recovery firms might reduce their intended vacancy duration, as was observed in Germany with engineers in 2006. The intended vacancy duration (unadjusted) changed from 103 days in 2005 (recession, low labour demand) to 58 days in 2006 (Biersack/Kettner/Schreyer 2007). Even with constant recruitment duration and a constant start lag, the hiring delay would increase in such a case, reflecting mainly a high need of employers to recruit fast, but not reflecting changes in the hiring process itself.

Chart 4: Hiring delay, GDP and employment, 2000-2010

Sources: Hiring durations: German Job Vacancy Survey, weighted, GDP: Federal Statistical Office, Employment: Federal Employment Agency
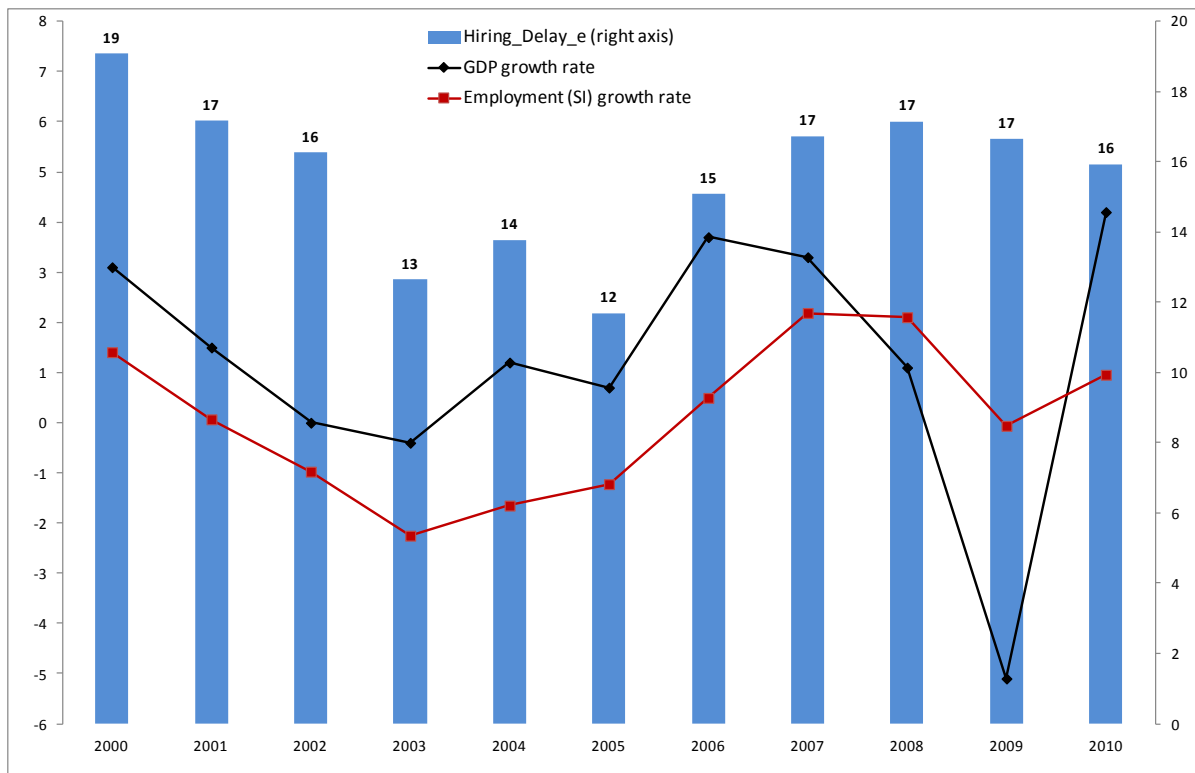
A main aim of our work on hiring is therefore not just to find out determinants of the several phases of the vacancy duration, but also to relate the single phases of hiring to each other. Whereas the hiring delay seems to be related to the overall economic and labour market development, the vacancy duration, consisting of recruitment duration and start lag, seems to be rather independent from the macro development, see Chart 5. Their fluctuations do not follow the overall economic trend. What is influencing them specifically, and how is this related to one of the main outcome variables of the hiring process, the hiring delay? To what extent do firms significantly influence the success of their staff searching processes and to what extent are external factors determining hiring durations? With regard to such questions, we will shed more light on of some hypotheses discussed in the literature, but have not been analysed so far for Germany and especially not analysed on the basis of a representative employer survey covering employers and hiring processes from all economic sectors and size classes over a ten-year period.
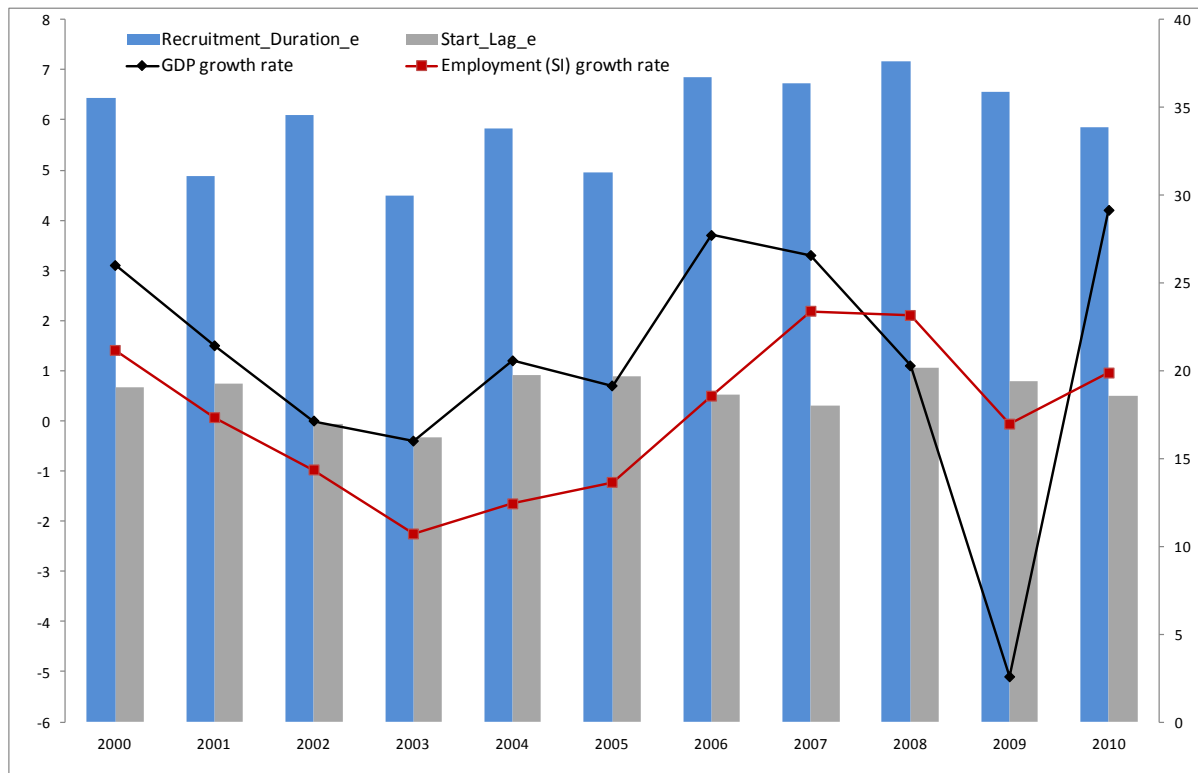
Chart 5: Recruitment duration, Start Lag, GDP and employment, 2000–2010

