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The Effect of Regional Competition and Company-sponsored Training on the Productivity-Wage Wedge*

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- Preliminary version -

The new training literature argues that imperfect labour market competition drives a wedge between productivity and wage increases in skills. We apply recent advancements in the joint estimation of production and wage functions to show a compressed wage structure in Germany. We also use regional and industry variation in labour market competitiveness and show that there is a premium on productivity and wages, but the productivity-wage wedge does not diminish in labour markets that are more competitive.

JEL: J24, M53, R23

Keywords: training, productivity, productivity-wage wedge, regional competition

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1. Introduction

Life-long learning and skill updating become more important as technology advancements reduce the shelf-life of knowledge. In education and training after labour market entry, employers play the key role. Employers provide the majority of training after entering the labour market (Booth and Brian, 2005; Booth and Katic, 2011; Waddoups, 2014) because they have an information advantage against employees about technological trends in the industry, trends in the organisation of work and the nature of workplaces, plans for investment in new machines, new processes and new products.

An increasing relevance of employer-led training calls for a sophisticated understanding of mechanisms that allow employers to invest in skills of employees. The most influential theoretical framework is the human capital theory (Becker, 1962) evolving into the new training literature (Acemoglu and Pischke, 1999). The theory argues that a compressed wage structure caused by imperfect labour markets is the relevant precondition for employers to pay even for training in purely transferable skills. A wage structure is compressed if productivity increases stronger in skills than wages increase in skills. The so-called productivity-wage wedge (in skills) serves employers as a return to investment in training (Acemoglu and Pischke, 1999; Booth and Zoega, 2004; Leuven, 2005).

A few empirical papers have verified that a compressed wage structure exists (Conti, 2005; Dearden et al., 2006; Konings and Vanormelingen, 2015)¹ and that more compressed wages lead to more employer-sponsored training (Pfeifer, 2016). For example, Konings and Vanormelingen (2015) have shown that productivity increases stronger in skills than wages increase in skills for a sample of Belgium firms accounting for the endogeneity of input factors.

We extend the study of Konings and Vanormelingen (2015) and include a trigger for a compressed wage structure. A compressed wage structure can be caused by imperfect competition that allow a smaller wage than productivity increase in skills (Acemoglu and Pischke, 1999; Booth and Zoega, 2004; Leuven, 2005). We analyse the direct link whether more competition on the labour market decreases the productivity-wage wedge in skills. Therefore, we focus on one classical measure for imperfections in the labour market: the degree of labour market competition in local labour markets (Manning, 2011). Firms can exercise regional power because the majority of individuals has strong regional preferences, which restricts regional mobility.² The number of employers in a specific

¹ Conti (2005) and Dearden et al. (2006) estimate the productivity and wage premium of training using sector level data for a pre-2000 period for Italy and UK, respectively. Both find positive effects of training that are larger for productivity than for wages.

² Overall, the regional migration is low in Germany (e.g., Hunt, 2004; Bauernschuster et al., 2014). Among those who migrate are well-known heterogeneities with respect to the skill level and the degree of risk-aversion. Hunt (2004) and Bauernschuster et al. (2014) show that more skilled worker are more likely to

industry and region determines the level of labour market competition. In other words, the monopsony power of employers decreases if more employers compete for employees on a regional labour market. Hence, the more competition, the less compressed the wage structure and the lower the productivity-wage wedge in an area. We analyse the productivity-wage wedge applying recent advancements in jointly estimating production and wage functions and solving the endogeneity problem. We address endogeneity following the approach proposed by Akerberg et al. (2015) using intermediate inputs to identify the production function. We estimate the wage premium controlling for potential biases from unobserved labour quality.

We show that wages are indeed compressed in Germany. More competition in local labour markets evolves in a premium on productivity and wages, but the skill increase in connection with the regional competition has no additional statistical significant effect on the productivity-wage wedge.

Our analysis is also related to literature investigating the labour market conditions that allow firms to provide training. A number of studies show that firms in more competitive labour markets are less likely to pay for employee training (Brunello and Gambarotto, 2007; Mühlemann and Wolter, 2007; Brunello and de Paola, 2008; Mühlemann and Wolter, 2011; Rzepka and Tamm, 2016).

The remainder of the paper proceed as follows: The next section describes our estimation strategy. Section 3 contains a description of the data set and variable definitions. In Section 4 we present our results and the last section concludes.

