Productivity in German manufacturing firms: Does fixed-term employment matter?

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Abstract

In this study the relationship between the use of fixed-term employment and labor productivity is investigated. The existing literature provides theoretical and empirical arguments for a positive relationship as well as for a negative one. Using temporary employment as a tool of adjustment on changes in product demand should increase labor productivity. A moderate use of fixed-term employment to screen new potential employees should also increase labor productivity, while an extensive use to replace core workers with temporary ones may reduce labor productivity due to less motivation of both types of employees. Regarding human capital an increasing share of fixed-term employees should go in line with decreasing labor productivity, because the incentive to invest in firm specific human capital of employees with a fixed-term contract is lower compared to permanent employees. Combining the different channels how the use of temporary contracts affect labor productivity we expect a non linear maybe inverse U-shaped relationship. A moderate use of fixed-term contracts should increase labor productivity due to increasing flexibility of labor input and the possibility to screen potential new employees. An intensive use should have a negative effect on labor productivity due to less motivation of both types of employees and lower human capital for employees with a fixed-term contract.

The study uses data of the IAB Establishment Panel for the period 2004 to 2009. The data are gathered and compiled by the German Federal

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Employment Agency (Bundesagentur für Arbeit). It is an annual survey covering about 16.000 establishments per year and it is aimed to be representative both for average and for longitudinal analysis (Fischer et al., 2009). The questionary includes questions on staff development, personnel requirements, sales, investment, exports, but also R&D, innovation and organizational change (Bellmann et al., 2002). In addition, there are explicit questions about different forms of employment that have been used, such as temporary agency work or fixed-term employment. Altogether, the dataset contains about 320 variables, form which, however, most are related to labor market issues.

Our empirical findings provide no support for the hypothesis of an inverse U-shaped relationship between the use of fixed-term employment and labor productivity. Regressing labor productivity on the share of fixed-term employees on total work force of an establishment and its quadratic term leads to no significant coefficients for both variables in most regression models. Using fixed effects regression models allows us to control for establishment specific fixed effects. Moreover, applying system GMM dynamic panel models take into account dynamic effects and potential endogeneity resulting from a correlation between explanatory variables and past error terms. Potential selection into the use of fixed-term contracts is taken into account by using a two stage approach, where in the first stage the inverse Mills ration based on a probit model is calculated and is included in the second stage regression models. Regardless of the applied estimation method the hypothesis of an inverse U-shaped relationship is not confirmed.

Keywords: fixed-term employment, labor productivity, manufacturing
JEL-Codes: D24, L23, L60

1 Introduction

The importance of fixed-term employment in Germany is continuously increasing. The share of fixed-term contracts at new hires increased from around 30 percent in 2000 to about 45 percent in 2010 (IAB, 2011). Although approximately 50 percent of all fixed-term contracts ends by transfer into permanent contracts, the proportion of fixed-term workers in Germany increases continuously. In 2010, more than 9 percent of all employees liable to social security in Germany are employed under a fixed-term contract. In 2000 this figure was only about 6 percent (Gundert & Hohendanner, 2011). The increasing importance of this form of employment raises the question whether and how it might affect firm performance.

Previous research on temporary work and fixed-term contracts has identified mainly two reasons for using this instrument. Firstly, the instrument is used to increase the external flexibility of labor input. Hence, severance payments and the like are not necessary, since expiring contracts simply reduce the number of employees in the case of declining demands. Second, fixed-term contracts can be used to screen for productive workers. So, by selecting the latter and offering them permanent contracts, the overall quality and productivity of the workforce should increase.

However, within the labor market and management literature, the disadvantages of temporary work are revealed. Here, it is mainly the demotivating affect temporary work can have on temporary but also permanent workers by abusing this instrument. Moreover, the firm specific human capital of temporary workers is lower than that of permanent workers and firms have little incentive to invest in the training of temporary workers.

Since there are opposing effects of temporary work, its overall effect on firm performance is unclear. Previous literature on this topic is rare. Using sector aggregates, Damiani and Pompei (2010) analyzed the effect of labor protection on TFP growth in 18 European countries in the period 1995 to 2005. They also control for the effect of growth in temporary employment on TFP finding a negative and significant relation. Also using sector data Auer et al. (2005) analyze the effect of employment tenure on productivity in 13 European countries for the period 1992 to 2003. Their results show that firm productivity is higher in firms with a stable workforce and hence fewer temporary worker. It follows that firms with a lower share of fixed-term employees should have a higher productivity.

At the micro level, Cappellari et al. (2010) use 13,000 firm level observations of all Italian sectors for the period 2004 to 2007 to analyze the effects of deregulation reforms of apprenticeship and fixed-term contract. They find a small negative but only weakly significant effect of the reforms of fixed-term employment on labor productivity and have therefore to reject their hypothesis that reforms in the legislation of fixed-term increase labor productivity. However, this result is in line with the results of the two previously mentioned studies. Finally, Kleinknecht et al. (2006) analyzed the effect of fixed-term employment based on 590 Dutch firm observations. They find no significant effect of the percentage of personnel on temporary contracts on sales growth. In order to check the robustness of this finding, they also split the dataset into R&D active and No R&D active firms. Again, in both subgroups no effect of the use of fixed-term employment on sales growth was found.

