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Double qualifications, earnings and gender in Germany

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Abstract. After obtaining the German upper secondary school-leaving certificate (Abitur), school-leavers are free in their choice of career path. Obtaining a double qualification by first completing an apprenticeship and then graduate from university is thereby popular. Using the BIBB/BAuA Employment Survey of the Working Population on Qualification and Working Conditions 2018, this paper analyses the individual effects of these double qualifications by exploiting the rich information on education in the data. In relation to earlier studies, we find that the proportion of men gaining a double qualification decreased by 8 percentage points but is almost constant for women. Furthermore, we detect a significantly negative effect of double qualification on wages for women, but no significant effect on wages for men. We presume that these changes may be related to the rising inequality due to the rising number of academics and the increase of earnings inequality.

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1. Introduction

In the last decade both the absolute and relative number of individuals who pass the Abitur increased. As these individuals can enter universities or polytechnics (Fachhochschule), dual apprenticeship training may be expected to become less attractive. Nevertheless, 20 % of these school-leavers decide against studying in favour of apprenticeship training (Autorengruppe Bildungsberichterstattung, 2020). Furthermore, a rising number of apprenticeship graduates hold an entrance qualification for universities or university of applied sciences. Thus, they want to pursue a double qualification and receive both a vocational qualification as well as an academic degree.

The number of individuals who pass the Abitur and start their career with an apprenticeship training considerably increased after the double high school graduation finished in the year 2014. Dohmen et al. (2021) find that the relation of school-leavers with Abitur who start an apprenticeship training to the total number of school-leavers with Abitur was 21 % in the year 2002, reached 31 % in 2014 and increased to 35 % in 2019. Although we do not know the exact number of university graduates who also completed an apprenticeship training, this rising number suggests that individuals with a double qualification expect a higher wage or job satisfaction compared to those without such a double qualification.

This paper contributes to the literature on earnings determination in three ways: First, we conduct a new study on the impact of double qualifications on individual earnings using the BIBB/BAuA Employment Survey of the Working Population on Qualification and Working Conditions in Germany 2018. We compare our results with those obtained from previous studies, which rely on data from the time before the rise of double qualifications. Second, these studies are based on data that refers to the early 1990s and the beginning of the twentieth century, when wage polarization had just begun. Technological progress and competition from low-wage countries contributed to an increase of earnings inequality (Dustmann et al., 2009 for Germany; Spitz-Oener, 2006; Goos et al., 2014 for European Countries). Since 2010, the inequality has not increased further (Baumgarten et al., 2020; Möller, 2016; Fitzenberger & Seidlitz, 2020). Card et al. (2013) and Möller (2016) show that a rise in the dispersion of firm pay premiums as well as large changes in the composition of employees contributed substantially to the recent changes in wage inequality in Germany. Brüll & Gathmann (2020) demonstrate the relevance of the increased supply of highly qualified employees for the development of the wage dispersion in Eastern Germany. Third, the comparison of our results with those from previous studies is interesting, because during the last two decades, the proportion of employees working part-time has increased from 5.2 % in the year 2001 to 11.5 % in the year 2019 for men and from 39.6 % in the year 2001 to 48.4 % in the year 2019 for women (IAQ, 2020). Working part-time and switching between part- and full-time employment decreases the earnings received compared to men and women working full-time without intervening part time employment spells (Fitzenberger & Seidlitz, 2020). Thus, the inclusion of part-time employees into our analyses seems to be important.

The outline of the paper is as follows: In section 2, we summarise the findings of theoretical background and previous studies. In section 3, the data set and the descriptive results are presented. We outline our empirical strategy, model specification and report our econometric results in section 4. Section 5 provides some concluding remarks.

2. Theoretical background and previous research

Traditional human capital theory regards double qualifications as useful if the direct costs of an additional educational path are covered by extra returns. Following Buttler & Tessaring (1993) education cannot be regarded as a requirement for certain occupations any longer; instead, nowadays education increases the individual's overall occupational options. In the case of double qualifications, individuals can "upgrade" their skills obtained during apprenticeship training by entering a university or a university of applied sciences. The crucial question is whether the strategy of double qualifications and thus to increase the number of "arrows in the quiver" improves or worsens the individual's earnings position. In their pioneering study, Büchel & Helberger (1995) find no positive effect of double qualifications on wages at the beginning of the career. Bellmann et al. (1996), Büchel & Bausch (1998) and Bellmann & Stephani (2012) do not restrict their analysis to the start of the working life but still do not find positive income effects for individuals with double qualifications. Nevertheless, the effects are also not significantly negative.