Sources: Hiring durations: German Job Vacancy Survey, weighted, GDP: Federal Statistical Office, Employment: Federal Employment Agency

The following chapter presents first regression results on the determinants of vacancy duration, recruitment duration and start lag. Despite the fact that so far the relationship between the several durations have not been modelled, , the results give very interesting insights into the determinants of the main components of the hiring process in German firms.

Due to the nature of our data survival models are applied. They allow treating those observations as censored that show durations longer than a defined maximum duration what depends on our assumptions on the accuracy of duration data that are collected retrospectively. We follow the approach of Burdett/Cunningham (1998) and other papers, who argue that because of retrospective answering and approximation by the respondents data quality on specific duration dates might be low for those hiring processes that started long ago in the past. Burdett/Cunningham censor their data on hires in the U.S. quite early, from 90 days on. We censor comparably late but will check the effects of an earlier censoring on the estimation quality in future steps. We apply the following restrictions:

a) Cases of (unadjusted) vacancy duration > 1000 days are excluded generally from the analyses.

b) Only those hiring processes are included in the analyses that are consistent in their single durations (recruitment duration + start lag = vacancy duration).

c) For the presented estimations cases of adjusted vacancy duration > 381 days have been censored, as well as adjusted recruitment duration > 380 days and adjusted start lag > 380 days.

In a first step we estimate the determinants of recruitment duration, start lag and vacancy duration independently from each other in three single models. In a second step we include time dependencies and relate the start lag to recruitment duration and intended vacancy duration in an extended model.

6. Hazard Function Estimation results

For the estimations we apply Cox Proportional Hazard Rate Models. This kind of semiparametric model combines an unspecified time-dependent baseline hazard function lambda and a linear function of k covariates x. The hazard rate for the hiring process i at time t is:

$$h_i(t) = \lambda(t) \exp(\beta_1 x_{i1} + \ldots + \beta_k x_{ik})$$

with $t = 1 \ldots T$
           T = maximal duration of the hiring process
           $i = 1 \ldots N$
           N = number of hires

The models for the several periods during the hiring process - the recruitment duration, the start lag and the vacancy duration - are estimated independently of each other, using duration data adjusted for weekends and public holidays. Independent variables x are:

Firm specific variables:
- Region: Western and Eastern Germany
- Firm size, measured by the number of employees in six categories
- Impairment of economic success by a lack of sales during the past 12 months
- Impairment of economic success by a lack of qualified labor during the past 12 months

-   Employee turnover rate[6]

Job specific variables:
-   Occupation
-   Reason for the hire (replacement or additional demand, short-term or long-term perspective)
-   Night-/ shiftwork required
-   Long-term experience in this specific occupation required (more than the usual level)
-   Additional knowledge and training required (more than the usual level)

External variables:
-   Unemployment rate by federal states
-   Year

Other:
-   Previous status of the hired person (employed, unemployed, other)

Estimation results for the hazard ratios are presented in Tables 4 to 6 for recruitment duration, start lag and vacancy duration.

6.1   Recruitment duration

The recruitment duration is defined as the period between the start of search and the recruitment date. As table 4 shows, the hazard ratios for the years 2004 to 2010 are significantly lower than the ratios for the reference year 2000, implying that the hazard of a recruitment decision tended to decrease over time. For example the overall economic situation was quite similar in 2000 and 2007, but for 2007 the hazard is just 83 percent of the 2000 value. The unemployment rate as well as the employment dynamics – measured by employee turnover rates – show positive effects on the hazard of a successful recruitment decision. More unemployed job seekers and higher employment dynamics were in tendency related to shorter recruitment durations.

Hiring processes in East Germany show a significantly lower hazard of the recruitment decision than those in West Germany. One may have assumed the opposite effect, because of a comparably weak labor market performance in the East. However, the estimation controls

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[6] Employee turnover rate = 0.5 x (number of newly hired employees during the recent 12 months + number of employees who left the firm during the recent 12 months) / number of employees.

for unemployment, so the dummy variable captures other influences connected to regional differences. Whereas middle-size firms show a comparably higher hazard of a recruitment decision, the very large firms with at least 500 employees show a significantly lower rate. This result supports Kettner (2012), who argues that in large firms restrictive selection processes and a comparably low level of ability to compromise lead to more hiring difficulties, despite a comparably high number of applicants and quite favorable financial and personal resources to fill open positions.