This paper contributes to the literature by analyzing the effect of fixed-term employment on labor productivity for German manufacturing firms. In contrast to the aforementioned studies, we control for the inherent selection problem into using fixed-term contracts by means of the inverse Mills ratio, since some firms systematically do not use this instrument. Additionally and like Fuss and Wintr (2009) we apply dynamic panel data models to overcome the potential endogeneity problem. The remainder of the paper is organized as follows. The subsequent chapter discusses related literature and derives the hypothesis. The data are introduced and first descriptive statistics are discussed in section three. The methods used in this study as well as the empirical strategy will be introduced in section four. Further, the results of the empirical analyses are presented in this section, while section five concludes.

2 Theoretical framework

In this section we present theoretical and empirical arguments to explain the relationship between the use of temporary employment and labor productivity. Within the extensive labor market and management literature, we identify three main factors and how they affect labor productivity. The first one is temporary employment as a tool to adjust the employment level on product demand fluctuations. The second one is the screening aspect of temporary employment and the last one argues via firm specific human capital. At the end of this section we

use the different channels to explain how the usage of fixed-term contracts affect labor productivity and present our hypothesis.

Temporary employment and adjustment on demand fluctuations

One important reason for firms to make use of temporary employment is to adjust there employment level on fluctuations of product demand. Houseman (2001) provides results of a survey on reasons to use temporary employment. There adjustment on demand fluctuations is the most important reason for firms to make use of temporary employment. Making use of fixed-term contracts allows firms to reduce their work force when the contract ends without paying firing costs (Saint-Paul, 1996). Bentolila and Saint-Paul (1992) provide a theoretical model predicting the use of flexible labor contracts to adjust labor force on changes of product demand. Nunziata and Staffolani (2007) analyze the impact of firing cost on the use of temporary work. Within their frame work increasing firing cost will lead to an extended use of fixed-term contracts to deal with product demand fluctuations. Empirical evidence for the adjustment argument is found by Vidal and Tigges (2009). Moreover, Houseman (2001) finds a significant relationship between industry seasonality and the probability to make use of temporary work. Using data of establishments in Germany, Hagen (2003) reports that using fixed-term contracts increase the adjustment speed of work force on changes in product demand. Because of a higher flexibility of using fixed-term contracts as a tool to deal with changes in product demand using temporary work should have a positive effect on labor productivity.

Temporary employment and screening

Another main aspect of fixed-term contracts is the fact, that it can be used to screen for new productive worker or to substitute core workers. According to principal agent theory firms can not observe the productivity of potential new employees before hiring them. Wang and Weiss (1998) provides a theoretical model where firms use fixed-term contracts to screen new employees for a certain period. After the screening period the more productive employees will get open end contracts. Using fixed-term contracts to screen potential new employees increases the productivity in two ways. First, during the probation period the

employee has an incentive to increase its effort to get an open end contract at the end of the probation period. Second, providing open end contracts only to the more productive employees after the probation period will in crease the productivity in the long run. Empirical evidence for the screening argument is found by Gerfin et al. (2005) and Addison and Surfield (2009). Morewover, Engellandt and Riphahn (2005) find that employees with a fixed-term contract have a higher probability to work unpaid overtime compared to employees with open end contracts.

For Germany, empirical evidence for the screening argument is reported by Boockmann and Hagen (2008). Gash (2008) find empirical evidence for fixed-term contracts to be a bridge to an open end contract. Moreover, McGinnity et al. (2005) show that fixed-term contracts are especially used as a tool to screen new employees in case of the transition from education to work for West Germany. Overall, empirical evidence for the use of temporary work as a sorting mechanism is given for Germany. However, in the case of Spain, where the labor market is highly segmented between temporary and permanent work, there is no evidence for screening (Amuedo-Dorantes, 2000).

As mentioned above, fixed-term employees can also be used to substitute core workforce. Yet, this strategy is accompanied with negative effects, since it could lead to a decreasing motivation of workers with fixed-term contracts as well as the core employees (Vidal & Tigges, 2009). Less motivation of both types of workers could then result to lower labor productivity (Brown & Sessions, 2005). This effect directly depends on the share of temporary workers on total work force of a firm. If the share of employees with fixed-term contracts is relative high, employees fear a replacement strategy instead of screening and motivation may decrease (Cuyper et al., 2008).

Regarding the screening aspect the effect of fixed-term contracts depends on its share on firm‘s total work force. A moderate use of fixed-term contracts should increase labor productivity due to the screening possibility of newly hired employees. An excessive use could have negative influence on labor productivity because motivation of both types of workers decreases.

Temporary employment and human capital

The last channel is about fixed-term contracts and the incentives to invest in firm specific human capital. Investing in firm specific human capital becomes

profitable in the long run. Hence, if the contract of employees ends after a relative short period, there is little incentive for firms to invest in the firm specific human capital of these employees. Therefore an increasing share of fixed-term contracts on total work force should go in line with decreasing investments in firm specific human capital. Empirical evidence for a negative relationship between temporary work and investing in human capital is reported by Arulampalam et al. (2004). Also Booth et al. (2002) find that employees with temporary jobs receive less training than employees with open ended contracts. Moreover, findings of Shire et al. (2009) suggest that firms offering further training tend to make use of long term contracts rather than temporary employment. The same is reported by Albert et al. (2005). They find that firms, that do not provide vocational training, have higher shares of temporary work compared to firms offering further training. Their results also show, that giving a firm provides on the job training employees with temporary contracts have a lower probability of receiving further training compared to ones with open ended contracts. Regarding the relationship of fixed-term employment and the incentive to invest in human capital, an increasing share of employees with temporary contracts reduced an establishments labor productivity due to lower investments in firm specific human capital.