2. Estimation Strategy

We analyse the productivity-wage wedge by jointly estimating the production and wage function, following a standard framework introduced by Hellerstein et al. (1999) and recently applied by Konings and Vanormelingen (2015). This section introduces the empirical framework to estimate the production function and the wage equation. Afterwards we incorporate the level of labour market competition into the framework.

The production function of interest is shown in equation (1):

$$\log(q_{it}) = \alpha_0 + \alpha_1 \log(l_{it}) + \alpha_2 \log(k_{it}) + \alpha_3 \text{skill}_{it} + X_{it}'\alpha + \gamma_t + \omega_{it} + \varepsilon_{it} \quad (1)$$

where q_{it} is the productivity measure, i.e. value added, for a firm i in year t . Labour l_{it} , capital k_{it} and the share of skilled workers skill_{it} are the overserved input factors. X'_{it} are firm-specific control variables, γ_t are year effects, ω_{it} unobserved productivity shocks and ε_{it} denotes the error term.

migrate over longer distances. Additionally, risk-averse individuals are less likely to migrate over long distances (Bauernschuster et al., 2014).

Estimating equation (1) by OLS results in biased estimates if unobserved productivity shocks ω_{it} are correlated with the input factors of interest (Marschak and Andrews, 1944). To account for the endogeneity issue, we apply the latest methodological advancement by Akerberg et al. (2015).³ They argue that firms' current demand for intermediate inputs permits catching unobserved productivity because the productivity-relevant shock ω_{it} is unobserved for the econometrician, but not for the firm when making their input choices.⁴ Thus, the demand for intermediate inputs is a function of labour, capital, unobserved productivity and, in our case, skills:

$$intermediates_{it} = f_t(l_{it}, skills_{it}, k_{it}, \omega_{it}) \quad (2)$$

Hence, to estimate equation (1) we include the inverted function for intermediate input demand in equation (1)⁵:

$$\begin{aligned} \log(q_{it}) = & \alpha_0 + \alpha_1 \log(l_{it}) + \alpha_2 \log(k_{it}) + \alpha_3 skills_{it} + X_{it}'\alpha + \gamma_t \\ & + f_t^{-1}(interm_{it}, l_{it}, skills_{it}, k_{it}) + \varepsilon_{it} \end{aligned} \quad (3)$$

This approach relies on three assumptions:

Timing of input choices: The input factor capital is predetermined and can be described by $k_{it} = f(k_{it-1}, i_{it-1})$ where investments i_{it-1} are decided in the previous period t-1. Thus, capital is uncorrelated with the current (in period t) unobserved productivity ω_{it} when estimating equation (1). We follow Konings and Vanormelingen (2015) and assume the specific functional form for the capital formation:

$$k_{it} = (1 - \delta)k_{it-1} + i_{it-1} \quad (4)$$

Thus, the capital is depreciated by a constant rate δ . The input factors labour l_{it} and skills $skill_{it}$ are set to be endogenous. Labour can be chosen at any time representing a dynamic hiring and firing close to real labour markets. The empirical framework addresses the endogeneity of both, labour and skills (Akerberg et al., 2015). The intermediate input demand function of a firm, equation (2), shows that the intermediates are conditional on labour and capital, i.e. the intermediate inputs are chosen after or

³ During the last seven decades, several econometric approaches have been proposed to consistently estimated production functions (see Akerberg et al. (2015) and van Beveren (2012) for a comprehensive overview).

⁴ Unobserved productivity is assumed to follow a first order Markov chain.

⁵ By assumption, the production function is Leontief in their intermediate inputs. We use a polynomial in intermediate inputs, labor, capital and training to proxy $f_t^{-1}(\cdot)$ (cf. Konings and Vanormelingen, 2015; and for a more general application Petrin and Levinsohn, 2012). We use the stata module ivreg2 (Baum et al., 2010) to estimate the production function according to the Akerberg et al. (2015) framework as proposed by Petrin and Levinsohn (2012). The coefficients of interest are identified in a two-stage procedure.

simultaneous to the input factor labour in period t , the same period as the production takes place.

Scalar unobservable and strict monotonicity: The intermediate input demand function, equation (2), is assumed to have only one unobservable and needs to be strictly monotonous in ω_{it} in order to construct the inverted function $f_t^{-1}(\cdot)$ and to be included in equation (3). The strict monotonicity implies that no unobservable factors directly affect the intermediate inputs. Otherwise, the inversion of the intermediate input demand function would be infeasible.