Individuals who complete a double qualification will not get the full returns of their educational path, as there is technical and economic obsolescence of

human capital. In the wake of rising wage dispersion in Germany in conjunction with the higher absolute and relative number of academics, it is important to take this obsolescence into account (Van Loo et al., 2001). In the context of double qualifications, the depreciations of human capital are even more prevalent than in the case of university studies as it takes years to hold a training qualification as well as a university or polytechnic degree.

Janßen & Backes-Gellner (2009) distinguish between knowledge-based and experience-based tasks. They argue that the human capital of individuals performing knowledge-based tasks strongly suffers from depreciation, whereas the human capital of individuals performing experience-based tasks does not. Human capital related to older technologies and work processes depreciates. Therefore, individuals who only focus on high technological skills throughout the career will be outperformed by younger colleagues at later stages of his working life.

Besides, risk considerations could play a role when it comes to double qualifications. Albeit their relevance it was not until the beginning of this century that risk considerations were introduced into the economics of education (Christiansen et al., 2007; Palacios-Huerta, 2003). As future earnings cannot be predicted precisely during education, the question arises how future earnings and the wage risk are correlated and whether there is an efficient trade-off between them (Christiansen et al., 2007; Tuor & Backes-Gellner, 2010). Individuals, who pursue a double qualification, are risk averse (Behrens et al., 2008; Büchel & Helberger, 1995). Double qualifications can be seen as a strategy to diversify human capital investments and should thus result in a lower wage risk (Edeling & Pilz, 2017; Hammen, 2011; Hillmert & Jacob, 2013). This could be especially relevant for women who are in general believed to be more risk averse than men (Croson & Gneezy, 2009). However, results obtained by Tuor & Backes-Gellner (2010), Hammen (2011) and Bellmann & Stephani (2012) on systematic differences in the wage risk of individuals with and without double qualifications are mixed.

3. Data set and descriptive results

To investigate the effect of double qualifications on earnings we use the BIBB/BAuA Employment Survey 2018 (Hall et al., 2020). This rich data set provides a representative sample of 20,012 individuals from the German active labour force. The survey is restricted to individuals who work at least 10 hours per week and are at least 15 years old. The questionnaire was developed by the Federal Institute for Vocational Education and Training (Bundesinstitut für Berufsbildung, BIBB) and the Federal Institute for Occupational Safety and Health (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, BAuA). Further information about the data set and the methodology can be found in Rohrbach-Schmidt & Hall (2020). One caveat of the data set is that it is a cross section and thus, results cannot be interpreted causally. Still, as the survey contains rich information on employees' characteristics and their "educational biography", it is well suited for our analysis.

We only look at individuals who have passed the Abitur or the Fachabitur (German certificate of aptitude for specialized higher education, e.g. at a polytechnic) and have gained their school-leaving certificate in Germany. Additionally, these individuals – after having passed their Abitur or Fachabitur examinations – either went straight to university or completed a course of vocational training in the dual system first and studied afterwards. Therefore, they all hold a university or a polytechnic degree. We exclude school-based vocational training from the analysis due to its limited comparability. Furthermore, other possible educational paths – apart from those already mentioned – are not included in the analysis. Reason for that is the large number of possible combinations of school, vocational training and studies at universities (of applied sciences) in Germany from which individuals can choose, some of which are difficult to compare. For the sake of simplicity and in order to focus on the hypothesis put forward by Büchel & Helberger (1995), we therefore limit our analysis to an estimation sample of 3,909 individuals. Table A1 in the appendix gives descriptive information. Of course, we cannot rule out the possibility that individuals make educational decisions at different points in time. That means, that it is not necessary for individuals to intend to go to university afterwards when they start vocational training.

Table 1 shows that 21.16 % of all university and polytechnic graduates have a double qualification. Double qualifications are more frequent for men than for women (see Table 1). Compared with the results of Bellmann & Stephani (2012) the proportion of male graduates having a double qualification decreased substantially from 32 % in 2006 to 24.32 % in 2018, whereas there are smaller changes concerning women (21 % in 2006 vs. 17.93 % in 2018). Table 1 also shows that there are no regional differences between Western and Eastern Germany. Again, when compared with the results of Bellmann & Stephani (2012), there is a decline in the percent-

Table 1. Double qualifications of university and polytechnic graduates, by gender and region

	With double qualification	Without double qualification
Total (N=3,909)	21,16 %	78,84 %
Women (N=1,935)	17.93 %	82.07 %
Men (N=1,974)	24.32 %	75.68 %
Western Germany (N=3,436)	21.10 %	78.90 %
Eastern Germany (N=473)	21.56 %	78.44 %

Source: The data set used is the BIBB/BAuA employment survey 2018.

age of graduates having a double qualification in both Western and – more pronounced – Eastern Germany. We cannot corroborate the regional differences found by Bellmann & Stephani (2012).