Temporary employment and labor productivity

Taking together the above discussed channels we expect a nonlinear relationship between the intense of using fixed-term contracts and labor productivity. We find arguments for a positive relationship between the usage of fixed-term contracts and labor productivity as well as negative ones. Therefore the overall effect depends on the share of fixed-term contracts on total work force of an establishment. Using temporary employment as a tool of adjustment on changes in product demand should increase labor productivity. But however, the possibility of this strategy is restricted because an employee with a fixed-term contract could only be fired without paying firing costs when the contract ends. A moderate use of fixed-term employment to screen new potential employees should increase labor productivity, while an extensive use to replace core workers with temporary ones may reduce labor productivity due to less motivation of both types of employees. Regarding human capital an increasing share of fixed-term employees should go in line with decreasing labor productivity, because the incentive to invest in firm specific human capital is lower compared to permanent employees. Com-

bining the above discussed channels how the use of temporary contracts affect labor productivity we expect a non linear maybe inverse U-shaped relationship. A moderate use of fixed-term contracts should increase labor productivity due to increasing flexibility of labor input and the possibility to screen potential new employees. An intensive use should have a negative effect on labor productivity due to less motivation of both types of employees and lower human capital for employees with a fixed-term contract.

3 Data

Sample

The study uses data of the IAB Establishment Panel for the period 2004 to 2009. The data are gathered and compiled by the German Federal Employment Agency (Bundesagentur für Arbeit). It is an annual survey covering about 16.000 establishments per year and it is aimed to be representative both for average and for longitudinal analysis (Fischer et al., 2009). The questionary includes questions on staff development, personnel requirements, sales, investment, exports, but also R&D, innovation and organizational change (Bellmann et al., 2002). In addition, there are explicit questions about different forms of employment that have been used, such as temporary agency work or fixed-term employment. Altogether, the dataset contains about 320 variables, form which, however, most are related to labor market issues.

In order to apply panel models some more data editing is necessary. It must be remembered that the questions within a wave are aimed on different dates and time horizons. The questions regarding the output or the business development are from the past year. In contrast, most of the questions related to the labor input are from the current year. Moreover, while the questions related to the firms output are yearly data, some of the input related questions, as for instance regarding temporary agency worker, are observations at the 30th of June of a year. Hence, data preparation needs to ensure that data from different time horizons are assigned to the correct year and that the later analysis is adequately treating date data and annual data. First, in order to solve the time dimension problem, the procedure proposed by the IAB for assembling the waves has been reworked so that the variables of each wave are assigned to the year the information belongs to. Consequently two observations out of subsequent years are needed to create one

observation for an establishment. Doing this decreases the number of observations dramatically.

Further data cleaning is mainly the exclusion of missing observations. Finally, all observation for non-manufacturing establishments are deleted as well as all observations before 2004 and after 2008. For the latter there are two reasons: First, including data before 2003 might bias the results due to labor market reforms until 2003. Second, with the questionary of the wave of 2009, we have information regarding output variables for 2008 but not for 2009. The output information are merged with the input data of the wave for 2008 and the remaining variables for 2009 are useless. Furthermore, we only included firms with a minimum of five employees. Overall data preparation reduces the number of observations by almost by almost 85,000 to 10,946. Finally, all firms with less than three observations are excluded in the latter analysis in order to apply panel data models. This reduces the number of observations further to 8,821 from 2,244 manufacturing establishments in the period 2004 to 2008.

Measurement of variables

The dependent variable in the analysis is the log of labor productivity (LaborProd), which is calculated as real sales per capita. The deflation was done using sectoral producer price indices of the OECD for Germany. The regressor of interest is the log of the share of fixed-term employed on total employees (Share). Here, neither the number of temporary agency workers nor interns are taken into account. The reason is that both numbers are asked for as date data. We know, however, that the job duration of fifty percent of all temporary agency workers in client firms is less than 3 month. Interns in Germany work something between one and six month. Hence, although we might find temporary agency workers or interns at the 30th of June, it is highly possible that they have not been in the firms in the beginning of a year and that they will not be there until the end of a year. Simply adding them to the number of employees would therefore cause the analyses to be biased. For the so-constructed variable, we expect the coefficients of Share to be significantly positive if the theoretical remarks of section two hold true. Moreover, since the effect might be non-linear, the variable is also included in the analyses with its squared values (Share2) and the respective coefficient is expected to be negative.

In addition to these regressors, we included the logarithms of the following

control variables: the overall number of employees to capture the size of the firms (Size); the proportion of intermediate inputs on sales (Intermediate) to capture the position of the firms in the value chain; the share of qualified employees on total labor force (Qualified) to catch the human capital intensity of production; the share of woman in the company (Female) as an additional control variable for the employment structure; the share of exports on sales (Export) to take into account the range of business activities of firms; and finally the investments per capita (Investment), which capture investments in ICT capital, production equipment, buildings and the like, as proxy for the capital intensity of production.

