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The Costs of Recruiting Apprentices: Evidence from German Firm-Level Data

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The Costs of Recruiting Apprentices: Evidence from German Firm-Level Data

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Abstract

In this paper, we use firm-level data to analyse a firm's costs of recruiting apprentices in Germany. We find that recruitment costs amount on average to 600 Euros per hire (approximately one month of apprentice pay or 1-2 per cent of a firm's training expenditures), but costs are heterogeneous across firms and vary strongly with the training occupation. Our results suggest that shortages in the local supply of apprentices and a high degree of competition among training firms in the region increase recruitment costs. Furthermore, we find that firms with a works council or an investment-oriented training strategy incur higher recruitment costs. Finally, marginal recruitment costs first increase but eventually decrease for firms hiring a large number of apprentices. Our results are important in light of the increasing firm competition for talented school leavers induced by demographic change.

JEL Classification: J24, J32, J63, M53

Keywords: Recruitment costs, apprenticeship training, human capital investment, local labour markets, local training markets, demographic change

1. Introduction

The dual apprenticeship training system is the most important educational track at the upper-secondary level in Germany. Each year, more than 500,000 young adults enrol in the dual system (BIBB 2015). However, as firms and individuals freely decide whether to train or not, the 'training market' has frequently been subject to imbalances. Although the past two decades were marked by an excess supply of apprenticeship candidates, recent studies predict a severe decline of potential applicants due to demographic factors until 2025 (Maier et al. 2015). The imminent shortage of young adults opting for apprenticeship training may also be reinforced by policy initiatives to increase the share of university graduates. Adding to this, the Bologna reform of the German tertiary education system may draw the 'more able' school leavers away from apprenticeships towards the academic (bachelor and master) track.

Consequently, German firms will be confronted not only with a quantitative reduction in the supply of potential apprentices but also with a lower ability level of the average applicant for a training position. A lower supply, in turn, may have adverse effects on firms' cost-benefit ratio, as net training costs may increase because firms may be forced to provide lower-ability apprentices with additional training (Blatter et al. 2015, Muehlemann et al. 2013). Alternatively, they need to dedicate more time and effort in the search and screening of their apprentices. As searching (e.g. posting

vacancies in newspapers or on-line job platforms) and screening (interviewing and selecting candidates) are costly to the firm, one would expect firms facing tight training markets to have higher recruitment than firms that do not.

However, from the literature, little is known about the expenditures of firms when hiring apprentices. In this paper, we aim to close this gap by providing empirical evidence for the size and the determinants of firms' recruitment costs. We develop a simple framework with a set of empirically testable hypotheses. We derive a number of regional and firm-level supply- and demand-side indicators, and analyse their influence on the recruitment costs of training firms. More precisely, we assess the role of local demographic and labour market conditions, local competition among training firms and labour market institutions at the plant level (i.e., works councils and collective bargaining coverage) in shaping the recruitment costs of apprentices.

Our results show that firms spend, on average, 600 Euros to successfully recruit an apprentice, which corresponds to about one month of apprentice pay. However, there is a large variance in recruitment costs, as the highest observed recruitment costs are above 4,000 Euros. We find that a lower regional supply of apprentices increases a firm's recruitment costs. Similarly, we find a positive association between competition for apprentices (as measured by the local share of large training firms) and recruitment costs. Institutional factors, such as works councils and collective bargaining agreements, have ambiguous effects, but firms that train apprentices

for investment reasons incur higher costs for screening apprentices. Finally, our results suggest that average recruitment costs initially increase in the number of recruited apprentices (in the same period), but at a decreasing rate. For large numbers of recruits, firms can exploit economies of scale.

The paper is structured as follows. The next section outlines the most important institutions with respect to the German education system and labour market. Then we discuss the relevant literature in the field of recruitment costs. In the following section we develop hypotheses about the determinants of recruitment costs. This section is followed by the description of the data source and the construction of the variables of interest. Further we present the results of our regression analysis and provide some robustness checks. The last section concludes with some policy implications.

2. Education system and training institutions in Germany

Although the German education system is fragmented by extensive competencies at the state level ('Bildungshoheit'), some general features can be identified. Schooling at the secondary level is characterised by early tracking into three different school types: a) the 'Hauptschule' (9 years of education) with students typically graduating at age 15, b) the 'Realschule' (10 years of education) with students typically graduating at age 16 and c) the 'Gymnasium' (13 years of education) with students typically graduating at age 19. In several states, the duration of the 'Gymnasium' was

recently reduced from 13 to 12 years. However, our analysis is based on data from 2007, which is before such changes were in effect. For graduates of the 'Hauptschule' and the 'Realschule', a vocational track (i.e., either school-based vocational education or, in the majority of cases, an apprenticeship) is the most common educational pathway, whereas graduates of the 'Gymnasium' in addition have the option to attend universities or applied universities. Although formally implemented, students enrolled in 'Hauptschule' may change to 'Realschule' and then even go on to the 'Gymnasium', however, in practice such upward mobility is relatively rare. While in principle, enrolling in an apprenticeship does not require a secondary school leaving certificate, only 3 per cent of all apprentices did not graduate from a compulsory schooling track. Overall, 32 per cent of apprentices graduated from a 'Hauptschule' and 42 per cent from a 'Realschule'. Moreover, even though a high school degree grants access to university education, 23 per cent of all apprentices graduated from a 'Gymnasium' (BIBB 2013). The duration of an apprenticeship is typically between 2 to 3.5 years. In the beginning of the firm-apprentice relationship, a binding apprenticeship contract establishes the apprentice's wages for the entire training period, and the firm commits to provide adequate workplace training according to the national training regulations. The share of firms participating in apprenticeship training remained stable at approximately 23 per cent during the first decade of the new millennium (see Figure A2 in the appendix). The share of apprentices that were employed with the training firm one year after graduation increased

only slightly in recent years and corresponds to about two-thirds of all apprentices (Figure A2). Thus, the majority of training firms train apprentices for investment purposes, i.e., to satisfy their future demand for skilled labour.