We estimate the firms' wage equation in order to derive the wage premium for skilled employees using a standard Mincer equation (Mincer, 1974). The wage equation is likely to be biased if the skill measure is correlated with some unobserved quality of labour. With reference to the production function, labour quality is assumed to be the main component of the productivity-relevant shock ω_{it} .⁸ Thus, a proxy for the labour quality is the total factor productivity derived from the production function \widehat{TFP}_{it} , which can be included in the wage equation. The resulting wage equation is

$$\log(w_{it}) = \beta_0 + \beta_1 \log(k_{it}/l_{it}) + \beta_2 \widehat{TFP}_{it} + \beta_3 \text{skills}_{it} + X'_{it}\beta + \gamma_t + \varepsilon_{it} \quad (5)$$

and can be estimated by OLS. By controlling for the total factor productivity, we combine the productivity estimation and the wage estimation. Afterwards, we use a Wald test to test the equality of the productivity and wage premiums of skills statistically, i.e. $\alpha_3 = \beta_3$.

Finally, we extend the Konings and Vanormelingen (2015) framework by including imperfect labour market conditions, particularly we assess the role of regional competition reg_{it} on the productivity and wage premium of skills. Hence, our estimation equations are:

$$\begin{aligned} \log(q_{it}) = & \alpha_0 + \alpha_1 \log(l_{it}) + \alpha_2 \log(k_{it}) + \alpha_3 \text{skills}_{it} + \alpha_4 reg_{it} \\ & + \alpha_5 \text{skills}_{it} * reg_{it} + X'_{it}\alpha + \gamma_t \\ & + f_t^{-1}(\text{interm}_{it}, l_{it}, \text{skills}_{it}, \text{skills}_{it} * reg_{it}, k_{it}) + \varepsilon_{it} \end{aligned} \quad (6)$$

and

$$\begin{aligned} \log(w_{it}) = & \beta_0 + \beta_1 \log(k_{it}/l_{it}) + \beta_2 \widehat{TFP}_{it} + \beta_3 \text{skills}_{it} + \beta_4 reg_{it} \\ & + \beta_5 \text{skills}_{it} * reg_{it} + X'_{it}\beta + \gamma_t + \varepsilon_{it} \end{aligned} \quad (7)$$

⁸ In detail, the unobserved productivity shock ω_{it} has three components: an industry-specific effect ω_j , a time-specific effect ω_t , and the unobserved labour quality P_{it} , i.e. $\omega_{it} = \omega_j + \omega_t + P_{it}$ (cf. Frazer, 2001; Konings and Vanormelingen, 2015).

3. Data and variable definitions

To estimate the impact of regional competition and training on productivity and wages, we use the IAB Establishment Panel for the period 2007-2014. The IAB Establishment Panel is an annual German establishment survey and covers about 16,000 establishments with at least one employee liable to social security. The survey records information about firm characteristics, policies, employment, and personnel strategies (see Fischer et al., 2009; Ellguth et al., 2014).

We restrict our sample to private, profit-maximising establishments with more than five employees. We exclude the agricultural sector, establishments that move to another region and observations with missing values in key variables. Since the IAB Establishment Panel collects information about sales, input costs, and investments retrospectively for the previous year, we shift these variables by one year. Consequently, our estimation sample comprises the period 2007-2013.

We use two outcome variables productivity and wages. We measure productivity by a value added of sales minus input and wages by the total wage sum⁹, both deflated by the consumer price index.

To measure the skill level of the workforce we use the intensity of firms' further training. Training boosts the skills of employees and higher skills should be accompanied by a lower wage gain compared to the resulting productivity gain. The measure has the advantage that we indeed measure a skill upgrade and not additional individual characteristics associated with productivity differences such as ability, personality traits and self-image. In the data, further training is reported as the number of trained worker or the number of participants in training courses. We follow the imputation proposed by Düll and Bellmann (1998) to obtain the number of trained workers.

We assign each firm to a regional labour market using the labour market regions defined by Kosfeld and Werner (2012). The classification uses commuter flows rather than administrative borders to define labour market regions. The definition is common in regional labour market studies in Germany (see e.g., Görlitz and Rzepka, 2014; Rzepka and Tamm, 2016; Hirsch et al., 2016), which makes our results comparable.