Additional control variables in the analyses are the following dummy variables: the age of the companies (Age1-Age5) for companies with an age of less than five years, five to nine years, ten to fourteen years, fifteen to nineteen years and of twenty and more years; a dummy variable that becomes one if a company has closed a part of the firm within the last year (Closed); a dummy variable if a part of the firm was outsourced (Outsourced); if a spin-off has taken place (Spin); a dummy variable that becomes one if a part of another company was integrated (Integrated); dummy variables if the majority owner is East German (Owned1), West German (Owned2), a foreigner (Owned3), is the state (Owned4), has no majority owner (Owned5) or if the majority owner is unknown (Owned6); dummy variables for each of the sixteen industries in the analyses; as well as sixteen dummy variables for federal states the establishments are located in; six dummy variables for the legal form of the companies (LegalForm1-LegalForm6) which are individual enterprise, partnerships, Inc., capital companies, corporation and others; dummy variables for companies with sectoral collective agreement, company collective agreement and no collective agreement (Tarif1-Tarif3); and a dummy variable taking the value of one if a company has a work council (WorkConcil).

Table 1 provides descriptive statistics for all continuous explanatory variables and for the dependent variable labor productivity, distinguishing between within and between variation and Table 2 contains simple descriptive statistics for the dummy variables. For most variables between variation exceeds within variation. Interestingly for the share variable the between variation is only a little higher. Hence, the share of fixed-term employees changed considerably over time and does not vary only between establishments.

Table 3 reveals the regional distribution of observations and Table 4 contains the descriptive statistics of the share of fixed-term employment per industry. From Table 3 it can be seen that 4398 establishments are located in west Ger-

many, while 4138 are located in east Germany and Berlin is the location of 285 establishments. The mean share is rather low, ranging from 2 to 5 percent in the entire data set. But among those firms that used fixed-term employment, the mean ranges from 5.5 to 13 percent. Moreover, the maximum share ranges from 26 to almost 100 percent. Thus, fixed-term employment is a significant input factor and occasionally also used heavily. Finally, since some firms have never used this instrument, the analysis is subject to a selection problem.

4 Empirical investigation

The analysis of the relationship between the use of fixed-term contracts and labor productivity is done in three steps. First we present our estimation strategy. The next subsection contains the main results and the last subsection shows some robustness checks.

Methods and empirical strategy

To control for the potential self-selection into the use of fixed-term contracts, the empirical estimation starts with the estimation of a probit selection model. The dependent variable takes the value of one if a company uses fixed-term contracts and zero otherwise. Based on the result of the probit model we calculate the inverse Mills ratio. This ratio is then used as an additional variable in the regression models to control for the selection effect. For detailed discussion of this approach see Briggs (2004). To increase identification of the model and to avoid potential multicollinearity between the inverse Mills ratio and the explanatory variables of the regression models we exclude some variables used in the selection model from the regression models in the second stage, as proposed by Puhani (2000).

The actual estimation strategy is as follows: To get a first impression of how the use of fixed-term contracts and labor productivity are related, we start with estimating a simple OLS regression model. In order o exploit the panel structure of the data and to control for correlation between unobserved fixed effects and the explanatory variables we apply a fixed effect regression model. Finally we estimate two specifications of a system GMM model to account for dynamic effects and possible endogeneity of explanatory variables. To overcome the potential weak instrument problem of the first difference GMM estimator

proposed by Arellano and Bond (1991), we apply the system GMM estimator implemented by Arellano and Bover (1995) and by Blundell and Bond (1998). In the first specification, all explanatory variables are treated as exogenous. In the second specification, both share variables and the export variable are treated as potentially endogeneous. To overcome this potential correlation between these variables and current error terms, we model them to be predetermined. Thus, they are still potentially correlated with past error terms but not with current ones.

For a first robustness check the fixed effects model and both system GMM specifications are estimated without controlling for the inherent selection effect and for a sub sample containing only firms making use of fixed-term employment. To take into account differences between West and East Germany, we apply separate estimations for both groups. This estimations again cover the fixed effects model and both system GMM specifications.

Estimation results

The analysis starts by calculating the inverse Mills ratio to account for potential self-selection into the use of fixed-term contracts. The corresponding estimation results of the probit model are outlined in column one of Table 5. In accordance with Kleinknecht et al. (2006), we find a positive coefficient for firm size and a negative one for the share of highly qualified employees.

The actual analysis of the relationship between labor productivity and the share of fixed-term employees in total workforce starts with an OLS model in column two, followed by a fixed effects model in column three of Table 5. In both estimates, we find a positive but insignificant coefficient for the Share variable and a negative and weakly significant coefficient for the squared Share variable. Hence, the results rather indicate the existence of a weakly negative relationship between labor productivity and the use of fixed-term employment than the existence of an inverse U-shaped relationship. Column 4 and 5 contain the estimates of the system GMM approaches. In column 4, all regressors are modeled as exogenous, except the lagged dependent Variable, while in the second system GMM model, the Share variables as well as the export intensity are modeled to be predetermined. We treat both Share variables this way in order to check whether previous results are affected by potential endogeneity. Further, export intensity might also be endogenous, since it is still debated whether exporting

firms are more productive, or if they become more productive by starting to export. In both estimates, however, we find insignificant coefficients for Share and Share squared. This implies, first, that the imposed U-shaped relationship is rejected by both estimations and second, that the potentially negative but weak relationship, as found in OLS and the fixed effect model, finds also no support.