The specific institutional framework in Germany plays an important role for the continuing success of the dual apprenticeship system. A firm's representatives (i.e., the respective chambers of industry, commerce, crafts and agriculture) and unions play an integral part in reforming the system according to the needs of the private sector economy, as they are actively involved in the revision of training curricula and regulations. Moreover, they are involved in the processes to create new or modify existing training occupations. At the firm level, works councils are obliged to monitor the quality of training and intervene in the case of grievances. At the sectoral level, collective agreements often include regulations of initial and continuing vocational training. Moreover, works councils (through co-determination) or collective agreements (through wage determination and safety regulations) may directly influence a firm's decisions and thereby the costs when recruiting apprentices. Thus, apprenticeship training in Germany is embedded in a multi-layer institutional framework that affects the quality, attractiveness and transferability of skills obtained by individuals in this system. The following section reveals a lack of direct empirical evidence on the determinants of recruitment costs in Germany. The contribution of this paper to

the literature is to provide an empirical investigation of the determinants of a firm's costs for the recruitment of an apprentice.

An important feature of the German apprenticeship system is the commitment of firms to invest in training. Although about one-third of the training firms can compensate their training investment through the work of apprentices during training, the majority of German firms rely on some form of post-training benefits to cover their net training investment (Schoenfeld et al. 2010). An important post-training benefit is to use apprenticeship training as a screening device to save recruitment costs by retaining suitable apprentices as skilled workers after they graduate, rather than to hire skilled workers from the external labour market. Stevens (1994) develops a theoretical model and shows empirical evidence for the UK that firms indeed provide internal training to save future recruitment costs. In addition, firms with an investment-oriented training strategy may have an information advantage over outside firms, helping them to employ their most able apprentices. Accordingly, the potential benefits from apprenticeship training may exceed the saved resources from an average external hire. Therefore, anticipating the future benefits from training apprentices may increase competition for the most talented apprentices such that firms may find it worthwhile to invest their resources in the recruitment process accordingly- and not only in the subsequent training of their apprentices.

3. Relevant literature

Thus far, empirical evidence on the magnitude and the determinants of recruitment costs for apprentices is rare, mainly due to the limited availability of suitable data. However, recruitment costs for apprentices may be determined by factors similar to those for more experienced (skilled) workers. Recruitment (and training) costs to fill a vacancy for a skilled worker range, on average, from approximately two to four months of skilled worker pay (Blatter et al. 2012; Dube et al. 2010; Kramarz and Michaud 2010; Manning 2006, Muehlemann and Strupler 2015). Manning (2011) provides a recent survey of the literature and a discussion of the importance of hiring costs, whereas the early literature on labour adjustment costs is surveyed in Hamermesh and Pfann (1996). In Germany, hiring costs of already trained workers reach, on average, two monthly wage payments, although recruitment costs only account for approximately one-third of those costs – while two-thirds of the hiring expenditures are due to adaptation costs (Muehlemann and Pfeifer 2015).

Analysing the recruitment of experienced skilled workers, Muehlemann and Strupler (2015) find that recruitment costs increase when firms need to exert greater effort to find suitable employees in a tight local labour market. Muehlemann and Pfeifer (2015) find a similar result for the search cost component of hiring costs in Germany. For the case of apprentices, a similar situation may arise when the number of school-leavers (the main determinant of the supply of apprentices) varies due to de-

mographic change. In times of small cohorts of school leavers, a firm will have to exert more effort to find a sufficient number of suitable trainees. Muehlemann et al. (2009) find that in Switzerland, the number of apprenticeship positions is strongly associated with the cohort size of school leavers. Moreover, Muehlemann and Pfeifer (2015) show that institutional arrangements at the firm level are associated with a higher level of hiring costs of skilled workers.[1] Further, the coverage by collective bargaining agreements implies a negative association with the recruitment costs, but a positive association with adaptation costs, thus leading to an insignificant overall effect of collective bargaining on the hiring costs. The authors explain the higher recruitment costs in works council firms with the legal right of works councils to intervene in the recruitment process. The lower recruitment costs in firms covered by collective bargaining may arise due to the externalisation of wage negotiations, which reduces the time and, therefore, the costs of an interview. The higher adaptation costs are explained by the greater incentives of firms to invest in continuing training as the tenure of workers in firms with collective wage bargaining is longer. Finally, economic models of the labour market often assume a convex cost structure as a firm may find it increasingly difficult to hire additional suitable workers in a given period (e.g., Manning 2006). However, firms may also be able to exploit economies of scale, e.g., by setting up a human resources department that facilitates the processing of a large number of applications and interviews. Many studies find empirical support for convex hiring costs, such as Blatter et al. (2012) for Switzer-

land, Manning (2006) for the United Kingdom, Dube et al. (2010) for the United States, and Muehlemann and Pfeifer (2015) for Germany, whereas others find evidence for a linear cost structure (Kramarz and Michaud 2010). However, to our knowledge, there are no studies that analyse the cost structure of recruitment costs for apprentices with respect to the number of trainees.

In the following section, we develop a framework motivating several hypotheses for the main determinants of apprentices' recruitment costs.

4. Hypotheses about the determinants of recruitment costs

Our framework takes into account various parameters that have a direct or indirect influence on a firm's costs of recruiting apprentices.

The first set of explanatory factors relates to the local tightness in the training market (*RV*). We use the local demand-supply ratio (*dsr*), as described by Hucker (2013). This ratio is calculated by dividing the local number of apprenticeship vacancies by the local number of school leavers applying for apprenticeship positions. Apprenticeship vacancies that are predominantly publicly financed are excluded. A ratio greater than 1 relates to a situation of excess demand for apprentices, while a ratio smaller than 1 describes an excess supply of apprentices in the respective region. We expect that an excess supply of applicants increases the likelihood of finding a good match and thus reduces a firm's recruitment costs. Conversely, an excess

demand for apprentices increases a firm's search efforts to find suitable candidates. Fewer applicants in general, and especially fewer suitable applicants increase the costs of both the job posting and the screening and selection process. Thus, firms have to increase their effort to receive sufficient applications, and additionally the less suitable applicants (e.g. those who don't match the initially required schooling requirements) have to be tested more carefully to ensure a sufficiently good match quality.