To capture the overall economic situation of the firm, survey participants are asked about constraints of their business activities during the recent 12 months; specifically they are asked if their economic success was impaired by a lack of sales or by a lack of qualified staff. Sales of an individual firm will be correlated with the overall economic performance of the related sector. A comparably weak sector performance means lower labor demand and more job seekers, what makes it easier for firms to recruit, reflected in the hazard ratio. An opposite effect is estimated for a lack of qualified staff. Firm who report this have a significantly lower hazard of a successful recruitment decision. One would expect this result, as on average the experience of labour shortages will be related to experiences with longer recruitment durations.

The high significance levels show that occupational differences matter for recruitment durations. The German economy is characterized by a high importance of occupational titles and by an occupation-specific training system (for example reflected in the dual apprenticeship training). Despite a general trend towards more flexibility, labor market segmentation is high, and the entry into employment in specific occupations that require more than basic skills is often regulated resp. institutionalized. One would assume that this also affects how employers search for new employees in specific occupations and how they select among available applicants, thereby influencing the duration of recruitment. As reference category the group of Engineers, chemists, physicists and mathematicians was chosen. It is often discussed in the media and among the public as an occupation strongly affected by recruitment difficulties and labour shortages. As the estimation shows, all other occupations show significant higher hazard ratios. For some occupations such as Helpers without detailed specification (group 20) and Assemblers and metal workers (group 11) the hazard of a successful recruitment decision is more than two times higher than for the reference group, whereas the difference is comparable small (but significant) for Technicians and draftsmen (group 23) and for Librarians, interpreters, journalists and artists (group 29).

Besides occupational degrees employers might demand extra qualifications such as additional training certificates or long work experience in a specific field. In the survey, employers are asked for requirements that are not a usual component of job postings in this occupation, but require a level of qualification resp. experiences above the usual level. When an employer demands long term work experience in a specific field, the hazard of a recruitment decision is significantly lower than the hazard in case of hires into positions without this requirement. A similar result holds if additional knowledge and training degrees are required, i.e. degrees that are not part of the regular apprenticeship programs resp. usual university degrees, but can be received by employees in advanced vocational training, evening classes etc. For hires into such positions the hazard of a recruitment decision is about 10 percent lower than for the other positions. This is in line with Kettner (2012), who shows that such requirements trigger difficulties in hiring.

Unattractive working conditions might complicate recruitment. One variable available in the survey to capture unattractive conditions is the requirement of night- or shift work. It might seem surprising at first that for jobs with such requirements, the hazard of a recruitment decision is c. p. about 6 percent higher than for other positions. The explanation lies in what is already captured by the occupational variable: In some occupations night- or shift work is very usual and does not mean any specific requirement for candidates applying for a vacancy. The small but significant difference in the hazard ratio might either reflect the attractiveness of extra payment on the part of applicants (more applicants per position) or a lower level of requirements for those jobs subject to night- or shift work. Future research will include an additional variable on qualification levels and also sector information to analyze this more in detail.

The kind of contract might be relevant for the decision to hire resp. for the decision to apply for a job or to accept an offer. In the German Job Vacancy Survey we can distinguish between hires for replacement vs. for additional demand and between hires with a short-term and a long-term employment perspective. This correlates highly with the kind of contract offered to the applicant: permanent or temporary. Nevertheless the two variables are not identical: an applicant might get an offer for a temporary contract despite the fact that the employer has long-term plans to fill this position with the selected person.[7] For the firms' recruitment efforts and the duration of recruitment the employment perspective will be most important: If a position shall be filled with a long-term perspective, for additional demand as

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[7] A temporary contract might be used to extend the regular probation time to become more certain about the productivity of the new employee. Additionally, temporary contracts are increasingly used for flexibility reasons.

well as for replacement demand the hazard of a recruitment decision is only 75 percent of the hazard of recruitment into positions that shall be filled only temporarily replacing a former employee, what is the reference category here. Obviously firms who want to keep the new employee for a long time take more efforts and time to assess the productivity candidates. Thus it is not the distinction between replacement demand and additional demand but rather between short-term and long-term perspectives and the intended duration of the employer-employee-relation that seems to drive the recruitment behavior of employers.

The model fit (also in the models for start lag and vacancy duration) improves remarkably after adding a variable describing the previous status of the hired person[8]. It has three categories: the person was employed in another firm (reference), the person was unemployed, and the person had any other status (such as education or training, maternity leave, civilian service or out of the labor force). As the results show, the hazard of a successful recruitment decision was about 14 percent higher in cases when an unemployed person was hired, compared to hiring a person who was employed in another firm before. Different reasons may lie behind this. It might be those positions with lower requirements or with a lower level of responsibility (unobserved characteristics so far) that are more often filled with unemployed job seekers. Also, firms hiring unemployed persons might use public employment services more often meaning a quite standardized search method reaching many job seekers at once. In future research we will capture this with additional variables. However, the employer's behavior in searching and selecting applicants, in particular how willing he/she is to consider unemployed applicants, determine the chances of unemployed job seekers and might have an impact on the estimated hazard ratios.

6.2   Start lag

The second important period during the hiring process it the period between the recruitment decision and the start of work of the new employee. Regarding the hazard of the start of work, hires in West and East Germany do not differ significantly during the reference period (table 5). In a model without the variable on the previous status[9] of the hired employee a significant effect of Eastern Germany is visible, but this effect disappears once the previous status information is considered. It is the hiring of unemployed applicants that significantly and strongly increases the hazard for the start of work after the recruitment decision. Usually

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[8] Models estimated without the previous status of the hired person are not described here.
[9] not presented here

unemployed people can start working soon after the recruitment decision, because they don't need to give notice to a former employer and don't need to uphold a notice period. Nevertheless they might need some time after the recruitment decision for instance to reorganize family live or to move.