In general the results of our basic models do not support the hypothesis of an inverse U-shaped relationship between the share of fixed-term employees on total work force an labor productivity. The OLS model and the fixed effects model suggest a negative relationship between both, but the respective coefficients are only weakly significant. Using dynamic panel data models suggest no significant productivity effects for the share of employees with fixed-term contracts on total work force of an establishment.

With respect to the remaining control variables, firm size is found to have negative and positive parameters depending on the applied empirical method. In contrast, we find Intermediate intensity to have a positive effect on labor productivity in all estimates. This, however, might only control for the effect that higher turnovers are generated by using more intermediate inputs, which translates into higher productivity here, since labor productivity is defined as sales per capita. Another variable with significant coefficients in all models is Export. Hence, firms with a higher share on turnover abroad have a higher productivity. This remains, even if we model export intensity as predetermined. Moreover, a rising share of qualified does also increase the productivity. Only in the fixed effect model, the respective coefficient is not significant. The coefficient of the variable female which measures the share of females on total work force is negative and significant in all models except the fixed effects model where the respective coefficient is not significant. Hence, since we find no effect of the female variable in the within estimation, the share of female employees on workforce does not have any effect on labor productivity.

With respect to the selection effect, we find the expected. The coefficient of the inverse Mills ratio is significant in the OLS and the fixed effect approach. Hence, the estimation results are subject to a selection effect. Moreover, the coefficients in the System GMM approach are not significant. This is what we would expect, since by including the lagged dependent variable in the regression, a part of the distortion resulting from the selection is already taken into account.

Robustness checks

For an initial robustness check of the results in Table 5 we estimate the same models, except for OLS, but without taking the selection problem into account. The results of the fixed effect regression and the system GMM estimates are shown in column one to three of Table 6. The results of the latter two estimates confirm the previous findings. Neither the Share nor the squared Share variables are found to have an effect on labor productivity. Interestingly, however, the fixed effects model finds the proposed U-shaped relationship. Moreover, the results of the fixed effect estimation including the inverse Mills ratio (Table 4) look quite similar, even if they are not significant. But since we find no significant relationship in the system GMM estimates, as well as in the fixed effect regression that is estimates with the inverse Mills ratio, the significant U-shaped relationship in column one of Table 6 seems to be a result of the selection bias. Hence, we can confirm the existence of a selection effect. A further robustness check is carried out by reducing the sample to those firms that actually used fixed-term employment. The results of the fixed effect and the system GMM estimations are shown in column four to six. The results show, that even among firms that used this instrument, the hypothesis of an inverse U-shaped relationship between labor productivity and fixed-term employment cannot be confirmed. Rather, the results indicate a slightly negative effect, as in Table 5.

A final robustness check is carried out by running separate regression models for West and East Germany. For this robustness check all establishments located in Berlin are excluded, because it is not possible to assign them to West or East Germany in an adequate way. For each subsample one fixed effects specification and two system GMM models are estimated. The first three columns provide the results for West Germany and the results for East Germany are shown in column four to six. With respect to our hypothesis it must be noted, that all estimates reject the existence of an inverse U-shaped relationship between the intensity of using fixed-term employment and labor productivity.

It follows, that our hypothesis finds no support and this result is robust regardless of whether we account for the potential endogeneity resulting from a correlation between explanatory variables and past error terms of regressors or not and regardless of the subsample we look at. However, the analysis has also shown that the selection effect plays a role and can potentially lead to false conclusions.

5 Conclusion

In this study the relationship between the use of fixed-term employment and labor productivity is investigated. The existing literature provides theoretical and empirical arguments for a positive relationship as well as for a negative one. Therefore a nonlinear, maybe U-shaped relationship between both variables is expected. Our empirical findings provide no support for this hypothesis. Regressing labor productivity on the share of fixed-term employees on total work force of an establishment and its quadratic term leads to no significant coefficients for both variables in most regression models. Using fixed effects regression models allows to control for establishment specific fixed effects. Moreover, applying system GMM dynamic panel data models take into account dynamic effects and potential endogeneity resulting from a correlation between explanatory variables and past error terms. Potential selection into the use of fixed-term contracts is taken into account by using the two stage approach, where in the first stage the inverse Mills ration based on a probit model is calculated and is included in the second stage regression models. Regardless of the applied estimation method the hypothesis of an inverse U-shaped relationship is not confirmed.

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Table 1: Descriptive statistics: Continuous variables

Variable		Mean	Std. Dev.	Min	Max		N
LaborProd	overall	151081.1	184353.7	76.90006	2724388	N =	8821
	between		175463.7	7563.579	2220908	n =	2244
	within		44059.42	-460589.9	1190973	T-bar =	3.93093
Size	overall	232.8643	1266.344	5	46140	N =	8821
	between		1461.085	5	45024.67	n =	2244
	within		57.42949	-1492.136	2100.664	T-bar =	3.93093
Share	overall	0.0368188	0.075392	0	0.9931973	N =	8821
	between		0.060969	0	0.6739306	n =	2244
	within		0.0477061	-0.4767121	0.7685261	T-bar =	3.93093
Qualified	overall	0.7053579	0.2323985	0	1	N =	8821
	between		0.2116456	0	1	n =	2244
	within		0.1019511	-0.0225833	1.399197	T-bar =	3.93093
Woman	overall	0.2762162	0.2160087	0	1	N =	8821
	between		0.2120015	0	1	n =	2244
	within		0.0503991	-0.1737838	0.8018603	T-bar =	3.93093
Export	overall	0.1902857	0.2577416	0	1	N =	8821
	between		0.2496643	0	1	n =	2244
	within		0.0688229	-0.3597143	0.9102857	T-bar =	3.93093
Investment	overall	5907.227	14783.66	0	714285.7	N =	8821
	between		12510.8	0	410714.3	n =	2244
	within		10200.61	-297664.2	309478.6	T-bar =	3.93093
Intermediate	overall	52.73359	19.10919	1	100	N =	8821
	between		17.27207	3.8	100	n =	2244
	within		9.052377	5.98359	106.0669	T-bar =	3.93093