Moreover, we use an additional measure for the local competition among training firms (*comp*). While the supply-demand ratio captures the overall tightness of the training market, we also include the local share of large training firms and the share of large training firms in the neighbouring regions. We use the share of large training firms instead of the absolute number because the local labor markets differ in size and economic strength. Therefore the share of large training firms is a more appropriate indicator for the competition for apprentices among training firms. We expect that large firms may be more attractive for school leavers applying for apprenticeships as large firms not only offer higher wages for apprentices, but they typically retain a higher share of apprenticeship graduates and subsequently offer better career opportunities than small firms. As a result, an applicant would prefer to accept an offer from a large training firm and only accept offers from smaller firms in the event the former application was unsuccessful. Thus, we expect that in an en-

vironment with a high share of large training firms, the average recruitment effort will increase (not only for small firms but also among larger firms, as opposed to a situation with only a single large training firm that could simply select the most able applicants). Thus, we expect the following impact on recruitment costs for apprentices:

$$\underbrace{\overbrace{dsr}^{+}, \overbrace{comp}^{+}}_{RV} \quad (1)$$

A second set of factors addresses institutions that are implemented at the firm level (*IV*). The presence of a works council in the firm (*woco*) could influence recruitment costs through two opposing mechanisms. On the one hand, works councils may signal a higher training quality, better working conditions, and better future career options for apprentices (Backes-Gellner and Tuor 2010). Thus, the more able apprentices may be more likely to apply for posts in a firm with works councils, thereby reducing a firm's search effort. On the other hand, The Works Constitution Act (*Betriebsverfassungsgesetz,* 1972) provides a works council with legal informational and participatory rights in regard to the hiring and firing of personnel, including apprentices. The direct involvement of a works council in the recruitment process could make it more extensive and, consequently, more costly for the firm. Furthermore, as firms with works councils are more likely to retain apprentices after training (Kriechel et al. 2014), they may want to invest more resources to find a suitable

match. As works councils may have increasing and decreasing effects on recruitment costs, determining the net effect remains an empirical question. A further indicator for firm-level institutions is the coverage by collective bargaining agreements, as denoted by *cba*. As collective bargaining in Germany mainly occurs at the local or sectoral level, the covered firms must comply with the bargained wage agreements and safety regulations. Therefore, we expect bargaining coverage to impact negatively on recruitment costs as wage and safety issues are regulated externally at the local or sectoral level, i.e., before the hiring occurs. Thus, we expect the following effects of institutional factors on recruitment costs for apprentices:

$$\underbrace{\overbrace{woco}^{?}, \overbrace{cba}^{-}}_{IV} \tag{2}$$

A third set of factors that potentially influence recruitment costs relates to the firm level (*FV*). First, a firm with an investment-oriented training strategy (*strat*), defined as a firm with a high subjective preference to retain an apprentice as a skilled worker after graduation, may invest more resources in the recruitment process not only to find a suitable apprentice but also a suitable future skilled worker. Firms with a production-oriented training strategy may not exert a search effort above a certain maximum threshold as the marginal benefit of the search effort is limited to the training period. In contrast, for a firm with an investment-oriented training motive, the marginal benefit of the search effort relates to the entire expected tenure of a skilled

worker (in addition to the training period). Second, we assume that a firm with a higher training intensity (*intense*) - as measured in weekly hours of instruction time per apprentice - also provides better quality training. As there is a large literature on the complementarity between ability and training (i.e., the marginal effect of training on productivity is higher for more able individuals, cf. Harmon et al. 2003), we expect that firms providing more training will also exert greater search effort to find high-ability apprentices. We expect that this effect is separate from the effect of a firm's training strategy as discussed herein (*strat*). As a higher training intensity may also yield a higher productive contribution of trainees in the short run, the effect of the training intensity on recruitment costs is not necessarily limited to investment-oriented training firms.

Third, the number for apprenticeship places within the firm level (*numb*) may either be positively or negatively related to the average recruitment costs. A firm may exploit economies of scale when recruiting several apprentices at the same time, e.g., for firms with a human resources department. Therefore both the costs for posting vacancies and the costs for screening and selection may decrease as e.g. only one job advertisement for several positions is necessary and possibly less interviews per position are needed as the firm can pick e.g. three candidates out of five instead of one out of five. Conversely, it may become increasingly difficult to find suitable apprentices that meet the requirements of the firm. In other words, finding a first good

match is easier than finding the second or third (and so on). Marginal recruitment costs for apprentices then may increase with the number of apprentices. In particular, the advertisement costs may increase as it might become necessary to post additional vacancies. The net effect of the number of recruited on a firm's recruitment costs must be determined empirically. Thus, we expect the following effects of firm-level factors on recruitment costs for apprentices:

$$\underbrace{\overbrace{strat}^{+}, \overbrace{intense}^{+}, \overbrace{numb}^{?}}_{FV} \tag{3}$$

Table 1 summarizes the expected effects of our three sets of factors on a firm's recruitment costs.

Table 1: Expected effects on recruitment costs

		Expected effect on Recruitment Costs (RC)
Regional training market variables (*RV*)	Demand-supply ratio (*dsr*)	**+**
	Competition among training firms (*comp*)	**+**
Institutional variables (*IV*)	Works council (*woco*)	**?**
	Collective bargaining agreement (*cba*)	**-**
	Investment-oriented strategy (*strat*)	**+**
Firm level variables (*FV*)	Training intensity (*intense*)	**+**
	Number of recruits (*numb*)	**?**

In the subsequent section, we describe the data for our analysis and provide a detailed description of the calculation of a firm's recruitment costs for apprentices as well as the descriptive statistics of the remaining variables of interest.