The influence of the business cycle, measured by the time dummies, has only a small and mostly insignificant impact on the start lag compared to its impact on the recruitment duration. As for the recruitment duration a higher unemployment rate and higher employee turnover significantly increase the hazard for the start of work. Middle size firms have a significantly higher hazard of about 11 to 15 percent than very small firms, whereas for firms with at least 249 employees there is only a small and weakly significant difference to the reference category. Very small and large firms are c. p. quite similar in the start lag period; of course, the reasons are likely to be different and need to be investigated in further research. The experience of a lack of sales during the past 12 months results in a higher hazard rate, similar to the recruitment duration. However, employers that report a lack of labor show different results: whereas the hazard of the recruitment decision decreases, the hazard of the start of work increases. One explanation might be a stronger effort of employers to get the hired person as soon as possible if they generally experience comparably long recruitment durations.

As with the recruitment duration, highly significant occupational differences are visible for the start lag too. Here they will mainly be affected by different rules on the necessary period of notice to the previous employer. For instance, in occupations where many employees work in long-term projects with high responsibility the period of notice will be relatively long; and even those who will change to another firm might themselves insist on finishing their projects in the previous firm. Institutional effects are also captured by the occupational variable. Whereas in some occupations the administrative requirements are quite low and allow the immediate start of work after the recruitment decision, it is more complicated in other occupations, for instance if the job requires a health certificate.

Hires into long-term employment relationships (long-term replacement and long-term additional demand) show a significantly lower hazard (about 78 percent) compared to hires into temporary employment. So far it remains open, if it is mainly the behavior of the employer or of the hired person that influences the length of the start lag.

The effects of particular working conditions and additional qualification and education requirements on the start lag are similar to the first model on recruitment duration. It can be

assumed that most hired persons who fulfill the requirements on additional qualifications and long-term experience will come from other firms. Therefore these persons might need more time to change from one employer to the other, because of a longer period of notice and/or because of less willingness of the previous employer to negotiate a severance agreement.

6.3   Vacancy duration

The vacancy duration is the period between the start of search and the start of work, resp. the sum. Estimation results are shown in table 6. Comparing them with the results on recruitment duration and start lag reveals strong similarities to the recruitment duration outcome. Whereas this period takes 34 days on average (see table 1), the start lag is about 19 days. As one would expect the total duration of the hiring process is mainly influenced by the recruitment period. However, the inclusion of time dependent covariates is a very important next step to go more into the details of the single periods and the factors that influence their length.

6.4   Extended model: Start lag related to recruitment duration and intended vacancy duration

An important advantage of the German data on hires is the possibility to relate the phases of the hiring process to each other. For instance, one question discussed in 6.2 was on the relevance of the length of recruitment duration for the length of the start lag. It brought up the hypothesis that there might be a stronger effort of employers to get the selected applicant as soon as possible into work after a comparably long recruitment duration.

Therefore we include time dependencies into the estimation of the start lag. We keep all independent variables as in the first model on the start lag. First we include the recruitment duration as time dependent variable into the estimation. Results (not presented here) do not show significant effects of the recruitment duration, whereas the estimation was very robust regarding the other variables. Obviously it is not the absolute length of recruitment duration that is influencing the start lag of hires.

Instead, it is the relation between the recruitment duration and the intended vacancy duration significantly that influences the start lag, as the estimation results in table 7 show. In this model an additional dummy variable with value 1 reflects the case that the date of recruitment is later than the intended duration of the entire hiring process, i.e. later than the intended date

of the start of work (recruitment duration > intended vacancy duration). Here the hiring process is already in delay at the date of recruitment, when an applicant is just selected, but usually is not able to start working immediately. The dummy variable takes the value 0 if the date of recruitment is earlier than or equal to the date of intended start of work, reflecting a situation in which the employer can still expect to realize his/her original conception on the total length of the hiring process.

As results show, the hazard ratio of the newly included dummy variable is strong with 1.645 and highly significant. Compared to the first model on the start lag (without time dependencies, see Section 6.2) results on all other variables do not change remarkably and are quite robust. So we conclude that the hazard of the start lag is significantly influenced by a delay at the date of recruitment and that employers take more efforts to get the selected person into work as soon as possible to minimize the delay of the total hiring process. A delay at the date of recruitment might even influence the selection of applicants. As discussed earlier, unemployed applicants will usually be available earlier than applicants employed in other firms. As in the first model we control for the previous status of the hired person. The effect for the hire of an unemployed compared to an employed applicant is only slightly lower (hazard ratio of 1.679). Additionally we include an interaction between the hire of a previously unemployed and the usage of the Public Employment Services to recruit a new employee. Not surprisingly, this variable shows a positive and significant hazard ratio, implying noticeable effects of the public services on the length of the start lag by their efforts to place available unemployed job seekers as soon as possible to open positions. Employers who use this specific search channel and who can successfully hire an unemployed person can reduce the start lag significantly.

7. Directions for Future Research

An important next step in the analyses of hiring durations on base of the German Job Vacancy Survey is the deeper analysis of the role of time dependencies between the different phases of the hiring process. The possibility to distinguish between single phases is an important advantage of our data set, because we can analyze if specific factors do influence the single periods in different ways and if/how they depend from each other. This will provide important insights into the employers' side of matching and on the determinants of the duration of hires.

We will check other kinds of survival models on their explanatory power for different periods of the whole hiring duration and will include additional variables to shed more light on the employer's behavior. For instance the German Job Vacancy Survey provides more detailed information on which recruitment channels were used by the employer to announce the vacancy apart from of Public Employment Services. Here the time series still needs to be recoded consistently, because between 2000 and 2010 the relevant questions changed several times. Prejudices of employers against unemployed applicants will be included as well at least for some years to check their influence on the duration of hiring process

From 2004 on there is more information available on specific requirements of the job, going beyond the usual above-average-requirements, such as additional formal knowledge, social skills, leadership skills and computer skills. Also from 2004 on we can use information on the required qualification level. These data might contribute to explaining differences in the hiring process even better. Other data sets will be checked for information on explaining hiring durations in specific occupations, sectors or regions. The role of external labor market conditions will be analyzed more in detail, for instance by calculating different measures of labor market tightness.