Figure 1 presents the Kernel densities of the hourly wage distributions for men and women separately (note that the wage distributions refer to the wage at the time of the survey and not on the first wages after graduation). It can be seen that the wage distribution of women without double qualification is slightly shifted to the right compared to the wage distribution of women with double qualification. For men there is no such rightward shift of the distribution of those without a double qualification. Contrarily, in the third quarter of the distribution there is a rightward shift of the distribution for men with a double qualification, meaning that those earn more than men without a double qualification.

4. Econometric results and discussion

We estimate an augmented Mincer-type earnings function with log earnings as the dependent variable (Mincer, 1974; Cahuc et al., 2014: 215-229 for a critical discussion): Based on a life-cycle model of Human Capital accumulation it is suggested that it is optimal to begin with full-time schooling, then gradually diminish the proportion of one's time devoted to schooling after the beginning of employment. We use a limited-information maximum likelihood (LIML) estimator because it is less biased than a two stage least squares estimator in small samples (Angrist & Pischke, 2008).

As there are gender differences in the incidence of double qualifications (as seen in Table 1), we estimate our model separately for women and men (we also estimated our model on the full sample integrating gender interaction terms. The results can be found in Table A3 in the Appendix). Table 2 shows the estimations of wages oriented to the approach of previous studies. We include a dummy for having a double qualification, which is instrumented by the age at Abitur, Abitur mark, having an entrance qualification for a university of applied sciences, field of university studies and field of apprenticeship training on the first stage. The coefficient of the double qualification dummy is insignificant for men. For women, the double qualification dummy is signif-

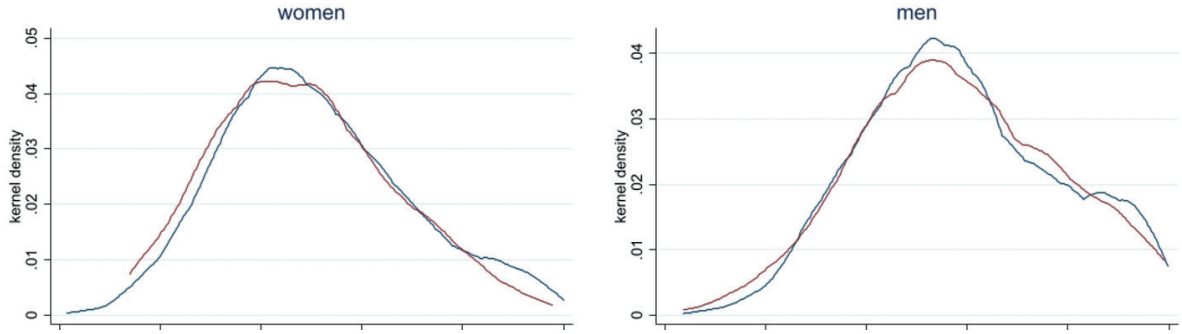

Fig. 1. Kernel densities of the hourly wage distributions with and without double qualifications, separately for women and men

Note: The Epanechnikov kernel function is applied.

icant and negatively associated with hourly wages (see Table 2). Having a double qualification reduces the log hourly wages of women c.p. by 12.2 percent. Thus, our results for men are in line with Bellmann & Stephani (2012), who found no significant results for men, too. For women, our results are in contrast to the ones of Bellmann & Stephani (2012) as they do not a significant association of double qualifications and wages for women either.

The other coefficients in Table 2 mostly reveal the expected pattern with respect to the direction of their effect and their significance: Older employees are better remunerated than younger employees (with a decreasing rate). Women whose mother tongue is German earn significantly more. For men, the effect of the mother tongue is also positive, but statistically insignificant. There is also a positive correlation of tenure and the number of subordinates with the log hourly wages. Additionally, larger firms pay significantly better than smaller ones.

When it comes to sector affiliation, we see differences between women and men (see Table 2). If employees working in public service are taken as the reference, women earn significantly less in all other sectors but manufacturing. Men earn significantly more when they are employed in manufacturing and services and less when they are employed in craft compared to being employed in public service. For the other sectors, we find no significant association with the log hourly wages compared to public service.