5. Data and variable construction

5.1 Data

For our analysis, we use data collected by the Federal Institute of Vocational Education and Training (BIBB). For a period of more than 40 years, the BIBB has conducted a number of surveys aimed at measuring the costs and benefits of apprenticeship training. As part of the training costs assessment, the surveys inquire about the recruitment costs of apprentices. The survey questions focus on the costs resulting from posting a vacancy as well as on the time and effort a firm dedicates to the screening and selection of apprentices. In addition to questions on recruitment costs, the surveys contain information about a number of structural, organisational and institutional characteristics of a firm.

For the present paper, we use data from the BIBB Cost-Benefit Surveys (BIBB CBS) that was conducted in 2008 with a reference year of 2007.[2] The field work of the survey was conducted by *infas* (Institute for Applied Social Sciences) (Schroeder and Schiel 2008). The general results regarding the costs and benefits of an apprenticeship programme are discussed in detail in Schoenfeld et al. (2010). The sample

was drawn from the administrative firm register, which contains all German firms that are subject to social security contributions for at least one employee and includes a total of 2,986 firms. As such, the data are representative of all German firms with at least one employee. We exclude firms with missing values in one or more of the dependent or independent variables (153 firms). We further remove cases that belong to the highest 1 per cent in their recruitment costs and their number of recruited apprentices (55 firms) to avoid results driven by outliers. Accordingly, our final sample consists of 2,778 firms.[3]

Moreover, we merge the firm-level data from the BIBB CBS with administrative data at the regional level, i.e., the local demand-supply ratio and the local share of large training firms (i.e., firms with more than 500 employees). The demand-supply ratio is calculated by the BIBB (Hucker 2013). Information on the share of large training firms is based on social security records collected by the Federal Employment Agency. The exact calculation method and detailed data description are provided by Heineck et al. (2011). The local differentiation in our data is based on administrative districts as defined by the Federal Employment Agency.

5.2 Calculation of recruitment costs

Our main variable of interest is the monetary costs for a firm's recruitment of an apprentice (*RC*). We observe average costs per apprentice to fill a training position

in firm *i*. The average recruitment costs for an apprentice consist of two components that focus on different aspects of the recruitment process. First, we denote search costs, i.e., average costs for posting and administrating a vacancy, by *PCi*.

Second, we calculate the average costs associated with screening and interviewing applicants to fill a vacant apprenticeship post and denote these costs by *SCi*. First, the survey contains information about the average time *h* (in hours) that managers (h_i^m) and skilled workers (h_i^s) spend for the interview process to fill one training position. This also includes preparation time and post-interview processing time. We subsequently multiply the total time with the respective wage of a manager (w_i^m) and a skilled worker (w_i^s) in firm *i*. Thus, average screening and selection costs per vacancy are given by $SC_i = (w_i^m * h_i^m) + (w_i^s * h_i^s)$. Average recruitment costs to fill a vacancy in firm *i* are given by

$$RC_i = PC_i + SC_i \tag{4}$$

Obviously there might be other sources of recruitment costs that are not covered by the BIBB CBS, such as traveling costs of the applicants or costs for an assessment centre that might be organised in some firms. Hence, the measured costs can be regarded as a lower bound of the actual recruitment costs.

In Table B1, we present the descriptive results for average recruitment costs. They sum up to about 600 Euros per recruit, which corresponds to about 1 month of train-

ee pay. Given that a firm's gross investment in training averages about 15,300 Euros per year of training (Schoenfeld et al. 2010), recruitment costs merely amount to 1-2 per cent of a firm's total training expenditures. The major parts of these costs are screening and selection costs (512 Euros). Together, managers and workers spend on average 2.5 hours with the recruitment process. Table B2 presents the descriptive statistics of the indicator variables described in Section 4. The regional demand-supply ratio is close to 1, meaning that apprenticeship vacancies and applicants balance out across all regions. The share of large training firms is higher in those regions where the surveyed firms are located, as compared to the neighbour regions (1.08 per cent to 0.85 per cent). 12 per cent of the firms have a works council, 54 per cent are bound to collective bargaining and 46 per cent claim to retain all apprentices after training and therefore follow a pure investment-oriented training strategy. On average, firms recruit 2 apprentices and trainers invest 5.8 hours per week in the training of an apprentice. Table B3 gives an overview of the structural distribution of the training firms.

6. Estimation strategy and results

6.1 Estimation strategy

To estimate the structure of a firm's recruitment costs for apprentices, we run the following ordinary least squares regression models:

$$
\begin{aligned}
RC_i = {} & \alpha + \beta_1 dsr_{ri} + \beta_2 comp1_{ri} + \beta_3 comp2_{ri} \\
& + \beta_4 woco_i + \beta_5 cba_i \\
& + \beta_6 strat_i + \beta_7 intense_i + \beta_8 numb_i + \beta_9 numb_i^2 \\
& + \beta_{10} X_i + \epsilon_i
\end{aligned}
\tag{5}
$$

With regional variables *RV* in region *r*, and institutional variables *IV* and firm-level variables *FV* for firm *i*. Concerning the number of apprentices a firm hires in a given period, we also include a quadratic term to allow for a nonlinear relationship between the number of apprentices and the recruitment costs. Moreover, *X* includes additional control variables for firm size (7 categories), economic sector (5 sectors)[4], field of training vocation (13 fields) and region (East or West Germany).