As the coefficients of the time dummies indicate, there is no effect of the Hartz reforms visible in our estimations[10]. One would expect increasing hazard ratios over time. Instead they are significantly lower from 2004/2005 on. In our model a higher matching efficiency and increasing willingness of applicants to compromise do not result in lower hiring durations. Such effects might well still exist but are masked in our specification by other developments, such as increasing relative supply shortages. These reduce hiring success and in tendency will increase duration, but so far are not captured sufficiently to allow a separation between them and effects from institutional reforms. Another aim of our future research is therefore a more detailed consideration of the available supply and the consideration of the effects of public labor market policy on hiring durations.

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[10] Models with three Hartz-Dummies instead of Dummies for the years show very similar results, with no effects of the Hartz reforms.

Table 4: Hazard Rate Estimation – Recruitment duration

		Dependent Variable: Recruitment Duration (adjusted)			
		Parameter Estimate	Hazard Ratio	95% Confidence Limits	
Year	2000 (ref.)				
	2001	0,0028	**1,003**	0,941	1,069
	2002	-0,0275	**0,973**	0,909	1,041
	2003	0,0145	**1,015**	0,948	1,085
	2004	-0,0592 **	**0,943**	0,889	0,999
	2005	-0,1033 ***	**0,902**	0,850	0,957
	2006	-0,1304 ***	**0,878**	0,829	0,930
	2007	-0,1850 ***	**0,831**	0,786	0,879
	2008	-0,1652 ***	**0,848**	0,801	0,898
	2009	-0,1899 ***	**0,827**	0,782	0,875
	2010	-0,1714 ***	**0,842**	0,796	0,892
Region	West (ref.)				
	East	-0,1733 ***	**0,841**	0,800	0,884
Labour turnover rate		0,0532 ***	**1,055**	1,037	1,073
Unemployment rate		0,0077 ***	**1,008**	1,002	1,013
Firm size class	<10 (ref.)				
	10-19	0,0679 ***	**1,070**	1,028	1,114
	20-49	0,0333 *	**1,034**	0,996	1,074
	50-249	0,0593 ***	**1,061**	1,022	1,102
	249-499	-0,0022	**0,998**	0,951	1,047
	500+	-0,1005 ***	**0,904**	0,865	0,945
Lack of sales	0/1	0,0565 ***	**1,058**	1,031	1,086
Lack of staff	0/1	-0,4151 ***	**0,660**	0,635	0,686
Occupation[#]	22 (ref.)				
	1	0,3763 ***	**1,457**	1,349	1,573
	2	0,4105 **	**1,508**	1,056	2,151
	3	0,4393 ***	**1,552**	1,229	1,960
	4	0,5363 ***	**1,710**	1,283	2,278
	5	0,4589 ***	**1,582**	1,385	1,807
	6	0,3983 ***	**1,489**	1,309	1,694
	7	0,8175 ***	**2,265**	1,754	2,925
	8	0,3968 ***	**1,487**	1,365	1,621
	9	0,4587 ***	**1,582**	1,483	1,688
	10	0,3183 ***	**1,375**	1,263	1,497
	11	0,7784 ***	**2,178**	1,769	2,682
	12	0,4383 ***	**1,550**	1,329	1,807
	13	0,4827 ***	**1,620**	1,136	2,312
	14	0,3927 ***	**1,481**	1,368	1,604
	15	0,6253 ***	**1,869**	1,720	2,030

[#] See Tables 2 and 3 for a listing of occupational groups.

Table 4 continued

		Dependent Variable: Recruitment Duration (adjusted)			
		Parameter Estimate	Hazard Ratio	95% Confidence Limits	
Occupation[#]	*16*	0,7261 ***	**2,067**	1,848	2,312
	17	0,6463 ***	**1,909**	1,706	2,135
	18	0,5136 ***	**1,671**	1,465	1,907
	19	0,6960 ***	**2,006**	1,778	2,262
	20	0,9150 ***	**2,497**	2,272	2,744
	21	0,5826 ***	**1,791**	1,626	1,972
	23	0,2542 ***	**1,289**	1,204	1,381
	24	0,3486 ***	**1,417**	1,328	1,512
	25	0,3008 ***	**1,351**	1,258	1,450
	26	0,6738 ***	**1,962**	1,843	2,088
	27	0,2928 ***	**1,340**	1,274	1,410
	28	0,3171 ***	**1,373**	1,264	1,491
	29	0,1443 ***	**1,155**	1,045	1,277
	30	0,3794 ***	**1,461**	1,367	1,562
	31	0,3441 ***	**1,411**	1,335	1,491
	32	0,4848 ***	**1,624**	1,517	1,738
	33	0,3946 ***	**1,484**	1,337	1,647
Reason for the hire	*temporary replacement*				
	long-term replacement	-0,2885 ***	**0,749**	0,723	0,777
	temporary additional	0,2282 ***	**1,256**	1,195	1,321
	long-term additional demand	-0,3169 ***	**0,728**	0,701	0,757
Night- or shiftwork	*0/1*	0,0640 ***	**1,066**	1,041	1,092
Long-term experience in this specific occupation required	*0/1*	-0,0712 ***	**0,931**	0,912	0,951
Additional knowledge and training required	*0/1*	-0,1052 ***	**0,900**	0,877	0,924
Previous status of the new employee	*employed in another firm*				
	unemployed	0,1389 ***	**1,149**	1,122	1,177
	other	-0,0098	**0,990**	0,961	1,020
N		37.427			
censored		42			