Next, we investigate the systematic differences between the wage risk of individuals with and without double qualifications. In line with Tuor & Backes-Gellner (2010) we use the average squared coefficient of variance proposed by Hartog & Vijverberg (2007) as a measure of wage risk. The same measure is used by Hammen (2011) and Bellmann & Stephani (2012). Thus, we ensure comparability with existing studies on double qualifications. According to the results presented in Table 3, we see only a small difference in the wage risk of individuals with and without double qualifications. For women with a double qualification the wage risk is slightly lower than for those without a double qualification. For men the opposite is true: the wage risk for men with a double qualification is slightly higher than the wage risk of men without a double qualification. Thus, the hypothesis of a lower wage risk for individuals with a double qualification presented in section 2 can only be supported for women, although the difference in the wage risk with and without double qualifications is rather small. For men, the hypothesis cannot be supported. This is in line with Hammen (2011) and Tuor & Backes-Gellner (2010).

5. Conclusions

The release of the BIBB/BAuA Employment Survey 2018 enables us to use current data to revisit double qualifications, i.e. after obtaining the German upper secondary school-leaving certificate (Abitur) completing an apprenticeship first and then graduate from university. We provide insights into individual effects of this education strategy although our results cannot be interpreted causally. This is worthwhile against the backdrop of a rising wage dispersion in Germany.

Our analyses reveal that – in comparison with Bellmann & Stephani (2012) – the proportion of men with a double qualification decreased by 8 percentage points between the year 2006 and 2018 but only 3 percentage points for women. Furthermore, our findings suggest that having a double qualification has a negative association with hourly wages. However, the respective regression coefficient is not significant for men. Although, the significant negative relation of doubles qualifications and earnings for women can be seen in connection with gender specific developments on the German labour market, e.g. the prevalence of part-time employment, further research is needed to corroborate the impact of part-time jobs on earnings for women.

Finally yet importantly, for women with a double qualification the wage risk is slightly lower than for those without a double qualification, but for men the opposite is true. Thus, the hypothesis of a lower wage risk with a double qualification can only be corroborated for women, but not for men.

Summing up, double qualifications are a widespread educational strategy among Abitur holders. Since the number of A-levels in Germany in general and the number of Abitur holders choosing apprenticeship training after school is higher than ever, a new look at double qualifications is worthwhile. Our results suggest pronounced differences in the incidence and the impacts on earnings between men and women. Also, double qualifications do not seem to be a guarantee for a lower wage risk. These findings are interesting in light of the fact that, compared to earlier studies, a greater wage dispersion and increasing wage inequality can be observed in Germany. There could be an interaction between the growing number of academics, also due to double qualifications, and the observed association between double qualifications on the on hand and earnings and income risk on the other hand.

Table 2. Log hourly wages of university and polytechnic graduates, LIML regressions by gender

	Women	**Men**
Double qualification (dummy)	-0.122**	-0.007
	(0.050)	(0.051)
Age (years)	0.045***	0.031***
	(0.012)	(0.010)
Age, squared	-0.0004**	-0.0002
	(0.0001)	(0.0001)
Foreigner (dummy)	-0.061	-0.003
	(0.062)	(0.060)
Mother tongue German (dummy)	0.115**	0.070
	(0.046)	(0.044)
Actual experience (years)	-0.001	-0.0005
	(0.005)	(0.005)
Actual experience, squared	-0.0001	-0.0002**
	(0.0001)	(0.0001)
Tenure (years)	0.008***	0.005***
	(0.001)	(0.001)
Number of direct subordinates, in 100	0.001*	0.001***
	(0.001)	(0.0002)
Establishment size (reference: 1-19 employees)		
20-99 employees (dummy)	0.143***	0.136***
	(0.028)	(0.032)
100-499 employees (dummy)	0.148***	0.154***
	(0.030)	(0.032)
500 or more employees (dummy)	0.221***	0.272***
	(0.030)	(0.031)
Sector (reference: public service)		
Manufacturing (dummy)	0.089***	0.200***
	(0.032)	(0.023)
Craft (dummy)	-0.220***	-0.240***
	(0.042)	(0.085)
Trade (dummy)	-0.327***	0.013
	(0.087)	(0.047)
Other services (dummy)	-0.027	0.057**
	(0.024)	(0.022)
Other sector (dummy)	-0.090**	0.044
	(0.037)	(0.046)
Eastern Germany (dummy)	-0.140***	-0.163***
	(0.027)	(0.028)
Weekly working hours	0.008***	0.014***
	(0.001)	(0.001)
Number of observations	1,935	1,974
R^2	0.2295	0.2986
Joint significance of dummy variable groups	Establishment size ***	Establishment size ***
	Sector ***	Sector ***