6.2 Regression results

Table 2 displays the results of the OLS-regressions with the costs for posting vacancies (*PC*), the costs for screening and selection (*SC*) and the total recruitment costs (*RC*) as dependent variables. In each model, we include control variables for firm size, economic sector, occupational field and a dummy variable indicating whether a firm is located in East or West Germany. We find a positive and significant effect of the demand-supply ratio on recruitment costs, which is consistent with our hypothesis that a tighter training market increases a firm's search effort. An increase of two

standard deviations in the demand-supply ratio (sd=0.05) is associated with a 13 per cent increase in recruitment costs – a rather moderate effect. Furthermore, we find that firms in a region with a higher number of large training firms must invest more to find suitable apprentices. An increase in the share of large firms in the (neighbouring) region by one standard deviation increases the average recruitment costs by 79 (40) Euros. This result is consistent with our hypothesis that a stronger competition for school leavers increases the costs for a firm to find a suitable match among the apprenticeship applicants.

Concerning the institutional variables, training firms with a works council have significantly higher recruitment costs than firms without a works council (see Table 2). This result suggests that the cost-increasing effect (through participation in the recruitment process) dominates the cost-reducing effect (through the signalling of better training quality) of works councils, as discussed in section 4. To account for the fact that large firms have a much higher probability of having a works council than small firms, we also run the same regression in a restricted sample of firms with 20 to 200 employees. We find that the coefficient of *woco* remains statistically significant (although only at the 10 per cent level). The respective coefficient is economically substantial as the existence of a works council is associated with an increase in average recruitment costs of 255 Euros. However, this effect cannot be interpreted as strictly causal because the employees' decision of incorporating works councils is

not exogenous to the firm. Nonetheless, our results suggest a robust association between works councils and the recruitment costs for apprentices. With regard to collective bargaining coverage in the firm, we find a negative effect that is not statistically significant (Table 2). Nonetheless, while the time spent screening in firms with works councils is significantly shorter than the time spent in firms without such agreements, but the higher wage levels in collectively bargained firms offset the negative effect on the recruitment costs (Table B5).

We further find that firms with an investment-oriented training motive incur higher recruitment costs than firms with a production-oriented training strategy. Thus, firms with a long-term interest in their apprentices spend greater effort in the screening and selection processes compared to firms that expect (most of) their apprentices to leave the firm after the training period. However, the effect size with a coefficient of 74 Euros is moderate (a 12 per cent increase in average recruitment costs).

Regarding the impact of the number of hired apprentices on recruitment costs, we find non-linear effects, as both the linear and the quadratic term are statistically significant. While the number of apprentices initially increases average recruitment costs, the negative quadratic terms indicates that marginal costs increase at a diminishing rate and eventually decrease for firms hiring more than 12 apprentices per period.

Table 2: Recruitment costs OLS regressions

	Costs for job postings	Costs for Screening & selection	Total recruitment costs
Local supply side variables (RV)			
Demand supply relation	183.02	685.54**	868.56***
	(153.62)	(289.84)	(288.49)
Share of large training firms in region	21.77*	136.37***	158.13***
	(11.49)	(36.43)	(37.46)
Share of large training firms in neighbor region	20.39	180.57**	200.96**
	(31.12)	(88.51)	(92.41)
Institution variables (IV)			
Works council in firm	62.21**	192.76***	254.97***
	(25.72)	(59.86)	(61.59)
Bound by collective agreements	-3.94	-13.83	-17.77
	(11.26)	(33.00)	(37.78)
Firm-level variables (FV)			
Investment motive	26.03**	47.68*	73.72**
	(11.01)	(25.91)	(29.92)
Number of recruited apprentices	3.09	22.28**	25.37**
	(4.19)	(11.12)	(12.36)
Number of recruited apprentices (squared	-0.10	-0.93**	-1.02**
	(0.11)	(0.38)	(0.41)
Training personnel hours per week	2.18**	7.49***	9.67***
	(0.82)	(2.13)	(2.40)
Firm size controls	Yes	Yes	Yes
Economic sector controls	Yes	Yes	Yes
Vocational field controls	Yes	Yes	Yes
Regional controls	Yes	Yes	Yes
Constant	-221.78	-711.59**	-933.36***
	(141.53)	(315.12)	(309.91)
Observations	2778	2778	2778
Adjusted R^2	0.093	0.117	0.150

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Thus, firms hiring many apprentices may exploit economies of scale in the hiring process, as this result is largely driven by the screening and selection costs *SC* (Table 2, column 3).

Finally, we find a significantly positive effect of the training intensity on a firm's recruitment costs. As expected, firms that provide more instruction time per apprentice also invest more in vacancy postings and in the screening and selection processes of their apprentices. A one standard deviation increase in higher training hours is associated with a 66 Euro (approximately 10 per cent) higher average recruitment costs. With respect to the set of control variables, the results (not shown) suggest that recruitment costs increase with firm size and are of a higher magnitude in banking and real estate industry (compared to the crafts sector). Further, as indicated in Table B4 of the Appendix, recruitment costs differ strongly based on training occupations.

6.3 Robustness analysis

In this section, we discuss the robustness of the results obtained from our OLS regressions in Table 2. Table B5 in the Appendix presents three additional regressions. In the first regression, we take into account the possibility that firms having reported zero recruitment costs face different conditions than firms that incur costs for the recruitment of apprentices. These 155 firms may (or may not) have recruited appren-

tices from their network of family and friends and thus did not have to actively enter the training market to attract, screen and select suitable apprentices. We address this issue by estimating a Tobit regression model with the firms with a zero value for their recruitment costs being the censored part of the estimation. The first column in Table B5 shows that our results obtained from the main regression are largely confirmed in the Tobit estimation.

In the second regression in Table B5, we use the non-monetary components of recruitment costs, i.e., the screening and selection time skilled workers and managers spend on the recruitment process, as the dependent variable. We use the cumulated time for both groups of employees for the regression in column 2.[5] The reason for this exercise is that wage differences between firms may be responsible for some of the differences in recruitment costs. Thus, the additional regression supplies information about whether the observed effect on recruitment costs is driven by wages or if the amount of time dedicated to the screening and selection is directly influenced by the respective explanatory variables.

