

School-leaving certificates and vocational education and training – the role of firms as gatekeepers in Germany

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Abstract

Purpose – The aim of this study is to examine the characteristics of firms that influence their hiring decisions regarding the share of newly hired apprentices with Abitur and maximum lower secondary certificates.

Design/methodology/approach – The study uses 2,004 training firms of the BIBB Qualification Panel data from 2013 to 2018 to estimate fixed-effects regressions analysing the effect of firms' qualification structures and recruitment problems on the share of newly hired apprentices with Abitur (highest German secondary school-leaving certificate) and maximum lower secondary certificates (in German maximal Hauptschulabschluss).

Findings – The results indicate that firms with a higher qualification structure hire a higher share of apprentices with Abitur. However, the effect gets insignificant once controlling for the share of applicants with Abitur. Further, the study suggests that firms reduce their requirements on the school-leaving certificate of VET applicants when they suffer from unfilled training positions. Moreover, the share of applicants with Abitur and maximum lower secondary certificate has high explanatory power for the share of newly hired apprentices with these certificates.

Originality/value – The study highlights the role of firms in facilitating the transition of young people entering dual VET in Germany, whereas most studies so far have focused on the individual level. Further, the study contributes to the understanding of firms' hiring processes of apprentices beyond the question of whether a firm provides VET at all and could be used for designing labour market policy programs for youth.

Keywords Fixed-effects regressions, Recruitment for VET, Abitur, Maximum lower secondary school-leaving certificate, Firm-level, Unfilled training positions, Qualification structure

Paper type Research paper

1. Introduction

In Germany, firms are central gatekeepers for the transition of young adults from school to dual vocational education and training (VET) (Kohlrausch, 2012), which combines in-company training and additional vocational schooling. Firms' recruitment decisions structure the transitions of young adults, influencing which of them enter the dual VET system. An important signal for firms' decision which applicant to invite to a, usually standard, job interview is the school-leaving certificate. Ebbinghaus (2021) emphasises the significance of the school-leaving certificate for the transition to dual VET by demonstrating that firms set minimum requirements on the school-leaving certificate of new apprentices even though no institutional ones exist. In the last decades, two trends in the transition from school to VET in Germany have emerged: First, the number of young people starting VET with the highest

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secondary school leaving certificate (Abitur) rises (Bundesinstitut für Berufsbildung, 2022, p. 177). Second, the transition is becoming increasingly challenging for young people with a lower secondary school leaving certificate (Jacob and Solga, 2015).

So far, there has been little research investigating the role of firms in shaping these trends. Friedrich (2021) has shown that the task structure of firms correlates with the school-leaving certificates of newly hired apprentices of a firm. However, a systematic investigation of the role of (other) firm characteristics is still lacking. The aim of this study is to address this gap by investigating which firm characteristics contribute to the hiring of graduates with Abitur or lower secondary school graduates as apprentices.

A number of studies have investigated the reasons why firms train (Acemoglu and Pischke, 1998; Bellmann et al., 2014) and have examined the impact of various factors on this decision, such as supply shocks (Muehlemann et al., 2022). Another strand of literature deals with the influence of school-leaving certificates on the transition from school to VET at the individual level (Beicht and Walden, 2019; Protsch and Dieckhoff, 2011; Solga, 2002; Protsch and Solga, 2016). This study combines both strands of literature by focusing on firms' decisions regarding the school-leaving certificates when hiring new apprentices. The study examines firm characteristics associated with these hiring decisions.

A focus on the transition of young people into dual VET regarding the school-leaving certificates from a firm perspective offers some important insights into the transition process and connected inequalities. A considerable body of research has been conducted at the individual level, examining the characteristics that influence the likelihood of young people to enter dual VET (Roth, 2018; Nießen et al., 2020; Beicht and Walden, 2019; Protsch and Dieckhoff, 2011; Holtmann et al., 2021). However, research rarely focuses on the relationship between firm characteristics and the likelihood of young people starting dual VET. An exception is the vignette study of Wenzelmann et al. (2024) which investigates the probability that firms provide a training position to low-skilled school-leavers. Their results show that neither financial nor non-financial support does increase the probability of low-skilled school-leavers to be hired as apprentices.

The study contributes to the research on transitions into dual VET by illuminating the relationship between differences in access to dual VET opportunities based on school-leaving certificates and the characteristics of training firms. Using fixed-effect models with the BIBB Qualification Panel data from 2011 to 2018 (Friedrich et al., 2022), the study analyses the impact of the qualification structure of firms and recruitment problems for the recruitment of apprentices on the school-leaving certificates of newly hired apprentices.

2. Theoretical background

2.1 The link between the German education and VET system

High standardisation, high stratification, a strong school-to-work linkage and a pronounced path dependency characterise the German education system (Allmendinger, 1989; DiPrete et al., 2017). The school-leaving certificate strongly determines the further educational path of young people: the highest secondary school-leaving certificate, the Abitur, acts as a university entrance certificate and leads young people to the academic path. However, as a peculiarity of the German education system a substantial share of school-leavers with Abitur start an apprenticeship rather than going to university (e.g. Hartung and Weßling, 2024). Both the lower and the intermediate secondary school-leaving certificates do not (directly) open the academic path, but rather the vocational path. This vocational path comprises the VET system, which includes the dual training and the full-time school-based system. Dual training combines in-company training and additional vocational schooling. The access to dual training is market-based, with firms acting as gatekeepers who decide which young people they hire as future apprentices. Conversely, the access to the school-based system is not market-based, and firms play only a minor role. Given the divergent access to the school-based

system in which firms do not play a role, I do not investigate the school-based system and, henceforth, use VET to be synonymous with dual training.

Although dual training does not require a minimum school-leaving certificate, in practise the school-leaving certificate is a crucial factor in entering VET (Protsch and Dieckhoff, 2011). According to signalling theory, firms use the school-leaving certificate as signal (Spence, 1973) to anticipate the productivity of their VET applicants and to order them according to the skill they associate with the respective certificate in a labour queue (Thurow, 1975). However, one has to keep in mind that school-leaving certificates are not a perfect measure for human capital (e.g. Stratton *et al.*, 2017) or cognitive abilities. For Germany, we know that young people with lower school-leaving certificates have comparable cognitive abilities to some of those with higher school-leaving certificates (Holtmann *et al.*, 2018, p. 3). These cognitive abilities as well as non-cognitive abilities are also related to firms' hiring decisions (Protsch and Solga, 2015). Nevertheless, the school-leaving certificate is the most decisive signal that firms use for their hiring decision.