The variables of main interest is the measure for regional competition. We use the number of firms per industry in each regional labour market divided by the size of the labour market region in squared kilometres. This measure provides us with a density measure of the regional competition (see e.g. Brunello and de Paola, 2008; Mühlemann and Wolter, 2011; Rzepka and Tamm, 2016). We construct the variable using administrative data of the Establishment History Panel (BHP), which is a 50% sample of

⁹ The survey covers the wage bill of June each year. We multiply this sum by 12.

all firms with at least one employee (Schmucker et al., 2016) and merge the variable for regional competition for each regional-industry combination per year.

We assess the capital stock of the firm using the perpetual inventory method proposed by Hempl (2005). We measure firms' intermediate inputs as their reported inputs deflated by the input price index, which is provided by the German statistical office.

We use standard control variables for production function. We account for firm-level heterogeneity using indicator variables for works council, collective wage agreements, exporter status, young plant, single plant, and West Germany and variables for workforce composition, churning rate, and industry dummies. The choice of controls is in line with other analyses on firm-level productivity for Germany (e.g. Zwick, 2006; Trax et al., 2015; Grunau, 2016). We use the same set of control variables for the wage regression in order to get comparable results for the returns to training on productivity and wages. Table 1 displays the definition of all variables and provides basic summary statistics.

4. Results

This section presents the results of the empirical analyses. First, we show descriptively the difference in skills and regional labour markets with respect to productivity and wages. Second, we present the multivariate results for the productivity-wage wedge. Finally, we provide some robustness analysis.

Descriptive statistics

The upper part of Table 2 shows the pooled descriptive statistics for firms' productivity and wage sum separately for firms that provide further training and firms without any further training. On average, the (log.) value added and the (log.) wages of firms with further training is smaller than of firms without any training. Table 2 also shows that the majority of firms provide at least some kind of training, but the intensity of training varies. Thus, we focus on the intensity of the firms' further training.

The lower part of Table 2 shows the descriptive characteristics of firms by their level of regional competition, i.e. employer density. We split the sample at the median of employer density. The pooled summary statistics show that the provision and the intensity of training is similar across both groups. 71 percent of the firms provide some training. The average intensity of training is 26 percent. Firms in less competitive regions tend to be larger but the descriptive differences between the (log.) value added and (log.) wages in both groups are negligible.

Results

Table 3 shows the regression results of the productivity function (3) and the wage regression (5) estimated by OLS (columns 1 and 2) and by the method of Akerberg et

al. (2015, “ACF”) in columns (3) and (4). The ACF estimation ensures that the productivity estimate is not confounded by possible endogeneity of input factors. Both estimation approaches show that returns to training on productivity are larger than returns to training on wages, which is in line with theoretical prediction and thus confirms that wages are compressed in Germany. The size of the coefficients implies that an increase of the share of trained worker by ten percentage points increases the value added by 2.9 percent and the wage by 1.5 percent. The size of the coefficients is close to the effects for Belgium (Konings and Vanormelingen, 2015).

In Table 4, we include the level of regional competition and the interaction with the firms’ training intensity, i.e. equations (6) and (7). The impact of training on productivity and wages remains about the same in size compared to Table 3 when controlling for regional labour market competition. The coefficient for the level of regional competition is positive and significant throughout all specifications indicating that with increasing regional competition productivity and wages increase. The interaction term however falls short of statistical significance. Thus, the productivity-wage wedge does not close with more regional competition. Given the results from the literature that in more competitive regions, less training is provided (Brunello and Gambarotto, 2007; Mühlemann and Wolter, 2007; Brunello and de Paola, 2008; Mühlemann and Wolter, 2011; Rzepka and Tamm, 2016), we interpret our findings as an incidence for more efficient further training in more competitive labour markets.

Robustness

As a robustness analysis we use the indicator of firm’s further training activity (dummy variable) as the measure for skills. The results are displayed in Table 5. The dummy variable shows a positive and statistical significant effect of training participation on firms’ productivity and wages. The level of regional competition has a positive impact on both measures but turns out to be significant only in the wage regression (column 2 and 4). Further, the interaction effect of training and employer density has a positive effect on wages and productivity, but is only statistical significant in the wage regression. We interpret the positive coefficient as an incidence that a more competitive labour market reduces the productivity-wage wedge when the firm needs to decide about training participation in general.