We find that the coefficient of the demand-supply ratio is significant at the 10 per cent level in this regression, indicating that firms facing an unfavourable demand-supply ratio spend more time in the screening process of their apprentices. The coefficient of the collective bargaining coverage has been insignificant in the main regression but is significant at the 10 per cent level in our robustness regression. This

lends some support to the hypothesis that collective bargaining coverage indeed reduces the time that firms must dedicate to the screening process. With respect to the other explanatory variables, the results broadly confirm our previous findings.

We finally run quantile regressions on the determinants of recruitment costs. Figure A4 in the Appendix displays the results of this exercise in comparison to the results of the OLS regression. Each graph shows the coefficients for the 0.05 to the 0.95 quantiles, including confidence intervals for the respective explanatory variable. The horizontal dashed lines represent the coefficients of the OLS regression with their confidence intervals (dotted lines). The quantile regressions are more sensitive to outliers and helpful in case of a not perfectly normal distributed dependent variable. This is the case with our recruitment costs variable, which is skewed to the right with only a few firms with costs above 2,000 Euros (see Figure A3).

For most of the explanatory variables, the quantile estimators stay within the confidence intervals of the OLS-estimation. However, the point estimates of the 0.8 and above quantiles often diverge, but the coefficients also have rather large confidence intervals.

Summing up the results from our robustness exercises, we find support for the main results of the OLS regressions in Table 2.

7. Conclusions

In this paper, we analyse a firm's costs of recruiting apprentices. We find that a training firm's expenditures on apprentices are rather low, averaging 600 Euros (about 1 month of apprentice pay). However, recruitment costs are associated with the tightness and competition in the local training market. An excess demand for apprentices and a high local share of large training firms increase a firm's recruitment costs associated with hiring suitable apprentices. Institutional factors also influence the costs of recruitment. Firms with works councils invest more in the recruitment process of apprentices than firms without such an institution. In addition, we find that the training strategy of a firm plays a (moderate) role in determining recruitment costs for apprentices, as a firm following an investment-oriented strategy incurs approximately 12 per cent higher recruitment costs than a firm with a production-oriented training strategy. Finally, average recruitment costs first increase in the number of newly recruited apprentices but decrease at a threshold of 12 recruits. Thus, while hiring additional apprentices initially becomes increasingly costly, our findings suggest that firms hiring a large number of apprentices may exploit some economies of scale in the hiring process.

As the demographic change will lead to a decrease in the number of future school leavers in Germany, the competition for young talents between firms and educational tracks is likely to increase among firms. As a firm's participation in the appren-

ticeship training system is voluntary, our results imply that a firm may withdraw from training because the costs of finding suitable trainees become too high. From a firm's perspective, the withdrawal from training does not necessarily create a problem as long as a firm can recruit a sufficient number of skilled workers from the external labour market to satisfy its labour demand. However, the demographic change in Germany will also affect the quantity of skilled workers available on the external labour market, as the number of retirees is already higher than the number of new labour market entrants. Thus, firms will face a general scarcity of skilled labour on the intermediate qualification level, which becomes even more severe if the share of school leavers opting for an academic (tertiary) education continuous to increase. The consequence of such a change is therefore not only a shift in the supply of apprentices, but also a reduction in the average ability of apprenticeship candidates – which results in a downward shift in the firm's demand for apprentices. A lower average ability, in turn, impacts negatively on the acceptance and attractiveness of the entire vocational system. Thus, our results call for a stronger balance in the promotion of vocational and academic education, rather than a sole focus on the increase in the share of academic qualifications. Moreover, given that the firms' investments in the recruitment process for apprentices are fairly low on average (particularly compared to the investment in apprenticeship training), there might be room to invest more resources in the search process for suitable trainees. Given the current and future scarcity of skilled workers with a vocational degree in Germany,

improving a firm's recruiting behaviour to attract suitable apprentices might be a cost-efficient strategy to recruit a sufficiently large number of future skilled workers. However, future research on recruitment practices is necessary to get a better understanding of the firms' hiring behaviour – and particularly the firm-trainee match quality – in the German apprenticeship market.

Notes

[1] The authors find that worker representation in the form of works councils is associated with an almost 50 per cent increase in a firm's hiring costs.

[2] We concentrate on this survey as the surveys have no panel structure and methodical changes were made so that the data sets could not be used as a pooled sample.

[3] Including the outliers in the sample lead to the same the results except for the coefficients of the (squared) number of recruits. Excluding these outliers hence makes sense to avoid biased results.

[4] We aggregate the NACE (Rev. 1) classification to five groups consisting of manufacturing; trade; administration, education and health; services 1 (hotels and restaurants, transport and telecommunication, energy and water supply) and services 2 (banking and insurance, real estate, renting and business activities).

[5] Formally, we use the sum of h_i^m and h_i^s, as described in the section 'Calculation of recruitment costs', for the regression.