2.2 Firm characteristics and school-leaving certificates

The qualification structure of a firm should influence which school-certificates the newly hired apprentices have. Firms with higher levels of human capital are more productive (Crook *et al.*, 2011) if those employees perform also higher-qualified tasks instead of being mismatched (Mahy *et al.*, 2015). Those firms should also have higher requirements for their human capital resources and thereby the productivity of their future apprentices. For school-leavers the human capital resources are connected with the school-leaving certificate. Those who have obtained an Abitur and have spent more time in school have invested more, thereby acquiring more human capital (Becker, 1964) and can signal with their certificate a higher productivity (Spence, 1973). Consequently, school-leavers with Abitur are more likely to meet the high requirements of highly productive firms with higher levels of human capital. Hence, I assume, that firms with a high share of employees performing high-qualified tasks hire more apprentices with Abitur.

Furthermore, following the ideas of institutional discrimination, firms seek to employ apprentices who fit well into their team, with regard to factors such as age (Imdorf, 2012) or their migration background (Imdorf, 2007). The compatibility between employees in terms of their educational background might also be a consideration for firms when hiring apprentices. Employees with a university degree and apprentices with Abitur share the same school-leaving certificate and are due to that educational fit more equal than employees with a university degree and apprentices with maximum a lower or medium secondary school-leaving certificate. I argue that firms with a high share of employees with a university degree hire more apprentices with Abitur.

Especially recently, firms have encountered difficulties in recruiting young people for VET, which might have made it also more challenging for them to meet their demand for skilled labour (Leber and Schwengler, 2021). Those firms have two possibilities to meet this problem. First, they can abstain from dual training and hire skilled employees from the external labour market. However, this approach entails relinquishing the advantage of dual VET, which is to train young people for the firm-specific requirements. Furthermore, such a strategy is only feasible if there is sufficient skilled labour on the external labour market. Hinz (2019) has actually demonstrated that firms with unfilled training positions have not withdrawn from VET. Second, the firms with unfilled training positions can reduce the requirements they have for the school-leaving certificates of their future apprentices. Or put differently, they could extend their labour queue (Thurow, 1975) by including young people with a maximum lower secondary school-leaving certificate. Previous research from Protsch (2021) indicates that employers with recruitment problems do not alter their prevailing gender bias and Solga (2002) shows the known stigmatisation of lower secondary certificates. However, since the acquisition of missing skills, that might be associated with lower secondary school-leaving

qualifications due to the shorter period of schooling, could be facilitated through training, whereas the untypical sex of an individual within a firm or training occupation would remain unchanged, I assume that firms do alter their adjustment concerning the school-leaving certificate. I argue that firms are more willing to make concessions on the school-leaving certificate than on the typical gender of their apprentices. I hypothesise, that firms suffering from unfilled training positions hire more apprentices with a maximum lower secondary school-leaving certificate.

3. Empirical strategy

3.1 Method

To estimate the causal effect of firm characteristics on the hiring of new apprentices with Abitur and a maximum lower secondary school-leaving certificate, respectively, it is necessary to control for unobserved confounders (such as management quality, firms' reputation or firm culture). To do so, I estimate fixed-effects (FE) regressions (Brüderl and Ludwig, 2015) on firm-level panel data to wipe out time-constant unobservable variables.

The FE regression is based on the error components model specified as:

$$y_{it} = x_{it}\beta + \alpha_i + \varepsilon_{it} \quad (1)$$

where y_{it} denotes the outcome of a firm i at the time t . The vector X includes the observed covariates, while β denotes the corresponding estimators. α comprises the firm-specific and time-constant unobservable variables, while ε represents the idiosyncratic error that varies across firms and over time. Since α potentially correlates with the observed X vector, it biases β and must be eliminated to estimate unbiased effects.

To eliminate the variation across firms over time a within-transformation is used:

$$\bar{y}_i = \bar{x}_i\beta + \alpha_i + \bar{\varepsilon}_i \quad (2)$$

Subtracting Equation (2) from Equation (1) eliminates α and its potential bias on β , thereby obtaining the demeaned regression:

$$y_{it} - \bar{y}_i = \left(x_{it} - \bar{x}_i \right) \beta + \varepsilon_{it} - \bar{\varepsilon}_i \quad (3)$$

The resulting FE-estimator is not biased by firm-specific, unobserved heterogeneity and hence can be interpreted causally. However, it should be noted that the FE-estimator cannot estimate time-invariant firm-specific effects. In addition, I am not able to control for the selection effects of applicants and thus of the hired apprentices. Firms' effort to attract apprentices may change over time and may be related to the firms' qualification structure and recruitment problems, on the one hand, and to the application behaviour of young people, on the other. Other important aspects for applicants when choosing a firm are personal impressions, the location, working atmosphere and soundness (Hoxtell, 2019). However, location and working atmosphere should be time-invariant and hence controlled by the model. Soundness should be closely related to the business volume, which I control for. Personal impressions are difficult to capture and may also be related to my independent variables to some extent. In sum, I am not able to fully account for the selection effects of applicants and therefore my results may be biased.

3.2 Data

This study uses data from the BIBB Training Panel, which is based on a random sample and is representative of German firms with at least one employee subjected to social security contributions (Friedrich and Lukowski, 2023). The longitudinal data set covers the years

2013–2018 (Friedrich *et al.*, 2022). Although more recent data from the BIBB Training Panel is available, I have decided not to include data from later than 2019 due to the impact of the Corona Pandemic on the VET system in Germany (Bundesinstitut für Berufsbildung, 2021), which may conceal the effects I am interested in. In 2020 the amount of training contacts decreased whereas the amount of unfilled training positions increased (ibid.) particularly affected by this development were, among others, school-leavers with maximum lower secondary certificates (Neuber-Pohl *et al.*, 2021). I have also excluded the year 2018 because the business volume, which is a key control variable, is no longer measured as a metric variable thereafter.

To analyse changes in VET within a firm, it is necessary to select those firms which have hired apprentices on at least two occasions during the specified period. The final data set includes 4,390 observations from 2,004 training firms, with between 554 and 908 observations per year. These firms participated on average in 2 and up to 6 waves of the BIBB Training Panel. Table A1 in the Appendix depicts the key characteristics of the data set. Most of the included firms are located in western Germany (84%) and belong to the trade and repair sector or the business services sector (each about 20%). On average, the firms have about 55 employees and 2 apprentices.