Table 2: Descriptive statistics: Dummy variables

Variable	Mean	Std. Dev.	Min	Max	N
Age1	0.0457998	0.2090625	0	1	8821
Age2	0.0887654	0.284421	0	1	8821
Age3	0.1904546	0.392682	0	1	8821
Age4	0.1300306	0.3363562	0	1	8821
Age5	0.5449496	0.4980037	0	1	8821
Closed	0.0124702	0.1109781	0	1	8821
Outsourced	0.0133772	0.11489	0	1	8821
Spin	0.0070287	0.0835468	0	1	8821
Integrated	0.025734	0.1583498	0	1	8821
Owned1	0.2998526	0.4582192	0	1	8821
Owned2	0.5711371	0.4949417	0	1	8821
Owned3	0.0997619	0.2996993	0	1	8821
Owned4	/	/	/	/	/
Owned5	0.0179118	0.1326385	0	1	8821
Owned6	0.0091826	0.0953905	0	1	8821
LegalForm1	0.1616597	0.3681592	0	1	8821
LegalForm2	0.033783	0.1806805	0	1	8821
LegalForm3	0.7594377	0.4274492	0	1	8821
LegalForm4	0.0382043	0.1917	0	1	8821
LegalForm5	/	/	/	/	/
LegalForm6	0.0054416	0.0735701	0	1	8821
East	0.5068586	0.4999813	0	1	8821
Tarif1	0.3739939	0.4838895	0	1	8821
Tarif2	0.0938669	0.29166	0	1	8821
Tarif3	0.5321392	0.4989943	0	1	8821
WorkConcil	0.3998413	0.4898933	0	1	8821

Notes: Due to the private policy rules of the IAB, the desciptive statistics of some varibales are not publishable due to the small number of cases in the respective subgroups

Table 3: Descriptive statistics: Federal states

State	N	Percent
Schleswig-Holstein	186	2.11
Hamburg	60	0.68
Lower Saxony	766	8.68
Bremen	198	2.24
North Rhine-Westphalia	845	9.58
Hesse	468	5.31
Baden-Wrttemberg	785	8.9
Bavaria	606	6.87
Saarland	135	1.53
Rhineland-Palatinate	349	3.96
West	4,398	49.86
Berlin	285	3.23
Brandenburg	595	6.75
Mecklenburg-Vorpommern	390	4.42
Saxony	1,211	13.73
Saxony-Anhalt	776	8.8
Thuringia	1,166	13.22
East	4,138	46.91
Total	8,821	100

Table 4: Descriptive statistics: Share per industry

	all firms					only firms using fixed-term contracts				
Industry	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
food/luxury	955	0.0448	0.0996	0.0000	0.9500	439	0.0975	0.1284	0.0034	0.9500
textiles/clothing	273	0.0350	0.0674	0.0000	0.4348	127	0.0753	0.0821	0.0034	0.4348
paper/printing/	453	0.0272	0.0670	0.0000	0.8451	199	0.0619	0.0900	0.0016	0.8451
wood sector	480	0.0300	0.0862	0.0000	0.9756	143	0.1009	0.1338	0.0062	0.9756
chemical/pharmazeutical sector	522	0.0414	0.0700	0.0000	0.6000	309	0.0699	0.0793	0.0022	0.6000
plastics industry	484	0.0464	0.0733	0.0000	0.8667	312	0.0721	0.0805	0.0025	0.8667
glass/stones/ore extraction	485	0.0448	0.0830	0.0000	0.6667	235	0.0924	0.0992	0.0011	0.6667
manufacture of basic metals	649	0.0427	0.0858	0.0000	0.9932	359	0.0772	0.1033	0.0005	0.9932
recycling	93	0.0381	0.0826	0.0000	0.4500	27	0.1313	0.1070	0.0152	0.4500
manufacture of fabricated metal	1203	0.0319	0.0528	0.0000	0.4688	541	0.0710	0.0585	0.0020	0.4688
machinery and equipment	1288	0.0281	0.0457	0.0000	0.4286	696	0.0520	0.0511	0.0009	0.4286
motor vehicles, trailers and semitrailers	366	0.0484	0.0645	0.0000	0.3804	245	0.0724	0.0670	0.0013	0.3804
other vehicle production	148	0.0491	0.1209	0.0000	0.8333	83	0.0876	0.1510	0.0021	0.8333
manufacture of electrical equipment	594	0.0389	0.0710	0.0000	0.5238	306	0.0755	0.0839	0.0025	0.5238
precision and optical equipment	524	0.0207	0.0391	0.0000	0.2642	195	0.0557	0.0466	0.0026	0.2642
furniture, jewellery/toys	304	0.0495	0.1388	0.0000	0.9524	121	0.1243	0.1981	0.0029	0.9524