The data set used is the BIBB/BAuA employment survey 2018. Standard errors in brackets. */**/*** indicates statistical significance at the 10/5/1 percent level. Having a double qualification (Dummy) is instrumented by Age at the Abitur (years), Age at the Abitur, squared, Abitur mark (3 dummies), Having an entrance qualification for a university of applied sciences (dummy), field of university studies (5 dummies) and field of apprenticeship training (9 dummies).

Table 3. Wage risk measure by gender and double qualification

	Women	Men
With double qualification	0.014	0.016
Without double qualification	0.016	0.012

Note: The data set used is the BIBB/BAuA employment survey 2018. Wage risk is measured as the average squared coefficient of variance and relies on the specification of the LIML regressions presented in Table 2.

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Appendix

Table A1. Descriptive Statistics

	Women		Men		p-value (Mann-Whitney test)
	Mean	Std. Dev.	Mean	Std. Dev.	
Double qualification (dummy)	0.1793	0.3837	0.2432	0.4291	0.0000
Hourly wage in €	26.4674	13.3086	32.9679	17.6322	0.0000
Log hourly wages	3.1796	0.4449	3.3938	0.4489	0.0000
Age (years)	46.3189	10.8644	46.0917	11.0931	0.5516
Age at Abitur (years)	19.8791	2.6188	20.2964	2.8598	0.0000
Foreigner (dummy)	0.0310	0.1734	0.0274	0.1632	0.4975
Mother tongue German (dummy)	0.9406	0.2365	0.9463	0.2255	0.4378
Actual experience (years)	21.5644	11.5278	21.1196	11.4712	0.2212
Tenure (years)	12.9716	10.8740	12.7457	10.6264	0.8109
Number of direct subordinates	3.4171	13.4396	9.8642	45.3579	0.0000
Eastern Germany (dummy)	0.1344	0.3411	0.1079	0.3103	0.0112
Abitur mark very good (dummy)	0.2093	0.4069	0.1606	0.3672	0.0001
Abitur mark good (dummy)	0.5990	0.4902	0.5841	0.4930	0.3443
Abitur mark fair (dummy)	0.1876	0.3905	0.2462	0.4309	0.0000
Abitur mark satisfactory (dummy)	0.0041	0.0642	0.0091	0.0951	0.0553
1-19 employees (dummy)	0.1654	0.3716	0.1044	0.3058	0.0000
20-99 employees (dummy)	0.3504	0.4772	0.2472	0.4315	0.0000
100-499 employees (dummy)	0.2444	0.4299	0.2730	0.4456	0.0412
More than 500 employees (dummy)	0.2398	0.4271	0.3754	0.4843	0.0000
Public Service (dummy)	0.5421	0.4984	0.3779	0.4850	0.0000
Manufacturing (dummy)	0.0997	0.2997	0.2599	0.4387	0.0000
Craft (dummy)	0.0109	0.1036	0.0106	0.1026	0.9482
Trade (dummy)	0.0527	0.2235	0.0370	0.1888	0.0174
Other services (dummy)	0.2274	0.4193	0.2761	0.4472	0.0005
Other sectors (dummy)	0.0672	0.2504	0.0385	0.1924	0.0001
Observations	1,935		1,974		

Notes: The data set used is the BIBB/BAuA employment survey 2018. P-values refer to Mann-Whitney tests on differences in the distribution of the listed variables by gender.