The dependent variables are first the share of newly hired apprentices with Abitur and second the share of newly hired apprentices with maximum a lower secondary school-leaving certificate comprising those without a certificate. The share of newly hired apprentices with an intermediate certificate is not in the scope of this paper. The firms in my sample train apprentices in a total of 164 different occupations. 129 of these occupations are trained in firms which hire apprentices with Abitur and 123 in firms which hire apprentices with maximum lower secondary certificate. However, since the BIBB Training Panel asks about up to five training occupations but only about the total number of apprentices' school-leaving certificate, it is not possible to determine the share of apprentices by school-leaving certificate for each training occupation. Table 1 gives some examples of the share of newly hired apprentices with

Table 1. Examples for training occupations and average share of newly hired apprentices with Abitur or max. lower secondary certificate and average number employees with university degree, highly-qualified employees of firms which train these occupations

Occupation	Average share of newly hire apprentices with Abitur	Average share of applicants with Abitur	Average share of employees with university degree	Average share of highly-qualified employees
Chimney sweep	0.00	0.00	0.00	0.17
Event manager	0.25	0.13	0.25	0.29
Veterinary assistant	0.50	0.25	0.30	0.34
Bank clerks	0.64	0.57	0.12	0.23
Optometrist	1.00	0.27	0.00	0.17
Occupation	Average share of newly hire apprentices with max. lower certificate	Average share of applicants with max. lower certificate		
Tax clerk	0.00	0.07	0.17	0.22
Specialist salesperson–motor vehicles	0.25	0.47	0.00	0.03
Specialist for catering	0.50	0.77	0.01	0.03
Roofer	0.75	0.74	0.10	0.02
Florist	1.00	0.60	0.04	0.08

Source(s): BIBB Training Panel 2013–2018

Abitur and a maximum lower secondary certificate for firm that only train apprentices in one occupation. Overall, the results indicate that training occupations are related to both to the school-leaving certificate of the applicants and to the firm’s qualification structure. However, even in training occupations with a high share of apprentices with Abitur, such as optometrist, the share of employees with a university degree can be very low (zero), while the share of highly-qualified employees is much higher (0.17). Further, in training occupations with no apprentices with maximum lower school-leaving certificate there are corresponding applicants.

Figure 1 illustrates that the development of the share of newly hired apprentices of both degrees in the data aligns with the overall trends observed in Germany (cf. Bundesinstitut für Berufsbildung, 2022). Between 2014 and 2015, the share of young people with maximum lower secondary school-leaving certificates slightly shrinks, whereas the share of those with Abitur rises. After that, both shares have remained relatively stable.

The independent variable used to measure the qualification structure of a firm is the share of high-qualified employees relative to all employees. The BIBB-Training Panel defines high-qualified employees as those who perform tasks usually requiring a university or technical college degree or a master craftsman, technician or comparable qualifications.

I measure the share of employees with a university degree by dividing the number of employees with a university or applied university degree by the total number of employees.

Finally, to assess the recruitment problems faced by firms, I examine whether they have experienced difficulties in filling training positions. The questionnaire not only asks if the respective event happened but also the exact numbers.

Given that I estimate a FE-regression, it is not necessary to control for time-invariant variables such as branch or region. However, controlling for time-variant confounders is essential. To account for the overall economic situation of the firm, I use the business volume. Further, I use the number of employees as a control variable to account for changes in the size of the firm, while I use the share of temporary workers to control for atypical employment and related effects (Bardazzi and Duranti, 2016). Additionally, I include year dummies in the models to rule out period effects. To hire apprentices with Abitur and maximum lower secondary

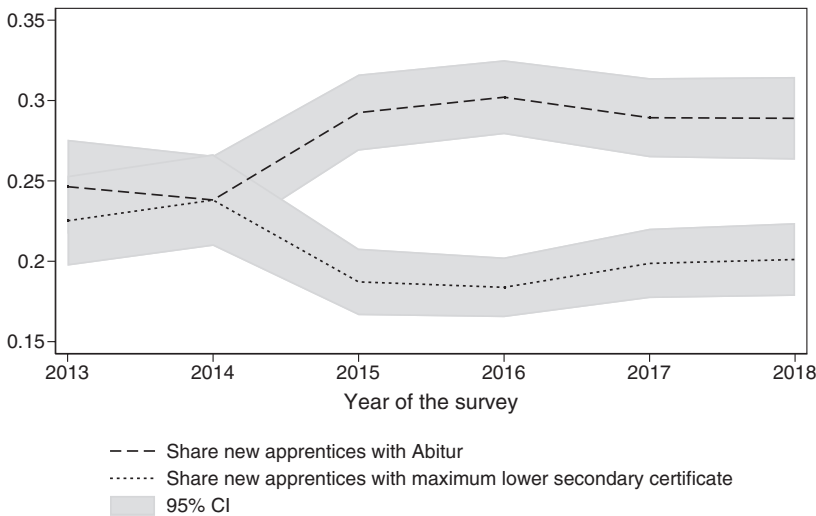


Figure 1. Share of newly hired apprentices with Abitur and maximum lower secondary school-leaving certificate over time. Source: BIBB training Panel 2013–2018, weighted results (for more information on the survey weights see Friedrich and Lukowski, 2023)

certificates, it is mandatory that young people with these certificates apply for VET in the respective firm. Consequently, I also control for the share of applicants with Abitur and maximum lower secondary certificates. The regional demand and supply in apprenticeships may also affect firms training decisions as well as the number of applications for training positions and should ideally be controlled. However, the survey data I use lacks detailed regional information which is why I am not able to account for regional changes.

FE-regressions with firms require sufficient within variation at the firm-level. Table 2 illustrates this required variation for the dependent, independent, and control variables. The within standard deviation for the share of newly hired apprentices with Abitur and for those with maximum lower secondary certificates is 0.16. This variation indicates that the share of apprentices with the respective degree differs between 2013 and 2018 within a firm by 16%. The share of high-qualified employees varies by 7% within a firm, and the number of unfilled training positions fluctuates by about 0.5%.

3.3 Analytic strategy

The shares of employee engaged in high-qualified tasks and possessing a university degree are highly and significantly correlated (0.79). Given that high-qualified tasks are defined in the BIBB Training Panel as those typically requiring a university or technical college degree or a master craftsman, technician or comparable degrees, the correlation is not unexpected. Nevertheless, both shares measure different aspects of the employment structure of a firm and are used to test different theoretical assumptions. Given the high correlation between the two variables, it is not possible to combine them in a single model. Consequently, I estimate separate models for each variable.

The models with the number of applicants as a control variable I estimate only for the years 2014–2017, as the respective questions were only asked in these years.