Table 5: Estimation results with controlling for the selection into fixed-term employment via inverse Mills ratio

Variable	1	2	3	4	5
L1 LaborProd				0.4321***	0.4482***
				(0.0887)	(0.0722)
Share		0.2182	0.2083	0.0027	-0.0044
		(0.1897)	(0.127)	(0.3363)	(0.2686)
Share2		-2.1818**	-1.3218*	-0.8666	-1.2378
		(1.0678)	(0.6896)	(1.0163)	(1.2448)
Size	0.6076***	0.0468***	-0.3484***	0.0292	-0.0058
	(0.0215)	(0.0076)	(0.044)	(0.1216)	(0.0502)
Intermediate	0.1020**	0.4059***	0.0348**	0.2041***	0.2008***
	(0.0404)	(0.0169)	(0.0135)	(0.0263)	(0.0257)
Qualified	-0.3933***	0.4627***	0.0453	0.2546***	0.2588***
	(0.1246)	(0.0538)	(0.038)	(0.0798)	(0.0632)
Female	0.2093	-0.9952***	-0.0400	-0.5732***	-0.5549***
	(0.1349)	(0.0554)	(0.0823)	(0.1231)	(0.0894)
Export	0.3215***	0.5122***	0.2853***	0.3528***	0.4402***
	(0.1027)	(0.044)	(0.0643)	(0.106)	(0.1464)
Investment	0.0201***	0.0219***	0.0044***	0.0068	0.0089**
	(0.0049)	(0.002)	(0.0012)	(0.0088)	(0.004)
Closed		-0.1304**	0.0251	0.0348	0.0471
		(0.0532)	(0.0291)	(0.054)	(0.0413)
Outsourced		0.0452	-0.0309	0.0356	0.0344
		(0.0602)	(0.0312)	(0.0472)	(0.0431)
Spin		0.0808	0.0762**	0.1026*	0.0992
		(0.0764)	(0.0326)	(0.062)	(0.0629)
Integrated		0.0529	0.0065	-0.0469	-0.0489
		(0.0405)	(0.0209)	(0.0325)	(0.0321)
Mills		0.0979***	0.4056***	0.0544	0.3692
		(0.0241)	(0.0918)	(1.2618)	(0.496)
Age Dummies	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Federal State Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Legal Status Dummies	Yes	Yes	Yes	Yes	Yes
Ownership Dummies	Yes	Yes	Yes	Yes	Yes
Collective Agreement	Yes	No	No	No	No
Work Council	Yes	Yes	Yes	Yes	Yes
constant	-2.849***	8.8645***	11.8994***	5.1643*	4.4982***
	(0.2378)	(0.1055)	(0.3359)	(2.7049)	(1.093)
No. of observations	8821	8821	8821	6224	6224
No. ID			2244	2124	2124
(Pseudo) R-squared	0.3211	0.5164	0.1276		
Wald chi2	2538.34			8146.84	7219.44
No. of instruments				65	77
Hansen test p-value				0.292	0.096
AR(2) test p-value				0.766	0.829

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Column (1): Probit; Column (2): OLS; Column (3): FE; Column (4): SysGMM exogen; Column (5): SysGMM predet.

Table 6: Estimation results without controlling for selection effects and only using firms that uses fixed-term employment

Variable	1	2	3	4	5	6
L1 LaborProd		0.4296***	0.4326***		0.4808***	0.4884***
		(0.0757)	(0.0745)		(0.0721)	(0.0712)
Share	0.2707**	-0.0102	-0.0401	0.1971	-0.1230	-0.1225
	(0.1256)	(0.1425)	(0.2558)	(0.1254)	(0.1395)	(0.2432)
Share2	-1.5777**	-0.8360	-1.1476	-1.3703**	-0.4483	-0.8886
	(0.6857)	(0.6879)	(1.2580)	(0.6722)	(0.6611)	(1.1704)
Size	-0.3695***	0.0345***	0.0308**	-0.3066***	0.0289***	0.0206*
	(0.0418)	(0.0101)	(0.0123)	(0.0550)	(0.0098)	(0.0118)
Intermediate	0.0301**	0.2044***	0.2026***	0.0446***	0.2109***	0.2060***
	(0.0135)	(0.0262)	(0.0262)	(0.0167)	(0.0299)	(0.0296)
Qualified	0.0480	0.2523***	0.2448***	0.0756	0.2139***	0.1986***
	(0.0377)	(0.0582)	(0.0592)	(0.0467)	(0.0595)	(0.0602)
Female	-0.0607	-0.5771***	-0.5789***	-0.0891	-0.5208***	-0.5266***
	(0.0808)	(0.0926)	(0.0915)	(0.0963)	(0.0963)	(0.0977)
Export	0.3021***	0.3570***	0.4395***	0.3080***	0.3379***	0.4957***
	(0.0650)	(0.0636)	(0.1431)	(0.0711)	(0.0684)	(0.1561)
Investment	0.0025**	0.0065***	0.0064***	0.0047***	0.0067***	0.0064***
	(0.0011)	(0.0018)	(0.0018)	(0.0014)	(0.0020)	(0.0020)
Closed	0.0185	0.0331	0.0348	0.0390	0.0524	0.0557
	(0.0285)	(0.0407)	(0.0408)	(0.0314)	(0.0448)	(0.0446)
Outsourced	-0.0371	0.0363	0.0389	-0.0363	0.0376	0.0420
	(0.0329)	(0.0430)	(0.0430)	(0.0351)	(0.0448)	(0.0446)
Spin	0.0787**	0.1030*	0.1022*	0.0787**	0.0835	0.0823
	(0.0318)	(0.0610)	(0.0605)	(0.0373)	(0.0726)	(0.0717)
Integrated	0.0106	-0.0464	-0.0463	0.0037	-0.0476	-0.0485
	(0.0211)	(0.0314)	(0.0315)	(0.0247)	(0.0356)	(0.0358)
Age Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Federal State Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Legal Status Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Ownership Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Work Council	Yes	Yes	Yes	Yes	Yes	Yes
constant	13.1218***	5.2810***	5.2731***	13.0638***	4.7271***	4.7036***
	(0.2061)	(0.7279)	(0.7131)	(0.2980)	(0.6945)	(0.6880)
No. of observations	8821	6224	6224	6265	4460	4460
No. ID	2244	2124	2124	1570	1500	1500
R-squared	0.1175			0.1328		
Wald chi2		8109.55	7959.76		6442.44	6339.10
No. of instruments		65	77		65	77
Hansen test p-value		0.435	0.058		0.507	0.218
AR(2) test p-value		0.757	0.752		0.898	0.899