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Figures

Figure A1: Supply and demand of apprenticeships

Figure A2: Firm participation in training and retention rate

Figure A3: Kernel density of recruitment costs

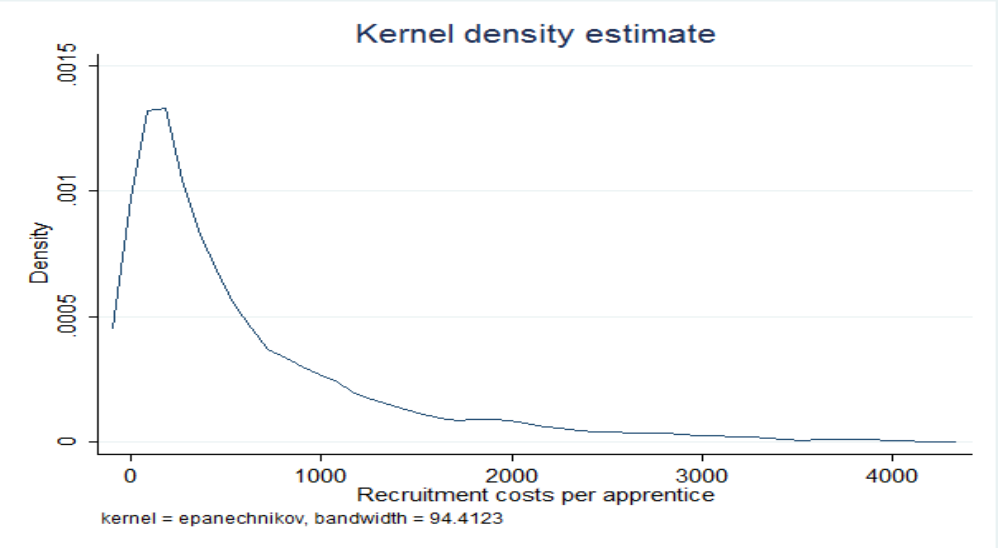
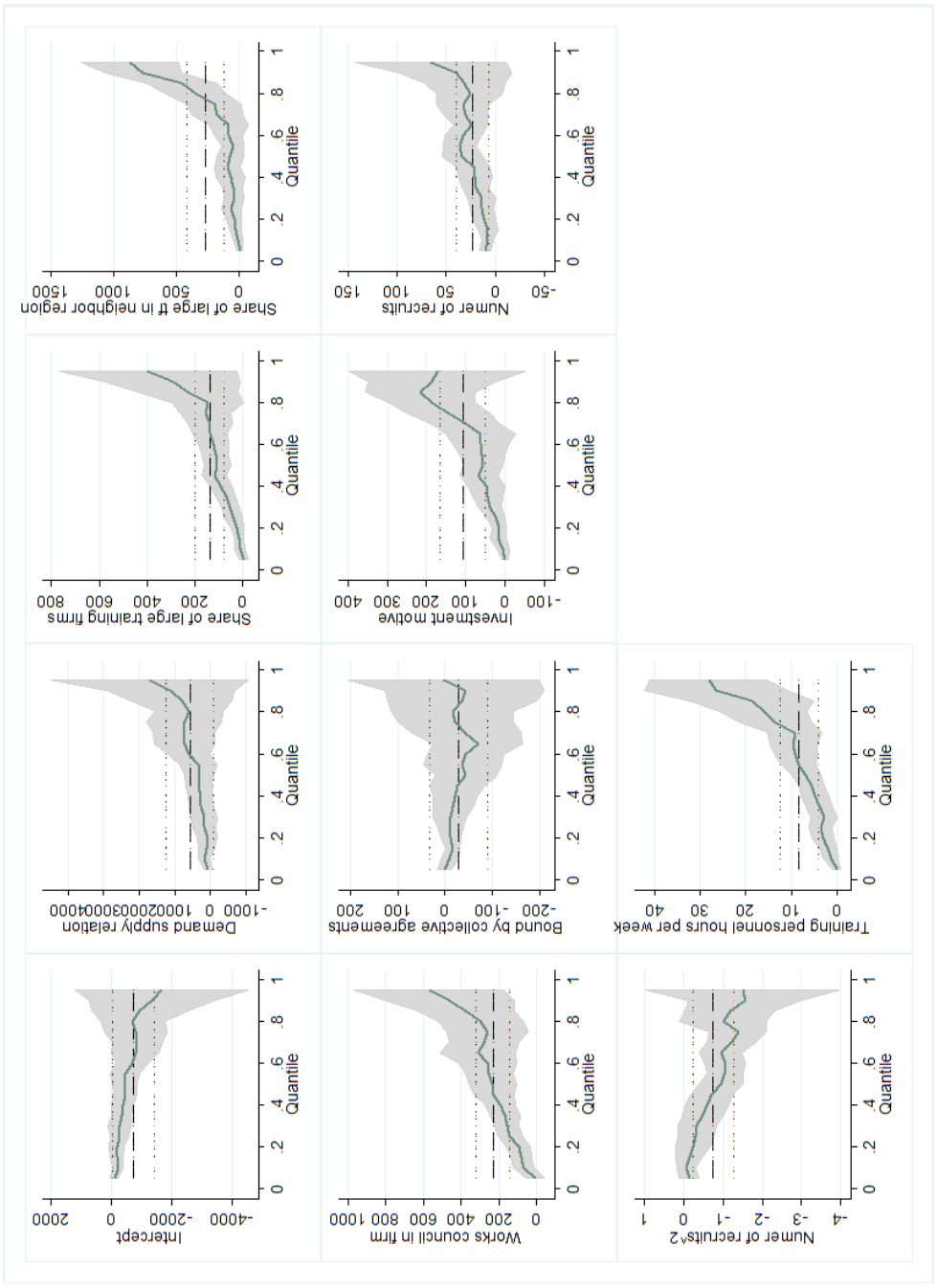


Figure A4: Quantile regressions



Tables

Table B1: Descriptive results of recruitment costs variables

	Mean	Standard deviation	Min	Max
Costs for posting vacancies	87.02	218.99	0.00	1000.00
Costs for screening and selection	512.35	616.16	0.00	4065.61
Time spent with screening process (days)	2.52	2.79	0.00	15.00
Recruitment costs per apprentice	599.37	702.88	0.00	4241.83
Observations		2778		

Table B2: Descriptive results of indicator variables

	Mean	**Standard deviation**	**Min**	**Max**
Local supply side and competition conditions (RV)				
Demand-supply ratio	1.00	0.05	0.76	1.08
Share of large training firms in region * 100	1.08	0.52	0.18	2.18
Share of large training firms in neighbour regions * 100	0.85	0.20	0.51	1.30
Institutions (IV)				
Works council	0.12	0.33	0.00	1.00
Bound to collective bargaining agreements	0.54	0.50	0.00	1.00
Firm-level variables (FV)				
Investment motive	0.46	0.50	0.00	1.00
Number of recruited apprentices	2.11	2.52	1.00	42.00
Training personnel hours per week	5.80	6.80	0.00	32.00
Observations		2778		