4. Results

4.1 Newly hired apprentices with Abitur

To explain the share of newly hired apprentices with Abitur, I argued that firms with higher levels of human capital and greater productivity hire more of them. The models M1.1 and M1.2 (cf. Table 3) encompass the share of high-qualified employees and show a significant relation between this share and the share of newly hired apprentices with Abitur. The results of model M1.1 indicate that on average a ten per cent increase in the share of high-qualified

Table 2. Mean and decomposed standard deviation into between and within components between 2013 and 2018

	Mean	Sd overall	Sd within	Sd between	N
Share of newly hired apprentices with Abitur	0.28	0.35	0.16	0.34	4,390
Share of newly hired apprentices with max. lower secondary certificate	0.20	0.31	0.16	0.30	4,390
Share highly qualified employees	0.19	0.18	0.07	0.17	4,390
Share employees' university degree	0.12	0.15	0.05	0.15	4,390
Number unfilled training positions	0.12	0.15	0.05	0.15	4,390
Business volume	400 M	9,500 M	6,700 M	6,200 M	8,536
Number employees	322.98	700.61	125.00	773.78	4,390
Share of applicants with Abitur	0.25	0.25	0.10	0.24	3,075
Share of applicants with max. lower secondary certificate	0.29	0.27	0.12	0.26	3,075

Source(s): BIBB Training Panel 2013–2018

Table 3. FE regression coefficients of M1.1 to M1.4, dependent variable newly hired apprentices with Abitur

	M1.1		M1.2		M1.3		M1.4	
Share of high qualified employees	0.109*	(0.054)	0.086	(0.057)				
Share of employees with university degree					0.173*	(0.075)	0.100	(0.088)
Number of unfilled training positions	0.001	(0.001)	−0.000	(0.002)	0.001	(0.001)	−0.000	(0.002)
Share applicants with Abitur			0.616***	(0.047)			0.617***	(0.047)
Share applicants with max. lower certificate			0.051 ⁺	(0.026)			0.050 ⁺	(0.026)
<i>Year (Ref. = 2016)</i>								
2013	−0.022	(0.020)			−0.019	(0.020)		
2014	−0.027 ⁺	(0.015)	−0.042**	(0.015)	−0.026 ⁺	(0.015)	−0.042**	(0.014)
2015	−0.005	(0.011)	−0.006	(0.011)	−0.004	(0.011)	−0.005	(0.011)
2017	−0.003	(0.011)	−0.008	(0.011)	−0.002	(0.012)	−0.007	(0.011)
2018	−0.010	(0.013)			−0.010	(0.013)		
Number of temporary employees	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)
Log. number employees	−0.004	(0.020)	0.002	(0.020)	−0.006	(0.019)	0.001	(0.020)
log. business volume	−0.001	(0.003)	−0.001	(0.003)	−0.001	(0.003)	−0.002	(0.003)
N	4,390		3,075		4,390		3,075	
R ² -within	0.004		0.179		0.004		0.178	
Note(s): P-Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Standard errors in brackets								
Independent variable: M1.1 and M1.2 Share of high qualified employees; M1.3 and M1.4 Share of employees with university degree								
Source(s): BIBB Training Panel 2011–2019, unbalanced panel								

employees rises the share of newly hired apprentices with Abitur by about one percentage points. However, when controlling for the share of applicants with Abitur and maximum lower secondary certificates (M1.2), the coefficient is not significant anymore.

The results for the educational fit between apprentices and employees are similar. The results of model M1.3 show a significant effect at the five per cent level. An increase of ten per cent in the share of employees with university degree is associated with a rise of 1.7% points in the share of newly hired apprentices with Abitur. The models including the share of applicants with Abitur and maximum lower secondary school-leaving certificate again have no significant coefficients.

Taken the results for the qualification structure and educational fit together, indicates that the share of applicants with Abitur significantly influences the share of newly hired apprentices with Abitur. An increase of 10% of applicants with Abitur rises the share of hired apprentices with Abitur by about 6% points. Given this importance of applicants, I further analyse the relevance of applicants' school-certificates. First, I estimate a bivariate regression without controls or other independent variables in order to better understand the relationship between the share of apprentices with Abitur and the share of applicants with this qualification. Second, to test whether firms hire additional apprentices when the supply of apprentices with Abitur is sufficiently high, I analyse the relationship between the number of newly hired apprentices regardless of their school-leaving certificate and the number of applicants with Abitur. Third, I estimate two additional models with an interaction term in order to analyse whether the share of applicants with Abitur moderates the effect of the qualification structure. The objective of these models is to test whether the share of applicants with Abitur strengthens or weakens the relationship between the share of newly hired apprentices with Abitur and the qualification

structure. It could be assumed that, when the share of applicants with Abitur is high, the qualification structure is less important for the decision to hire new apprentices with Abitur because firms prefer these applicants anyway. In contrast, when the share of applicants is low, the qualification structure is decisive. To illustrate the substantive significance of the results, I have predicted the margins for the share of newly hired apprentices with Abitur. These margins represent the average of the predicted values for all observations, where I use the values for the control variables as observed and not fixed to their mean values (Williams, 2012).

First, the bivariate regression confirms the importance of the share of applicants with Abitur for the share of newly hired apprentices with Abitur. Similar to models M1.2 and M1.4 an increase of 10% in the share of applicants with Abitur increases the share of hired apprentices by about 6% points (cf. Appendix table A2).

Second, I find that a higher number of applicants with Abitur is associated with a higher number of newly hired apprentices (cf. Appendix Table A3). This result is in line with the findings of Muehlemann *et al.* (2022), who found that an increase in the number of school-leavers with Abitur (due to a school reform in Germany that resulted in two cohorts graduating) has led to an increase in the number of apprenticeship contracts with young people with Abitur. Firms are likely to hire more apprentices when the supply of apprentices with Abitur is sufficiently high, which could indicate that some firms prefer apprentices with Abitur to those with other qualifications and are not willing to substitute them when the supply is too low. In addition, the results suggest that firms also provide additional training places to applicants with Abitur rather than replacing apprentices without Abitur.

Third, the interaction models reveal differences between the relationship of the share of applicants with Abitur with the qualification structure and the educational fit. The interaction term in model M1.7 (cf. Appendix Table A4) is not significant, indicating that the share of applicants with Abitur does not moderate the effect of the share of high-qualified employees. In contrast, the results of model M1.8 (cf. Appendix table A4) show a moderation: The effect of the share of applicants with Abitur decreases significantly as the share of university students increases. Figure A1 illustrates that the strength of the effect of educational fit varies according to the share of apprentices with Abitur. When the share of applicants with Abitur is low, the effect of the share of employees with a university degree is strong; whereas, when the share of applicants with Abitur is high, the effect of the share of employees with a university degree is weaker.

4.2 Newly hired apprentices with maximum lower secondary school-leaving certificate

Regarding the explanation of the share of apprentices with maximum a lower secondary school-leaving certificate that firms hire, I argued that firms experiencing recruitment problems in VET reduce their requirements for the school-leaving certificate of their future apprentices. The results of models M2.1 and M2.3 (Table 4) buttress this assumption. The models indicate that, one additional unfilled training position increases the share of newly hired apprentices with maximum lower secondary certificate by 0.04% points. The results suggest that firms adjust their hiring standards during the application process when they suffer from too few applications, even if it is not enough to ensure that all training positions are filled.

Beside the independent variables I use to test my hypotheses, the significant coefficient of the share of applicants with maximum lower secondary certificate is striking. A ten per cent rise of this share leads to an about five percentage point increase of the share of newly hired apprentices with maximum lower secondary certificate. Presumably firms tend to hire more apprentices with maximum lower secondary certificate when they can choose between more applicants with this certificate and probably could select the most motivated ones with the highest abilities. Surprisingly, also a higher share of applicants with Abitur increases the share of newly hired apprentices with maximum lower secondary certificate. This finding indicates that applicants with Abitur and those with maximum lower secondary certificate are not in competition with each other.