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Column (1): FE; Column (2): SysGMM exogen; Column (3): SysGMM predet.; Column (4): FE; Column (5): SysGMM exogen; Column (6): SysGMM predet.

Table 7: Estimation results for West and East Germany

Variable	1	2	3	4	5	6
L1 LaborProd		0.4681***	0.5471***		0.3639***	0.3535***
		(0.1516)	(0.0822)		(0.1182)	(0.1160)
Share	0.1505	-0.8429	-0.5958*	0.2228	0.2670	0.4523
	(0.1402)	(1.0447)	(0.3325)	(0.1735)	(0.3740)	(0.4537)
Share2	-0.5887	1.5623	2.4841	-1.6503*	-1.3399	-2.9330*
	(0.6126)	(3.5219)	(2.1071)	(0.8669)	(1.3700)	(1.5978)
Size	-0.4625***	0.2851	0.0407	-0.2110***	-0.0178	-0.0164
	(0.0573)	(0.3301)	(0.0938)	(0.0560)	(0.0687)	(0.0457)
Intermediate	0.0135	0.1745***	0.1686***	0.0529**	0.2525***	0.2412***
	(0.0160)	(0.0477)	(0.0283)	(0.0220)	(0.0521)	(0.0461)
Qualified	0.0161	0.1080	0.1321**	0.0705	0.4737***	0.4190***
	(0.0503)	(0.1107)	(0.0623)	(0.0531)	(0.1613)	(0.1204)
Female	-0.0897	-0.4819***	-0.4254***	-0.0069	-0.4544**	-0.5479***
	(0.1063)	(0.1810)	(0.1048)	(0.1257)	(0.2526)	(0.1696)
Export	0.2564***	0.4251*	0.2722*	0.2692***	0.3245**	0.8026***
	(0.0919)	(0.2280)	(0.1611)	(0.0872)	(0.1651)	(0.3015)
Investment	0.0024	-0.0066	0.0024	0.0065***	0.0275*	0.0221***
	(0.0015)	(0.0120)	(0.0040)	(0.0017)	(0.0148)	(0.0079)
Closed	-0.0039	-0.0854	-0.0154	0.0658	0.1529*	0.1271*
	(0.0341)	(0.1079)	(0.0453)	(0.0520)	(0.0986)	(0.0742)
Outsourced	-0.0613	0.0130	0.0045	0.0005	0.0161	0.0294
	(0.0405)	(0.0709)	(0.0504)	(0.0301)	(0.0982)	(0.0878)
Spin	0.0992**	0.0896	0.0989	0.0468	0.0756	0.0793
	(0.0435)	(0.1082)	(0.1069)	(0.0498)	(0.1302)	(0.1048)
Integrated	-0.0143	-0.0671	-0.0804*	0.0275	0.0199	0.0257
	(0.0248)	(0.0651)	(0.0437)	(0.0325)	(0.0660)	(0.0609)
Mills	0.3921***	-1.8329	-0.1209	0.5173***	2.6205	1.8873**
	(0.1194)	(2.2856)	(0.6291)	(0.1286)	(1.9841)	(0.9268)
Age Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Federal State Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Legal Status Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Ownership Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Work Council	Yes	Yes	Yes	Yes	Yes	Yes
constant	13.0308***	7.8484*	4.6868***	10.9176***	0.8333	2.4163
	(0.4405)	(4.3703)	(1.4106)	(0.4310)	(3.8827)	(1.7937)
No. of observations	4398	3054	3054	4138	2972	2972
No. ID	1141	1073	1073	1029	982	982
R-squared	0.1833			0.1269		
Wald chi2		2759.79	12039.14		2803.07	2650.22
No. of instruments		59	71		54	66
Hansen test p-value		0.863	0.627		0.216	0.111
AR(2) test p-value		0.039	0.037		0.664	0.721

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Column (1): FE West; Column (2): SysGMM exogen West; Column (3): SysGMM predet. West; Column (4): FE East; Column (5): SysGMM exogen East; Column (6): SysGMM predet. East