Table A2. First-stage regressions by gender

	Women	Men
Age (years)	0.041***	0.015
	(0.009)	(0.011)
Age, squared	-0.001***	-0.0003***
	(0.0001)	(0.0001)
Foreigner (dummy)	-0.134***	-0.054
	(0.039)	(0.047)
Mother tongue German (dummy)	0.026	0.092**
	(0.033)	(0.039)
Actual experience (years)	0.006	0.016***
	(0.004)	(0.005)
Actual experience, squared	0.0001	0.00003
	(0.0001)	(0.0001)
Tenure (years)	-0.001	-0.002
	(0.001)	(0.001)
Number of direct subordinates, in 100	0.0004	-0.0002
	(0.0003)	(0.0001)
Establishment size (reference: 1-19 employees)		
20-99 employees (dummy)	0.014	-0.007
	(0.023)	(0.031)
100-499 employees (dummy)	-0.001	0.012
	(0.026)	(0.032)
500 or more employees (dummy)	0.007	-0.027
	(0.027)	(0.032)
Sector (reference: public service)		
Manufacturing (dummy)	-0.004	-0.014
	(0.033)	(0.027)
Craft (dummy)	-0.025	0.055
	(0.084)	(0.098)
Trade (dummy)	0.023	-0.044
	(0.040)	(0.051)
Other services (dummy)	0.022	0.023
	(0.021)	(0.024))
Other sector (dummy)	0.002	0.019
	(0.027)	(0.045)
Eastern Germany (dummy)	0.005	-0.012
	(0.024)	(0.027)
Weekly working hours	0.0004	0.0007
	(0.001)	(0.001)
Age at Abitur (years)	0.025	0.116***
	(0.019)	(0.032)
Age at Abitur, squared	-0.0001	-0.002***
	(0.0004)	(0.001)
University of applied sciences entrance qualification (dummy)	0.156***	0.111***
	(0.041)	(0.037)
Abitur mark (reference: very good)		
Good (dummy)	0.030*	-0.002
	(0.018)	(0.023)
Fair (dummy)	0.057**	-0.0002
	(0.024)	(0.027)
Satisfactory (dummy)	-0.038	0.139
	(0.138)	(0.092)
Field of university/ polytechnic degree (5 dummies)	Yes	Yes
Field of apprenticeship (9 dummies)	Yes	Yes
Number of observations	1,935	1,974
R^2	0.3373	0.2721

Notes: The data set used is the BIBB/BAuA employment survey 2018. Standard errors in brackets. */**/*** indicates statistical significance at the 10/5/1 percent level.

Table A3. Log hourly wages of university and polytechnic graduates, interacted LIML regressions

Double qualification (dummy)	-0.068*
	(0.036)
Age (years)	0.032***
	(0.008)
Female*Age	0.044***
	(0.008)
Age, squared	-0.0002**
	(0.0001)
Female* Age squared	-0.0004***
	(0.0001)
Foreigner (dummy)	-0.011
	(0.061)
Female*Foreigner	-0.051
	(0.061)
Mother tongue German (dummy)	0.077*
	(0.044)
Female* Mother tongue German	0.112**
	(0.044)
Actual experience (years)	0.001
	(0.004)
Female* Actual experience	-0.002
	(0.004)
Actual experience, squared	-0.0002**
	(0.0001)
Female* Actual experience squared	-0.0001
	(0.0001)
Tenure (years)	0.005***
	(0.001)
Female*Tenure	0.008***
	(0.001)
Number of direct subordinates, in 100	0.001***
	(0.0002)
Female* Number of direct subordinates	0.001**
	(0.001)
Establishment size (reference: 1-19 employees)	
20-99 employees (dummy)	0.134***
	(0.002)
Female*20-99 employees	0.143***
	(0.026)
100-499 employees (dummy)	0.156***
	(0.032)
Female*100-499 employees	0.147***
	(0.029)
500 or more employees (dummy)	0.272***
	(0.032)
Female* 500 or more employees	0.218***
	(0.030)
Sector (reference: public service)	
Manufacturing (dummy)	0.207***
	(0.032)
Female* Manufacturing	0.085***
	(0.031)
Craft (dummy)	0.016
	(0.047)
Female*Craft	-0.226***
	(0.041)
Trade (dummy)	-0.224***
	(0.086)
Female* Trade	-0.336***
	(0.085)
Other services (dummy)	0.062***
	(0.022)
Female* Other services	-0.031
	(0.023)
Other sector (dummy)	0.045
	(0.046)
Female*Other sector	-0.090**
	(0.013)
Eastern Germany (dummy)	-0.166***
	(0.028)
Female* Eastern Germany	-0.140***
	(0.026)
Weekly working hours	0.014***
	(0.001)
Female*Weekly working hours	0.008***
	(0.001)
Number of observations	3,909
R^2	0.3069
Joint significance of dummy variable groups	Establishment size*** Sector***

Note: The data set used is the BIBB/BAuA employment survey 2018. Standard errors in brackets. */**/*** indicates statistical significance at the 10/5/1 percent level. Having a double qualification (Dummy) is instrumented by Age at the Abitur (years), Age at the Abitur, squared, Abitur mark (3 dummies), Having an entrance qualification for a university of applied sciences (dummy), field of university studies (5 dummies) and field of apprenticeship training (9 dummies).