Table 4. FE regression coefficients of M2.1 to M2.4, dependent variable newly hired apprentices with maximum lower secondary school-leaving certificate

	M2.1		M2.2		M2.3		M2.4	
Share of high qualified employees	−0.041	(0.042)	−0.031	(0.044)				
Share of employees with university degree					−0.066	(0.045)	−0.136**	(0.051)
Number unfilled training positions	0.003 ⁺	(0.002)	0.002	(0.002)	0.003 ⁺	(0.002)	0.002	(0.002)
Share applicants with Abitur			0.102**	(0.038)			0.102**	(0.038)
Share applicants with max. lower certificate			0.490***	(0.045)			0.489***	(0.045)
Year (Ref. = 2016)								
2013	0.054**	(0.021)			0.053*	(0.021)		
2014	0.044**	(0.016)	0.057***	(0.015)	0.044**	(0.016)	0.055***	(0.015)
2015	0.007	(0.011)	0.014	(0.011)	0.007	(0.011)	0.013	(0.011)
2017	0.003	(0.011)	0.003	(0.010)	0.003	(0.011)	0.002	(0.010)
2018	0.008	(0.013)			0.007	(0.013)		
Number of temporary employees	−0.000	(0.000)	−0.000	(0.000)	−0.000	(0.000)	−0.000	(0.000)
log. number employees	−0.001	(0.017)	−0.002	(0.018)	−0.000	(0.017)	−0.000	(0.018)
log. business volume	0.001	(0.003)	0.007 ⁺	(0.004)	0.002	(0.003)	0.007 ⁺	(0.004)
N	4,390		3,075		4,390		3,075	
R ² -within	0.006		0.149		0.006		0.151	
Note(s): P-Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Standard errors in brackets								
Dependent variable: M2.1 to M2.4 number unfilled training positions								
Source(s): BIBB Training Panel 2011–2019, unbalanced panel								

4.3 Robustness analyses

To validate my findings, I have conducted additional models as a robustness check. First, I have excluded all firms belonging to the public sector to ensure that the results are not driven by the peculiarities of the public sector (cf. [Wilson, 2021](#)) but also hold for private firms (R1.1 to R1.4 and R2.1 to R2.4). Second, I have estimated regressions with a binary dependent variable to ensure that the results were not driven by a skewed distribution of the dependent variables (R1.5 to R1.8 and R2.5 to R.8). Third, I have dropped all outliers with a very high number of employees (R1.9 to R.12 and R2.9 to R2.12). Forth, I have split the sample into manufacturing and non-manufacturing firms to test whether the dependent variables have effects depending on the branch (R1.13 to R1.20 and R2.13 to R2.20). Fifth, I have estimated hybrid models to investigate whether non-significant coefficients might be due to the small within variance (R1.21 to R1.24 and R2.21 to R2.24). The hybrid models allow to estimate coefficients for both the between and within variance. However, these models require testing for the additional time-invariant control variables. Hence, I control for region and branch.

Overall, the robustness analyses provided further support for the previously identified findings regarding the share of newly hired apprentices with Abitur (cf. [Appendix Table A5 To A7](#)). However, I do not find the expected effects for the models with the dummies as dependent variables (cf. [Appendix Table A5](#)). This result suggests that the qualification structure and the educational fit are decisive for the decision on how many school-leavers with Abitur to train, but not for the decision on whether to train them at all. The results for the split sample (cf. [Appendix Table A6](#)) indicate that the qualification structure is important only for the non-manufacturing but not for the manufacturing firms. The hybrid models (cf. [Appendix Table A7](#)) show significant between-coefficients even when controlling for the share of applicants with Abitur, which could imply that the insignificant coefficients are due to the

small within variance. However, the between coefficients could be biased by unobserved heterogeneity.

In contrast, the number of unfilled training positions reacts sensitive to the robustness checks (cf. [Appendix Table A8 To A10](#)). This finding suggests that the effect is driven by the public sector and larger firms (cf. [Appendix Table A8](#)). Further, recruitment problems also appear to be decisive for the decisions on how many school-leavers with maximum lower secondary certificate to train, but not for the decision to train them. The results for the split sample (cf. [Appendix Table A9](#)) illustrate that the number of unfilled training positions is decisive only for non-manufacturing firms. The hybrid models (cf. [Appendix Table A10](#)) show that the within and between resemble each other.

5. Conclusion and discussion

The recruitment decisions of firms concerning the hiring of new apprentices play a pivotal role in determining the transition of young people into dual VET in Germany. The aim of this study was to investigate the characteristics of firms that influence firms' decisions regarding the school-leaving certificate of the applicants they hire as apprentices. I have used the BIBB Training Panel to estimate fixed-effects regressions to analyse if firms' qualification structure and recruitment problems influence the share of newly hired apprentices with Abitur and maximum lower secondary school-leaving certificates, respectively.

The results showed that firms with higher levels of human capital tend to hire more newly hired apprentices with Abitur, as they may fit better in the firm's workforce. However, the coefficients are not significant anymore once I control for the share of applicants with Abitur. However, the hybrid models, estimated as a robustness check, reveal significant between coefficients when controlling for the share of applicants with Abitur, hence buttressing the relevance of the qualification structure.

Firms encountering difficulties in recruiting apprentices tend to lower their requirements for the school-leaving certificate of apprentices, as evidenced by significant increase in the share of newly hired apprentices with maximum lower secondary certificates. The results indicate that firms make concessions on the school-leaving certificate to expand their labour queue rather than completely withdrawing from dual training. However, the robustness checks suggest that difficulties in recruiting apprentices are mostly decisive for the public sector, larger firms and non-manufacturing firms.

High explanatory power for the share of newly hired apprentices with Abitur and maximum lower secondary certificate has the share of applicants with these certificates. First, firms seem to prefer apprentice with Abitur if enough apply irrespective of the threat that they could leave the firm after training. Second, the results for maximum lower secondary certificates indicate that if firms can choose the most motivated applicants or those with the highest abilities among a larger selection they also hire apprentices with maximum lower secondary certificates.

Although the data permits causal analyses, my study also has some limitations. The within firm variance of the dependent variables is rather small, which could explain the insignificant results. Moreover, previous research has demonstrated that firms anticipating recruitment problems in their region rate applicants differently ([Protsch, 2021](#)). As, mentioned before, the data lacks detailed regional information. Hence, I am not able to account for changes in the regional demand and supply in apprenticeships. The significant coefficients of the year dummies may be connected with those changes. Further research could commence at this juncture and address the regional disparities in firms' decisions regarding the training of their employees. Further, I have no information on the supply of apprentices with different school-leaving certificates. This lack of control could lead to an endogeneity problem, as the supply of high school graduates in particular could be linked to an increase in the number of newly hired apprentices ([Muehlemann et al., 2022](#)).