In addition, our main results (Table 4) are robust to a number of alternative measures. For example, we use administrative wage information and other variables for the level of regional competition (including employee density, log. population, Herfindahl index of

concentration). We also include additional regional variables as a general measure for agglomeration (log. employees) and use less conservative clusters.¹⁰

5. Conclusions

In this paper, we show that further training leads to wage compression, i.e. the productivity increase in skills is larger than the related wage increase in skills. The finding is in line with theoretical predictions from the new training literature. In addition, we analyse the impact of the level of regional competition, measured by employer density of each industry-region combination, on the productivity-wage wedge. Our results indicate that there is a premium on productivity and wages in more competitive labour markets but the skill increase in connection with the regional competition has no additional statistical significant effect on the productivity-wage wedge.

Our research extends the empirical evidence in the new training literature by analysing one important feature of imperfect labour markets: regional competition. We provide new evidence on the relevance of regional competition on the productivity-wage wedge.

¹⁰ Results are available upon request.

Tables

Table 1: Variable definitions and summary statistics

Variable	Definition	Mean	S.D.
Value added, log	Sales minus costs of intermediate inputs, deflated with consumer price index (CPI), log	14.197	1.790
Wages, log	Annual wages, deflated with CPI, log	9.951	0.549
Training, d	Indicator is 1 if firm has at least one training activity, else 0	0.710	0.454
Training, share	Number of trained workers relative to all workers	0.266	0.304
Capital, log	Firms' capital stock derived using the perpetual inventory method (Hempel 2005), deflated with CPI, log	12.416	3.282
Labour, log	Number of all workers, log	3.542	1.398
Material, log	Intermediate inputs adjusted to input price index (industry level)	8.049	1.960
Workforce composition:			
university graduates, share	Share of workers w/ university degree	0.027	0.074
qualified workers, share	Share of workers w/ completed apprenticeship training but w/o university degree	0.628	0.247
apprentices, share	Share of apprentice in the firm	0.047	0.075
part-time, share	Share of workers holding a part-time contract	0.198	0.233
female workers, share	Share of female workers	0.368	0.282
Churning rate	$\text{Churning rate} = \frac{(\text{Hires} + \text{Separations}) - (\text{Hires} - \text{Separations})}{\text{Firm Size (average)}}$	0.049	0.136
Coverage by collective wage agreements, d	Indicator is 1 if firm is covered by some collective wage agreements, else 0	0.419	0.493
Works council, d	Indicator is 1 if firm has a works council, else 0	0.273	0.446
Single plant, d	Indicator is 1 if firm is a single plant, else 0	0.798	0.401
Exporter status, d	Indicator is 1 if firm exports, else 0	0.331	0.471
Age ≤ 5 years, d	Indicator is 1 if firm's age is less or equal five years, else 0	0.087	0.282
West, d	Indicator is 1 if firm is located in West Germany, else 0	0.566	0.496
Firm Size:			
<100 employees, d	Indicator is 1 if firm has less than 100 employees, else 0	77.850	
100-500 employees, d	Indicator is 1 if firm has 100-500 employees, else 0	17.900	
>500 employees, d	Indicator is 1 if firm has more than 500 employees, else 0	4.260	
Regional Competition	Number of firms in each region and industry divided by the size of the region in km ²	0.730	0.831

Notes: N= 22.620

Data Source: IAB Establishment Panel 2007-2014, own calculations.

Table 2: Firms' characteristics by training provision and by regions

	Mean	S.D.	N
Firms w/o training provision			
Value added, log	13.160	1.356	6,550
Wages, log	9.712	0.591	6,550
Firms w/ training provision			
Value added, log	14.620	1.774	16,070
Wages, log	10.048	0.500	16,070
Firms in less competitive labour market regions (employer density below the median)			
Regional competition	0.246	0.105	11,311
Training, d	0.716	0.451	11,311
Training, share	0.262	0.302	11,311
Firm size, no.	142.804	1052.859	11,311
Value added, log	14.333	1.796	11,311
Wages, log	9.995	0.493	11,311
Firms in competitive labour market regions (employer density equal and above the median)			
Regional competition	1.215	0.949	11,309
Training, d	0.705	0.456	11,309
Training, share	0.270	0.306	11,309
Firm size, no.	123.901	806.265	11,309
Value added, log	14.062	1.775	11,309
Wages, log	9.907	0.597	11,309

Notes: Regional competition: number of employers in a labour market region and in the same industry divided by the size of the labour market region in squared kilometres.

Data Source: IAB Establishment Panel 2007-2014, own calculations.