Table B3: Descriptive results of structural variables

Firm-size	
1-9 employees	0.55
10-49 employees	0.33
50-99 employees	0.05
100-249 employees	0.04
250-499 employees	0.02
500-999 employees	0.00
1000+ employees	0.00
Economic Sector	
Crafts	0.33
Trade	0.23
Services I	0.14
Services II	0.14
Public services, education, health	0.16
Vocational field	
Metalworking	0.08
Electrical engineering	0.10
Information technology	0.07
Chemicals	0.01
Accommodation and food	0.13
Construction	0.11
Print and media	0.02
Health	0.12
Administrative: sales and distribution	0.14
Administrative: headquarters	0.19
Administrative: banks/insurance	0.02
Hairdressing	0.01
Measurement technology	0.01
Region	
West Germany	0.83
East Germany	0.17
Observations	2778

Table B4: Average recruitment costs

	Costs for posting vacancies	Personnel Costs	Recruitment costs per apprentice
Institutional framework			
No work council	67.97	468.13	536.10
	(185.51)	(576.98)	(643.59)
Work council	222.29	826.38	1048.67
	(351.25)	(774.57)	(911.97)
No collective agreements	83.48	542.62	626.10
	(214.23)	(599.59)	(679.91)
Collective agreements	90.01	486.71	576.72
	(222.96)	(628.92)	(721.21)
Training motive			
No investment motive	64.90	460.47	525.37
	(177.71)	(569.30)	(634.01)
Investment motive	112.60	572.36	684.96
	(256.34)	(661.44)	(766.32)
Firm Size			
1-9 employees	52.88	414.06	466.94
	(155.26)	(533.55)	(588.76)
10-49 employees	93.13	567.80	660.93
	(229.73)	(642.96)	(719.26)
50-99 employees	166.86	740.15	907.01
	(302.05)	(697.69)	(833.82)
100-249 employees	261.99	861.17	1123.16
	(369.44)	(784.60)	(945.88)
250-499 employees	266.96	881.84	1148.80
	(353.45)	(835.20)	(939.08)
500-999 employees	381.84	845.48	1227.32
	(417.42)	(874.96)	(1066.22)
1000+ employees	327.71	902.47	1230.19
	(397.27)	(778.83)	(909.21)

Continued on next page

Economic Sector			
Crafts	75.32	413.89	489.21
	(203.55)	(545.54)	(638.56)
Trade	87.95	492.01	579.96
	(219.45)	(569.21)	(657.49)
Services I	77.99	524.26	602.25
	(204.94)	(645.94)	(736.14)
Services II	111.38	739.38	850.76
	(259.42)	(747.94)	(823.73)
Public services, education, health	96.20	536.15	632.36
	(221.07)	(614.35)	(694.21)
Vocational field			
Metalworking	87.93	468.35	556.28
	(234.65)	(577.72)	(709.11)
Electrical engineering	72.56	461.43	533.98
	(196.50)	(566.14)	(637.94)
Information technology	143.71	718.89	862.60
	(296.64)	(704.10)	(818.82)
Chemicals	167.54	648.46	816.00
	(314.43)	(672.14)	(787.54)
Accommodation and food	64.16	350.26	414.43
	(181.95)	(461.39)	(548.46)
Construction	45.14	336.13	381.27
	(144.70)	(463.82)	(494.22)
Print and media	150.59	596.86	747.45
	(316.95)	(629.58)	(785.64)
Health	54.42	455.45	509.87
	(145.95)	(532.59)	(587.08)
Administrative: sales and distribution	86.39	519.75	606.14
	(210.37)	(611.56)	(689.49)
Administrative: headquarters	116.40	685.71	802.11
	(257.47)	(727.41)	(820.23)
Administrative: banks/insurance	239.44	823.46	1062.90
	(333.57)	(884.50)	(945.27)
Haircutting	20.03	136.84	156.88
	(39.36)	(178.27)	(178.13)
Measurement technology	92.75	891.74	984.49
	(177.00)	(756.63)	(752.85)
Total	87.02	512.35	599.37
	(218.99)	(616.16)	(702.88)
Observations	2778	2778	2778

Standard deviation in second row. All numbers in Euro.

Table B5: Robustness regressions

	Tobit recruitment costs	Interview time per apprentice (days)	Interview time managers (days)
Local supply side variables (RV)			
Demand supply relation	1003.61***	3.50**	2.31**
	(313.76)	(1.47)	(1.04)
Share of large training firms in region	154.25***	0.56***	0.40**
	(39.83)	(0.18)	(0.15)
Share of large training firms in neighbor region	193.07**	0.65*	0.56*
	(94.72)	(0.33)	(0.32)
Institution variables (IV)			
Works council in firm	267.62***	1.01***	0.30
	(63.40)	(0.27)	(0.20)
Bound by collective agreements	-21.56	-0.27*	-0.12
	(40.70)	(0.14)	(0.11)
Firm-level variables (FV)			
Investment motive	70.32**	0.06	0.05
	(31.46)	(0.11)	(0.09)
Number of recruited apprentices	31.10**	0.13***	0.06*
	(12.99)	(0.05)	(0.04)
Number of recruited apprentices (squared)	-1.20***	-0.00***	-0.00**
	(0.42)	(0.00)	(0.00)
Training personnel hours per week	10.18***	0.04***	0.03***
	(2.57)	(0.01)	(0.01)
Firm size controls	Yes	Yes	Yes
Economic sector controls	Yes	Yes	Yes
Vocational field controls	Yes	Yes	Yes
Regional controls	Yes	Yes	Yes
Constant	-1115.56***	-2.31	-1.64
	(336.16)	(1.43)	(1.05)
Sigma	674.14***		
	(26.67)		
Observations	2778	2778	2778
Adjusted R^2		0.089	0.043

Clustered standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
The Tobit regression contains 155 left-censored observations.