The objective of the study was to estimate causal effects, which requires time-variant characteristics. However, time-invariant characteristics may also be decisive in determining

whether to hire apprentices with Abitur or maximum lower secondary school-leaving certificate but are not the scope of my analyses. Future research could investigate, for example, differences between branches and especially occupations. The cognitive requirements of training occupations in the German VET system are distinct and correlate with the typical school-leaving certificate of apprentices learning these occupations (Friedrich *et al.*, 2023). Linking these occupational requirements with firm-specific requirements could be a promising research approach to further investigate who firms train.

The study contributes to the understanding of firms' hiring process of apprentices according to their school-leaving certificate. This understanding is essential to ensure that the VET system functions effectively in providing young people with a pathway to stable employment. Against the background of the continuing increase in the number of school leavers with Abitur, the study indicates that these graduates are particularly valuable to firms with a high qualification structure and could be integrated into the VET system, to some extent even without displacing apprentices without Abitur. Moreover, in the context of Germany's ongoing shortage of skilled labour, it is crucial to know that firms are willing to make concessions on the school-leaving certificate rather than withdraw from dual training. Policymakers should support these firms in their efforts, as integrating also school-leavers without or lower secondary certificate in the labour market is an important ongoing task for the VET system.

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Further reading

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Table A1. Key characteristic of the dataset

	<i>N</i>	Per cent		
<i>Location</i>				
West	1,689	84.30		
East	315	15.70		
<i>Branch</i>				
Agriculture/mining and energy	47	2.35		
Manufacturing	305	15.23		
Construction	365	18.19		
Trade and repair	410	20.47		
Business services	403	20.11		
Personal services	280	13.98		
Medical services	168	8.39		
Public services and education	26	1.28		
	Mean	Sd	Min	Max
Number apprentices	21.01	52.55	1	1,500
Number newly hired apprentices	2.21	5.50	1	650
Number newly hired apprentices with Abitur	0.54	1.83	0	80
Number newly hired apprentices with max. lower secondary certificate	0.55	2.07	0	250
Share of high qualified employees	0.19	0.19	0	1
Share of employees with university degree	0.10	0.16	0	1
Number unfilled training positions	0.21	1.14	0	78
Share applicants with Abitur	0.19	0.27	0	1
Number applicants with Abitur	6.4	39.14	0	1,500
Number applicants with max. lower certificate	7.53	120.50	0	9,010
Number of temporary employees	4.00	25.05	0	5,390
Amount employees	53.49	222.77	1	14,130
Business volume	554 M	10700 M	0.000001 M	500,000 M
Source(s): BIBB Training Panel 2013–2018, weighted values				

Source(s): BIBB Training Panel 2013–2018, weighted values

Table A2. Bivariate regression coefficients of M1.5, dependent variable newly hired apprentices with Abitur

	M1.5	
Share of applicants with Abitur	0.594***	(0.045)
N	3,075	
R ² -within	0.170	

Note(s): P-Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Standard errors in brackets

Independent variable: Share of applicants with Abitur

Source(s): BIBB Training Panel 2011–2019, unbalanced panel

Table A3. Regression coefficients of M1.6, dependent variable number of newly hired apprentices

	M1.6	
Number of applicants with Abitur	0.067*	(0.0374)
<i>Year</i> (Ref. = 2016)		
2014	0.298	(0.662)
2015	−0.900	(1.020)
2017	−0.772	(0.485)
Number of temporary employees	0.187	(0.182)
log. number employees	10.226	(7.165)
log. business volume	0.260	(0.241)
<i>N</i>	3,078	
<i>R</i> ² -within	0.262	
Note(s): <i>P</i> -Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Standard errors in brackets		
Independent variable: Share of applicants with Abitur		
Source(s): BIBB Training Panel 2011–2019, unbalanced panel		

Table A4. Regression coefficients of M1.7 and M1.8, dependent variable newly hired apprentices with Abitur

	M1.7		M1.8	
Share of applicants with Abitur	0.630***	(0.057)	0.661***	(0.055)
Share of high qualified employees	0.145*	(0.085)		
Share of employees with university degree			−267**	(0.126)
Share of applicants with Abitur X share of high qualified employees	−0.180	(0.204)		
Share of applicants with Abitur X share of employees with university degree			−0.486*	(0.273)
<i>Year</i> (Ref. = 2016)				
2014	−0.043***	(0.014)	−0.042***	(0.014)
2015	−0.006	(0.011)	−0.004	(0.011)
2017	−0.007	(0.011)	−0.006	(0.011)
Number of temporary employees	0.000	(0.000)	0.000	(0.000)
log. number employees	0.002	(0.020)	0.001	(0.021)
log. business volume	−0.001	(0.003)	−0.002	(0.003)
<i>N</i>	3,075			
<i>R</i> ² -within	0.0.198		0.181	
Note(s): <i>P</i> -Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Standard errors in brackets				
Independent variable: Share of applicants with Abitur				
Source(s): BIBB Training Panel 2011–2019, unbalanced panel				

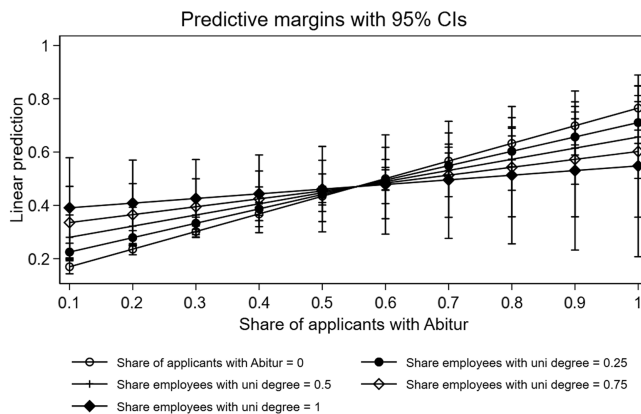


Figure A1. Share of newly hired apprentices with Abitur by share of applicants with Abitur and share of employees with university degree. Source: BIBB Training Panel 2013–2018; estimations are based on M1.8

Table A5. Regression coefficients of R1.1 to R1.12, dependent variable newly hired apprentices with Abitur