Table 3: The impact of training on productivity and wages

	Production Function (1)	Wage Regression (2)	Production Function (3)	Wage Regression (4)
Method:	OLS		ACF	
Training, share	0.217	0.141	0.289	0.146
	0.022	0.012	0.038	0.012
	0.000	0.000	0.000	0.000
Labour, log	0.987		0.700	
	0.011		0.013	
	0.000		0.000	
Capital, log	0.044		0.094	
	0.004		0.012	
	0.000		0.000	
Capital/Labour, log		0.026		0.026
		0.002		0.002
		0.000		0.000
Controls	Yes	Yes	Yes	Yes
Obs.	22,620	22,620	22,620	22,620
Firms	7,265	7,265	7,265	7,265

Notes: Dependent variable: log real value added in production function and log real total wage bill in wage regressions. Method: OLS in columns (1) and (2) and Akerberg et al. (2015) approach with input instruments (ACF) to control for the endogeneity of inputs and training in columns (3) and (4) Coefficients, robust standard errors and p-value shown.

Additional controls: dummies for works council, coverage by collective wage agreements, export status, young plant, single plant, West Germany; churning rate; firm size (3 categories); share of qualified workers, university graduates, share of apprentices, share of female worker, share of part-time workers, industry and year dummies. Total factor productivity (TFP) originates from the corresponding production function.

Data Source: IAB Establishment Panel 2007-2014, own calculations.

Table 4: The effect of regional competition and training on productivity and wages

Method:	Production Function	Wage Regression	Production Function	Wage Regression
	(1)	(2)	(3)	(4)
	OLS		ACF	
Training, share	0.225	0.134	0.242	0.091
	0.038	0.015	0.062	0.016
	0.000	0.000	0.000	0.000
Interaction of training, share and regional competition	-0.008	0.013	-0.012	0.015
	0.035	0.014	0.046	0.021
	0.824	0.380	0.792	0.481
Regional competition	0.047	0.035	0.032	0.032
	0.019	0.009	0.016	0.012
	0.015	0.000	0.049	0.009
Labour, log	0.987		0.708	
	0.011		0.014	
	0.000		0.000	
Capital, log	0.044		0.087	
	0.003		0.012	
	0.000		0.000	
Capital/Labour, log		0.025		0.015
		0.002		0.002
		0.000		0.000
TFP		0.042		0.017
		0.013		0.011
		0.001		0.142
Controls	Yes	Yes	Yes	Yes
Obs.	22,620	22,620	22,337	22,337
Firms	7,265	7,265	7,207	7,207

Notes: Dependent variable: log real value added in production function and log real total wage bill in wage regressions. Method: OLS in columns (1) and (2) and Akerberg et al. (2015) approach with input instruments (ACF) to control for the endogeneity of inputs and training in columns (3) and (4). Coefficients, robust standard errors and p-value shown (cluster: region). Regional competition: number of employers in a labour market region and in the same industry divided by the size of the labour market region in squared kilometres. Further notes see Table 3.

Data Source: IAB Establishment Panel 2007-2014, own calculations.

Table 5: Robustness analysis using indicator for training participation

Method:	Production	Wage	Production	Wage
	Function	Regression	Function	Regression
	OLS		ACF	
	(1)	(2)	(3)	(4)
Training, dummy	0.159	0.113	0.198	0.116
	0.023	0.011	0.044	0.012
	0.000	0.000	0.000	0.000
Interaction of training, d	0.010	0.023	0.013	0.023
and regional competition	0.019	0.010	0.026	0.010
	0.605	0.021	0.611	0.022
Regional competition	0.036	0.022	0.017	0.022
	0.022	0.012	0.024	0.012
	0.097	0.069	0.479	0.076
Labour, log	0.969		0.690	
	0.012		0.014	
	0.000		0.000	
Capital, log	0.044		0.085	
	0.003		0.012	
	0.000		0.000	
Capital/Labour, log		0.024		0.024
		0.002		0.002
		0.000		0.000
TFP		0.043		0.030
		0.013		0.019
		0.001		0.125
Controls	Yes	Yes	Yes	Yes
Obs.	22,620	22,620	22,337	22,337
Firms	7,265	7,265	7,207	7,207

Notes: Dependent variable: log real value added in production function and log real total wage bill in wage regressions. Method: OLS in columns (1) and (2) and Akerberg et al. (2015) approach with input instruments (ACF) to control for the endogeneity of inputs and training in columns (3) and (4). Coefficients, robust standard errors and p-value shown (cluster: region). Regional competition: number of employers in a labour market region and in the same industry divided by the size of the labour market region in squared kilometres.

Further notes see Table 3.

Data Source: IAB Establishment Panel 2007-2014, own calculations.

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