Table 5: Hazard Rate Estimation – Start Lag

		Dependent Variable: Start Lag (adjusted)			
		Parameter Estimate	Hazard Ratio	95% Confidence Limits	
Year	*2000 (ref.)*				
	2001	0,0134	**1,013**	0,951	1,080
	2002	0,0025	**1,003**	0,937	1,073
	2003	-0,0429	**0,958**	0,896	1,025
	2004	-0,0851 ***	**0,918**	0,867	0,973
	2005	-0,0678 **	**0,934**	0,880	0,992
	2006	-0,0665 **	**0,936**	0,883	0,991
	2007	-0,0237	**0,977**	0,923	1,033
	2008	-0,0247	**0,976**	0,921	1,033
	2009	-0,0380	**0,963**	0,910	1,018
	2010	-0,0259	**0,974**	0,921	1,031
Region	*West (ref.)*				
	East	0,0284	**1,029**	0,979	1,081
Labour turnover rate		0,0938 ***	**1,098**	1,082	1,115
Unemployment rate		0,0071 ***	**1,007**	1,002	1,012
Firm size class	*<10 (ref.)*				
	10-19	0,1048 ***	**1,110**	1,067	1,156
	20-49	0,1390 ***	**1,149**	1,106	1,194
	50-249	0,1158 ***	**1,123**	1,081	1,166
	249-499	0,0482 *	**1,049**	1,000	1,101
	500+	-0,0419 *	**0,959**	0,917	1,003
Lack of sales	*0/1*	0,0522 ***	**1,054**	1,026	1,082
Lack of staff	*0/1*	0,1777 ***	**1,194**	1,150	1,241
Occupation[#]	*22 (ref.)*				
	1	0,3064 ***	**1,359**	1,258	1,467
	2	0,5799 ***	**1,786**	1,252	2,548
	3	0,6396 ***	**1,896**	1,501	2,393
	4	0,5426 ***	**1,721**	1,291	2,293
	5	0,5426 ***	**1,720**	1,506	1,965
	6	0,3555 ***	**1,427**	1,255	1,623
	7	0,6222 ***	**1,863**	1,442	2,406
	8	0,5017 ***	**1,652**	1,516	1,800
	9	0,4929 ***	**1,637**	1,535	1,746
	10	0,3667 ***	**1,443**	1,326	1,571
	11	0,8545 ***	**2,350**	1,909	2,894
	12	0,4994 ***	**1,648**	1,413	1,921
	13	0,3767 **	**1,457**	1,021	2,080
	14	0,4009 ***	**1,493**	1,379	1,617
	15	0,6799 ***	**1,974**	1,816	2,145

[#] See Tables 2 and 3 for a listing of occupational groups.

Table 5 continued

		Dependent Variable: Start Lag (adjusted)			
		Parameter Estimate	Hazard Ratio	95% Confidence Limits	
Occupation[#]	16	0,7817 ***	**2,185**	1,953	2,444
	17	0,6373 ***	**1,891**	1,691	2,116
	18	0,8090 ***	**2,246**	1,968	2,563
	19	0,5508 ***	**1,735**	1,538	1,956
	20	0,6934 ***	**2,001**	1,821	2,198
	21	0,6244 ***	**1,867**	1,696	2,056
	23	0,2355 ***	**1,266**	1,182	1,355
	24	0,2914 ***	**1,338**	1,254	1,428
	25	0,0378	**1,039**	0,968	1,115
	26	0,5721 ***	**1,772**	1,665	1,886
	27	0,1679 ***	**1,183**	1,124	1,245
	28	0,1965 ***	**1,217**	1,121	1,322
	29	0,0366	**1,037**	0,938	1,147
	30	0,1224 ***	**1,130**	1,058	1,208
	31	0,1804 ***	**1,198**	1,133	1,266
	32	0,4842 ***	**1,623**	1,517	1,736
	33	0,3141 ***	**1,369**	1,234	1,519
Reason for the hire	temporary replacement				
	long-term replacement	-0,2512 ***	**0,778**	0,750	0,807
	temporary additional	-0,0181	**0,982**	0,934	1,033
	long-term additional demand	-0,2506 ***	**0,778**	0,749	0,809
Night- or shiftwork	0/1	0,0754 ***	**1,078**	1,052	1,105
Long-term experience in this specific occupation required	0/1	-0,0494 ***	**0,952**	0,932	0,972
Additional knowledge and training required	0/1	-0,1131 ***	**0,893**	0,870	0,916
Previous status of the new employee	employed in another firm				
	unemployed	0,5582 ***	**1,747**	1,705	1,791
	other	0,1131 ***	**1,120**	1,086	1,154
N		37.466			
censored		3			