	Public sector excluded				Dependent variable as dummy				Without outliers in firm size			
	R1.1	R1.2	R1.3	R1.4	R1.5	R1.6	R1.7	R1.8	R1.9	R1.10	R1.11	R1.12
Share of high qualified employees	0.111*	0.086			0.087	0.042			0.111 ⁺	0.090		
Share of employees with university degree			0.173*	0.091			0.146	0.120			0.190*	0.094
Number unfilled training positions	0.001	0.000	0.001	0.000	0.001	0.002	0.001	0.002	0.002	−0.001	0.002	−0.000
Share of applicants with Abitur		0.617***		0.619***		0.724***		0.723***		0.622***		0.623***
Share of applicants with lower certificate		0.051 ⁺		0.050 ⁺		0.063		0.063		0.055*		0.055*
<i>Year (Ref. = 2016)</i>												
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	−0.024		−0.021		−0.037		−0.034		−0.025		−0.022	
2015	−0.027 ⁺	−0.041**	−0.026 ⁺	−0.041**	−0.038	−0.059*	−0.038	−0.058*	−0.029 ⁺	−0.042**	−0.028 ⁺	−0.042**
2017	−0.005	−0.006	−0.004	−0.006	0.003	0.006	0.004	0.007	−0.006	−0.005	−0.004	−0.004
2018	−0.002	−0.008	−0.001	−0.007	0.011	0.008	0.012	0.008	−0.001	−0.004	0.000	−0.004
Number of temporary employees	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	−0.000	0.000	−0.000	0.000
Log. number employees	−0.005	0.002	−0.006	0.002	0.058	0.052	0.057	0.051	−0.004	0.003	−0.005	0.003
Log. business volume	−0.001	−0.001	−0.001	−0.002	−0.004	−0.003	−0.004	−0.003	0.000	−0.002	−0.000	−0.002
N	4,309	3,029	4,309	3,029	4,390	3,075	4,390	3,075	4,170	2,922	4,170	2,922
R ² -within	0.004	0.179	0.004	0.178	0.005	0.099	0.005	0.099	0.004	0.177	0.005	0.176

Note(s): P-Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Independent variable: R1.1 and R1.2, R1.5 and R1.6, R1.9 and R1.10 Share of high qualified employees; R1.3 and R1.4, R1.7 and R1.8, R1.11 and R1.12 Share of employees with university degree

Source(s): BIBB Training Panel 2013–2018

Table A6. Regression coefficients of R1.13 to R1.20, dependent variable newly hired apprentices with Abitur

	Manufacturing				Non-manufacturing			
	R1.13	R1.14	R1.15	R1.16	R1.17	R1.18	R1.19	R1.20
Share of high qualified employees	−0.033	−0.072			0.191**	0.169*		
Share of employees with university degree			0.025	−0.004			0.254*	0.163
Number unfilled training positions	0.003	0.002	0.003	0.002	0.002	−0.000	0.002	−0.001
Share of applicants with Abitur		0.650***		0.649***		0.572***		0.577***
Share of applicants with lower certificate		0.061		0.061		0.043		0.042
<i>Year (Ref. = 2016)</i>								
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	−0.050 ⁺		−0.050 ⁺		0.003		0.008	
2015	−0.058**	−0.058**	−0.057**	−0.057**	−0.002	−0.025	0.001	−0.024
2017	−0.016	−0.006	−0.015	−0.006	0.003	−0.006	0.007	−0.003
2018	0.005	−0.001	0.005	−0.001	−0.008	−0.010	−0.005	−0.008
<i>Year (Ref. = 2016)</i>	0.001		0.001		−0.022		−0.020	
Number of temporary employees	0.000	0.000	0.000	0.000	−0.000	0.000	−0.000	0.000
Log. number employees								
Log. business volume	−0.007 ⁺	−0.006 ⁺	−0.007 ⁺	−0.005	0.003	0.003	0.003	0.003
Number of temporary employees	0.043	−0.026	0.043	−0.024	−0.019	0.008	−0.017	0.011
<i>N</i>	1,767	1,279	1,767	1,279	2,623	1,796	2,623	1,796
<i>R</i> ² -within	0.013	0.227	0.013	0.226	0.009	0.150	0.008	0.147

Note(s): *P*-Values: + *p* < 0.10; **p* < 0.05; ***p* < 0.01; ****p* < 0.001

Independent variable: R1.13 and R1.14, R1.17 and R1.18 Share of high qualified employees; R1.15 and R1.16, R1.19 and R1.20 Share of employees with university degree

Source(s): BIBB Training Panel 2013–2018

Table A7. Regression coefficients of R1.21 to R1.24, dependent variable newly hired apprentices with Abitur

	Hybrid models			
	R1.21	R1.22	R1.23	R1.24
Within: share of high qualified employees	0.111*	0.088		
Between: share of high qualified employees	0.324***	0.128***		
Within: share of employees university degree			0.172*	0.102
Between: share of employees university degree			0.465***	0.161***
Within: number unfilled training positions	0.001	−0.000	0.001	−0.000
Between: number unfilled training positions	−0.012***	−0.003 ⁺	−0.011***	−0.003
Within: share applicants Abitur		0.616***		0.617***
Between: share applicants Abitur		1.032***		1.026***
Between: within: share applicants lower certificate		0.052*		0.052*
Between: share applicants lower certificate		0.006		0.006
<i>Year (Ref. = 2016)</i>				
2013	−0.023	0.000	−0.018	0.000
2014	−0.038**	−0.037**	−0.035**	−0.036**
2015	−0.012	−0.005	−0.010	−0.004

(continued)

Table A7. Continued

	Hybrid models			
	R1.21	R1.22	R1.23	R1.24
2017	−0.007	−0.013	−0.006	−0.012
2018	−0.011	0.000	−0.010	0.000
Within: number of temporary employees	0.000	0.000	0.000	0.000
Between: number of temporary employees	0.000	−0.000	−0.000	−0.000
Within: number employees	−0.004	0.005	−0.005	0.004
Between: number employees	−0.012	−0.007	−0.014	−0.007
Within: business volume	−0.001	−0.001	−0.002	−0.001
Between: business volume	0.034***	0.003	0.032***	0.002
<i>Region (Ref. = West Germany)</i>				
East Germany	−0.049**	−0.002	−0.056***	−0.005
<i>Branch (Ref. = manufacturing)</i>				
Agriculture/mining and energy	−0.021	0.000	−0.026	−0.000
Construction	−0.102***	0.001	−0.091***	0.004
Trade and repair	0.016	0.017	0.014	0.014
Business services	0.298***	0.077***	0.279***	0.073***
Personal services	0.121***	0.056***	0.106***	0.051**
Medical services	0.004	0.056 ⁺	−0.018	0.048 ⁺
Public services and education	0.035	−0.040	0.013	−0.041
N	4,390	3,075	4,390	3,075

Note(s): P-Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Independent variable: R1.21 and R1.22 Share of high qualified employees; R1.23 and R1.24 Share of employees with university degree

Source(s): BIBB Training Panel 2013–2018

Table A8. Regression coefficients of R2.1 to R2.16, dependent variable newly hired apprentices with lower secondary school-leaving certificate