Table 6: Hazard Rate Estimation – Vacancy duration

		Dependent Variable: Vacancy Duration (adjusted)			
		Parameter Estimate	Hazard Ratio	95% Confidence Limits	
Year	2000 (ref.)				
	2001	0,0221	**1,022**	0,959	1,089
	2002	-0,0103	**0,990**	0,925	1,059
	2003	-0,0077	**0,992**	0,928	1,062
	2004	-0,0808 ***	**0,922**	0,870	0,978
	2005	-0,1046 ***	**0,901**	0,848	0,956
	2006	-0,1275 ***	**0,880**	0,831	0,932
	2007	-0,1460 ***	**0,864**	0,817	0,914
	2008	-0,1305 ***	**0,878**	0,829	0,929
	2009	-0,1628 ***	**0,850**	0,803	0,899
	2010	-0,1434 ***	**0,866**	0,819	0,917
Region	West (ref.)				
	East	-0,1263 ***	**0,881**	0,839	0,926
Labour turnover rate		0,0783 ***	**1,081**	1,065	1,098
Unemployment rate		0,0101 ***	**1,010**	1,005	1,016
Firm size class	<10 (ref.)				
	10-19	0,1041 ***	**1,110**	1,066	1,155
	20-49	0,0932 ***	**1,098**	1,057	1,140
	50-249	0,1119 ***	**1,118**	1,077	1,161
	249-499	0,0314	**1,032**	0,983	1,083
	500+	-0,0794 ***	**0,924**	0,883	0,966
Lack of sales	0/1	0,0679 ***	**1,070**	1,043	1,099
Lack of staff	0/1	-0,3054 ***	**0,737**	0,709	0,766
Occupation[#]	22 (ref.)				
	1	0,4074 ***	**1,503**	1,392	1,623
	2	0,6085 ***	**1,838**	1,288	2,622
	3	0,5798 ***	**1,768**	1,414	2,255
	4	0,6501 ***	**1,916**	1,437	2,553
	5	0,5976 ***	**1,818**	1,592	2,076
	6	0,4739 ***	**1,606**	1,412	1,827
	7	0,9167 ***	**2,501**	1,936	3,231
	8	0,4941 ***	**1,639**	1,504	1,786
	9	0,5767 ***	**1,780**	1,669	1,899
	10	0,4009 ***	**1,493**	1,371	1,626
	11	1,0092 ***	**2,743**	2,228	3,378
	12	0,5355 ***	**1,708**	1,465	1,992
	13	0,5982 ***	**1,819**	1,275	2,595
	14	0,4721 ***	**1,603**	1,480	1,737
	15	0,7673 ***	**2,154**	1,982	2,340

[#] See Tables 2 and 3 for a listing of occupational groups.

Table 6 continued

		Parameter Estimate	Hazard Ratio	95% Confidence Limits	
		Dependent Variable: Vacancy Duration (adjusted)			
Occupation[#]	*16*	0,9261 ***	**2,525**	2,257	2,824
	17	0,7927 ***	**2,209**	1,975	2,472
	18	0,7180 ***	**2,050**	1,796	2,340
	19	0,7995 ***	**2,224**	1,972	2,509
	20	1,0332 ***	**2,810**	2,557	3,088
	21	0,7290 ***	**2,073**	1,882	2,283
	23	0,3032 ***	**1,354**	1,264	1,450
	24	0,3985 ***	**1,490**	1,396	1,590
	25	0,2270 ***	**1,255**	1,169	1,347
	26	0,7724 ***	**2,165**	2,034	2,305
	27	0,3030 ***	**1,354**	1,286	1,425
	28	0,3337 ***	**1,396**	1,285	1,516
	29	0,1099 **	**1,116**	1,009	1,234
	30	0,3302 ***	**1,391**	1,302	1,487
	31	0,3475 ***	**1,416**	1,339	1,496
	32	0,5864 ***	**1,797**	1,679	1,924
	33	0,4575 ***	**1,580**	1,424	1,754
Reason for the hire	*temporary replacement*				
	long-term replacement	-0,3564 ***	**0,700**	0,675	0,726
	temporary additional	0,1724 ***	**1,188**	1,130	1,249
	long-term additional demand	-0,3835 ***	**0,682**	0,656	0,708
Night- or shiftwork	*0/1*	0,0785 ***	**1,082**	1,056	1,108
Long-term experience in this specific occupation required	*0/1*	-0,0791 ***	**0,924**	0,904	0,944
Additional knowledge and training required	*0/1*	-0,1372 ***	**0,872**	0,850	0,894
Previous status of the new employee	*employed in another firm*				
	unemployed	0,3584 ***	**1,431**	1,397	1,466
	other	0,0364 **	**1,037**	1,006	1,069
N		37.399			
censored		70			

Table 7: Extended Hazard Rate Estimation – Start Lag

		Parameter Estimate		Hazard Ratio	95% Confidence Limits	
	Dependent Variable: Start Lag (adjusted)					
Region	*West (ref.)*					
	East	0,03875	*	**1,040**	1,000	1,081
Labour turnover rate		0.09554	***	**1,100**	1,084	1,117
Unemployment rate		0.00652	***	**1,007**	1,003	1,010
Firm size class	*<10 (ref.)*					
	10-19	0,0931	***	**1,098**	1,055	1,142
	20-49	0,1359	***	**1,146**	1,103	1,189
	50-249	0,1071	***	**1,113**	1,072	1,155
	249-499	0,0308		**1,031**	0,983	1,082
	500+	-0,0801	***	**0,923**	0,883	0,964
Lack of sales	*0/1*	0,0470	***	**1,048**	1,022	1,075
Lack of staff	*0/1*	0,0638	***	**1,066**	1,026	1,107
Occupation[#]	*22 (ref.)*					
	1	0,3424	***	**1,408**	1,305	1,520
	2	0,5872	***	**1,799**	1,261	2,567
	3	0,6515	***	**1,918**	1,526	2,411
	4	0,6284	***	**1,875**	1,407	2,499
	5	0,5727	***	**1,773**	1,553	2,024
	6	0,4189	***	**1,520**	1,338	1,728
	7	0,7145	***	**2,043**	1,585	2,633
	8	0,5247	***	**1,690**	1,552	1,840
	9	0,5109	***	**1,667**	1,563	1,777
	10	0,3842	***	**1,468**	1,350	1,597
	11	0,9460	***	**2,575**	2,092	3,170
	12	0,5756	***	**1,778**	1,527	2,071
	13	0,3608	**	**1,434**	1,005	2,047
	14	0,4451	***	**1,561**	1,442	1,689
	15	0,7242	***	**2,063**	1,900	2,240
	16	0,8023	***	**2,231**	1,996	2,493
	17	0,6715	***	**1,957**	1,751	2,187
	18	0,8146	***	**2,258**	1,983	2,572
	19	0,5826	***	**1,791**	1,589	2,018
	20	0,7767	***	**2,174**	1,980	2,387
	21	0,6327	***	**1,883**	1,711	2,072
	23	0,2569	***	**1,293**	1,208	1,384
	24	0,3306	***	**1,392**	1,305	1,485
	25	0,1101	***	**1,116**	1,041	1,198
	26	0,6261	***	**1,870**	1,758	1,989
	27	0,2094	***	**1,233**	1,172	1,297
	28	0,2567	***	**1,293**	1,191	1,403
	29	0,0577		**1,059**	0,959	1,170
	30	0,1867	***	**1,205**	1,128	1,287
	31	0,2607	***	**1,298**	1,228	1,371
	32	0,5491	***	**1,732**	1,619	1,852
	33	0,3259	***	**1,385**	1,249	1,537

[#] See Tables 2 and 3 for a listing of occupational groups.