	Public sector excluded				Dependent variable as dummy				Without outliers in firm size			
	R2.1	R2.2	R2.3	R2.4	R2.5	R2.6	R2.7	R2.8	R2.9	R2.10	R2.11	R2.12
Share of high qualified employees	−0.052	−0.030			−0.004	−0.032			−0.043	−0.035		
Share of employees with university degree			−0.063	−0.132*			−0.105	−0.205 ⁺			−0.061	−0.123*
Number unfilled training positions	0.003	0.003	0.003	0.003	0.003	0.006	0.003	0.006	0.001	0.001	0.001	0.001
Shar of applicants with Abitur		0.100**		0.101**		0.122*		0.123*		0.107**		0.107**
Shar of applicants with lower certificate		0.492***		0.492***		0.514***		0.513***		0.498***		0.498***
<i>Year (Ref. = 2016)</i>												
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	0.056**		0.055**		0.102**		0.099**		0.056*		0.055*	
2015	0.043**	0.055***	0.043**	0.054***	0.064*	0.081**	0.063*	0.079**	0.045**	0.057***	0.045**	0.056***
2017	0.007	0.014	0.007	0.013	0.000	0.012	−0.001	0.010	0.007	0.014	0.007	0.013
2018	0.003	0.003	0.003	0.003	−0.008	−0.007	−0.009	−0.008	0.003	0.004	0.003	0.003
Number of temporary employees	−0.000	−0.000	−0.000	−0.000	0.000	0.000	0.000	−0.000	−0.000	−0.000	−0.000	−0.000
Log. number employees	0.000	−0.002	0.001	−0.001	0.063 ⁺	0.035	0.063 ⁺	0.037	−0.007	−0.008	−0.006	−0.007
Log. business volume	0.001	0.006 ⁺	0.002	0.007 ⁺	0.003	0.011 ⁺	0.004	0.012*	0.001	0.006	0.001	0.007
<i>N</i>	4,309	3,029	4,309	3,029	4,390	3,075	4,390	3,075	4,170	2,922	4,170	2,922
<i>R</i> ² -within	0.006	0.150	0.006	0.151	0.009	0.068	0.009	0.070	0.006	0.152	0.006	0.153

Note(s): *P*-Values: + *p* < 0.10; **p* < 0.05; ***p* < 0.01; ****p* < 0.001
Independent variable: R2.1 to M2.12 number unfilled training positions
Source(s): BIBB Training Panel 2013–2018

Table A9. Regression coefficients of R2.1 to R2.16, dependent variable newly hired apprentices with lower secondary school-leaving certificate

	Manufacturing		R2.15	R2.16	Non-manufacturing			
	R2.13	R2.14			R2.17	R2.18	R2.19	R2.20
Share of high qualified employees	-0.128 ⁺	-0.094			0.020	0.004		
Share of employees with university degree			-0.148 ⁺	-0.250 ^{**}			-0.013	-0.066
Number unfilled training positions	0.000	-0.004	0.000	-0.004	0.004 ⁺	0.002	0.004 ⁺	0.002
Share of applicants with Abitur		0.004		0.005		0.176 ^{***}		0.176 ^{***}
Share of applicants with lower certificate		0.339 ^{***}		0.339 ^{***}		0.584 ^{***}		0.583 ^{***}
<i>Year (Ref. = 2016)</i>								
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	0.036		0.034		0.076 ^{**}		0.075 ^{**}	
2015	0.017	0.036	0.019	0.038	0.066 ^{**}	0.066 ^{**}	0.065 ^{**}	0.064 ^{**}
2017	0.003	0.010	0.003	0.009	0.009	0.016	0.009	0.015
2018	-0.015	-0.010	-0.015	-0.011	0.017	0.013	0.017	0.013
<i>Year (Ref. = 2016)</i>	-0.003		-0.004		0.018		0.018	
Number of temporary employees	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000
Log. number employees								
Log. business volume	0.003	0.007 [*]	0.004	0.009 ^{**}	0.000	0.007	0.000	0.007
Number of temporary employees	-0.008	-0.038	0.001	-0.023	0.002	0.009	0.002	0.009
Share of high qualified employees	0.218	0.181	0.143	0.089	0.156	-0.200	0.161	-0.190
N	1,767	1,279	1,767	1,279	2,623	1,796	2,623	1,796
R ² -within	0.007	0.084	0.006	0.089	0.010	0.207	0.010	0.208

Note(s): P-Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Independent variable: R2.13 to M2.20 number unfilled training positions

Source(s): BIBB Training Panel 2013–2018

Table A10. Regression coefficients of R2.1 to R2.16, dependent variable newly hired apprentices with lower secondary school-leaving certificate

	Hybrid models			
	R2.21	R2.22	R2.23	R2.24
Within: share of high qualified employees	−0.046	−0.035		
Between: share of high qualified employees	−0.227***	−0.042		
Within: share of employees university degree			−0.073 ⁺	−0.139**
Between: share of employees university degree			−0.266***	−0.048
Within: number unfilled training positions	0.004 ⁺	0.002	0.004 ⁺	0.002
Between: number unfilled training positions	0.009*	0.000	0.009*	0.000
Within: share applicants Abitur		0.101**		0.102**
Between: share applicants Abitur		0.068***		0.069***
Between: within: share applicants lower certificate		0.488***		0.487***
Between: share applicants lower certificate		0.790***		0.790***
<i>Year (Ref. = 2016)</i>				
2013	0.033*	0.000	0.030*	0.000
2014	0.045***	0.049***	0.044**	0.048***
2015	0.008	0.012	0.006	0.011
2017	0.008	0.012	0.008	0.011
2018	0.013	0.000	0.012	0.000
Within: number of temporary employees	−0.000	−0.000	−0.000	−0.000
Between: number of temporary employees	0.000	0.000 ⁺	0.000	0.000 ⁺
Within: number employees	−0.003	−0.004	−0.002	−0.003
Between: number employees	0.007	0.004	0.008	0.005
Within: business volume	0.001	0.006	0.001	0.006 ⁺
Between: business volume	−0.026***	−0.006	−0.026***	−0.006
<i>Region (Ref. = West Germany)</i>	−0.103***	−0.043***	−0.100***	−0.042***
East Germany	−0.009	−0.041*	−0.007	−0.041*
<i>Branch (Ref. = manufacturing)</i>				
Agriculture/mining and energy	0.183***	0.058*	0.178***	0.056*
Construction	0.007	−0.011	0.011	−0.009
Trade and repair	−0.110***	−0.018	−0.102***	−0.017
Business services	−0.031	−0.015	−0.021	−0.013
Personal services	−0.077*	0.027	−0.064*	0.030
Medical services	0.039	−0.006	0.042	−0.007
<i>N</i>	4,390	3,075	4,390	3,075

Note(s): *P*-Values: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Independent variable: R2.21 to M2.24 number unfilled training positions

Source(s): BIBB Training Panel 2013–2018

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