Table 7 continued

		Dependent Variable: Start Lag (adjusted)			
		Parameter Estimate	**Hazard Ratio**	**95% Confidence Limits**	
Reason for the hire	*temporary replacement (ref.)*				
	long-term replacement	-0,2781 ***	**0,757**	0,730	0,785
	temporary additional demand	-0,0049	**0,995**	0,946	1,046
	long-term additional demand	-0,2805 ***	**0,755**	0,727	0,785
Night- or shiftwork	*0/1*	0,0842 ***	**1,088**	1,062	1,114
Long-term experience in this specific	*0/1*	-0,0564 ***	**0,945**	0,925	0,965
Additional knowledge and training	*0/1*	-0,1110 ***	**0,895**	0,872	0,918
Previous status of the new employee	*employed in another firm (ref.)*				
	unemployed	0,5184 ***	**1,679**	1,635	1,724
	other	0,1202 ***	**1,128**	1,095	1,162
Interaction: previously unemployed and successful use of PES	*0/1*	0,1412 ***	**1,152**	1,111	1,194
Recruitment duration >= intended vacancy duration	*0/1*	0,4978 ***	**1.645**	1.609	1.682
N	38.100				
censored	3				

Annex: Translation of the main questions related to hiring durations in the German Job Vacancy Survey

Introducing question for the part of the questionnaire that is related to the most recent hire and hiring durations:

> *Did your company / administrative agency **hire** new personnel who are covered by social security during the past 12 months?*
>
> → *IF NO:* go to [Q78 – end of questionnaire]

Description what shall be reported here:

The latest case of a new hire
Please think about the latest case of a new hire your company / administrative agency conducted during the past 12 months – notwithstanding if this employee still works at your company / administrative agency.
Only think about employees who were covered by social security.
If your company / administrative agency hired several persons at the same time, please choose the person whose surname is first in the alphabet.

Questions on durations:

Dates of hiring

To which date did you want to fill this position at the earliest?
◊ *Day/Month/Year*

When did you start to search for a new employee to fill this position?
◊ *Day/Month/Year*

When did you choose this applicant?
◊ *Day/Month/Year*

When did the employment start?
◊ *Day/Month/Year*

References

Andrews, M.J., S. Bradley, D. Stott and R. Upward (2007): "Successful Employer Search? An Empirical Analysis of Vacancy Duration Using Micro Data". *Economica,* 1-26.

Barron, John M., Mark C. Berger and Dan A. Black (1999): "Employer Search, Training, and Vacancy Duration". *Economic Inquiry,* 35 (January), 167-192.

Biersack, W.; Kettner, A. and Schreyer, F. (2007): "Fachkräftebedarf: Engpässe, aber noch kein allgemeiner Ingenieurmangel" (Demand for skilled labour: shortages, but not a general lack of engineers). *IAB-Kurzbericht*, 16/2007, Nuremberg.

Burdett, Kenneth and Cunningham, Elizabeth (1998): "Toward a Theory of Vacancies". *Journal of Labour Economics*, 16 (3), 445–478.

Davis, Steven J., R. Jason Faberman, and John Haltiwanger (2013): "The Establishment-Level Behavior of Vacancies and Hiring". *The Quarterly Journal of Economics*, 128 (2), 581-622.

Holzer, Harry J., (1994): "Job Vacancy Rates in the Firm: An Empirical Analysis". *Economica,* 61(1), 17-36.

Kettner, A. (2012): Fachkräftemangel und Fachkräfteengpässe in Deutschland * Befunde, Ursachen und Handlungsbedarf. Dissertation at the Technical University Berlin. 276 pages. http://d-nb.info/1022885774/34 [10.04.2014]

Kettner, A.; Heckmann, M.; Rebien, M.; Pausch, S. and Szameitat, J. (2011): „Die IAB-Erhebung des gesamtwirtschaftlichen Stellenangebots – Inhalte, Daten und Methoden" (The IAB Job Vacancy Survey – content, data and methods). *Zeitschrift für ArbeitsmarktForschung* (Journal of Labour Market Research), 44 (3), 245-260.

Kettner, A. and Vogler-Ludwig, K. (2010): "The German job vacancy survey – an overview". In: European Commission / Eurostat (Ed.) First and Second International Workshops on Methodologies for Job Vacancy Statistics – Proceedings. *Eurostat Methodologies and Working Papers*, Luxembourg, 7-17. URL: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-10-027/EN/KS-RA-10-027-EN.PDF

Klinger, S. and Rothe, T. (2012): "The impact of labour market reforms and economic performance on the matching of the short-term and the long-term unemployed". *Scottish Journal of Political Economy*, 59 (1), 90-114.

van Ours, Jan and Geert Ridder (1991): "Cyclical Variation in Vacancy Durations and Vacancy Flows". *European Economic Review,* 35, 1143-1155.

Rebien, M. und Kettner, A. (2011): "Zur Konzessionsbereitschaft von arbeitslosen Bewerbern und Beschäftigten aus der betrieblichen Perspektive" (On the willingness to compromise of unemployed applicants and employees from the firm's perspective). *WSI-Mitteilungen*, 64 (5), 218-225.