Temporary Agency Work and the User Firm's Productivity

First Evidence from German Panel Data*

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Abstract: This paper investigates the relationship between the use of temporary agency work and the user firm's productivity. We hypothesise that modest use enhances numerical flexibility and thus productivity, while excessive use primarily aims at circumventing costly labour market regulations at the expense of firms' labour relations and productivity. In contrast to the sparse existing literature on this issue, we apply a large panel data set and fixed effects techniques. We find a robust hump-shaped relationship between the extent of temporary agency work use and the user firm's productivity, which corroborates our hypotheses.

Keywords: temporary agency work, firm productivity, flexible labour

New JEL-Classification: J50, L22, L23

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1 Introduction

In recent years, there has been a substantial gain of interest in and much controversy on flexible forms of labour. In particular, a special focus has been laid on strategies that aim at numerical flexibility of labour utilisation. Due to its rapid worldwide growth and its significant deregulation in many countries, temporary agency work (TAW) is at the heart of this debate. Typical research questions include, among others, the determinants of TAW use (e.g., Houseman, 2001; Houseman *et al.*, 2003; Mitlacher, 2007; Vidal and Tigges, 2009), whether TAW is a stepping stone to regular employment (e.g., Autor and Houseman, 2006; Ichino *et al.*, 2008; Kvasnicka, 2009), or whether there exists a wage penalty for temps (e.g., Segal and Sullivan, 1998; Forde and Slater, 2005; Jahn, 2010).

While the potential for realising cost reductions is one of the main reasons given for the use of TAW (e.g., Houseman, 2001; Oberst *et al.*, 2007), up to now there exists almost no evidence on the effects of TAW on the user firm's productivity. This comes at a surprise since both productivity and cost considerations are interchangeable in firms' profit-maximising rationale and since the direction of the productivity effect is unclear: Whereas gains in numerical flexibility following TAW use are arguably likely to increase the user firm's productivity, using TAW as a cost-cutting instrument, in particular for circumventing costly labour market regulations, may come at the expense of lowered productivity. Therefore, it is questionable whether TAW is just a low-road strategy of bidding down labour cost with negative effects on labour relations and productivity, or rather a productivity-enhancing instrument to meet flexibility requirements. Investigating the relationship between the extent of TAW use and the user firm's productivity is crucial in providing an answer to this question.

The few existing studies by Arvanitis (2005), Bryson (2007), and Kleinknecht *et al.* (2006) obtain rather mixed productivity results. This paper is intended to improve on these earlier studies in at least two ways: While none of these studies attempts to control for unobserved firm heterogeneity in TAW use, our large German panel data set allows us to apply fixed effects estimation techniques and thus to

arrive at more reliable results. In contrast to these studies, we also allow for a flexible relationship between the extent of TAW use and the user firm's productivity because our theoretical considerations suggest the effect to be hump-shaped rather than linear.

The paper is organised as follows: Section 2 presents some basic facts about TAW in Germany. Section 3 derives our hypotheses about the impact of TAW use on the user firm's productivity and shortly reviews the existing (sparse) empirical literature. Section 4 describes our data set and presents some descriptive evidence on TAW use in our sample. Our results are presented and discussed in Section 5, and Section 6 concludes.

2 Institutional Backdrop

Like in most countries worldwide, the German temporary work industry has grown considerably in the last years.[1] The number of employed full-time equivalent workers has roughly quadrupled since 1998 and doubled since 2004. In 2008, 9,465 temporary work agencies employed 760,000 full-time equivalent workers which amounted to about 2.0 per cent of the total active working population of Germany (cf. CIETT, 2010). This number is slightly above the European average of 1.7 per cent, so that Germany cannot be longer regarded as a small market for TAW compared to other countries.[2] In Germany, temps are predominantly male, concentrated in manufacturing, are typically poorly qualified (cf. Antoni and Jahn, 2009), and earn considerably less than perms (cf. Jahn, 2010). Though durations of both assignments to user firms and employment at agencies are rather short (cf. Antoni and Jahn, 2009), the former are nonetheless rather long by international comparison (cf. CIETT, 2010).

[1] Most recently, though, there has been a slackening of the pace of growth and apparently even a small reversion as Germany was hit by the current economic downturn (cf. Federal Employment Agency, 2010).

[2] For comparison, the share of temporary agency workers in the total active working population in 2008 is, for example, 4.1 per cent in the UK, 2.9 per cent in the Netherlands, 2.3 per cent in France, 2.2 per cent in Japan, and 1.7 per cent in the U.S. (cf. CIETT, 2010).

One of the main reasons for the rapid growth in TAW in Germany is seen in the massive relaxation of legal hindrances to TAW use (e.g., Mitlacher, 2007; Antoni and Jahn, 2009). In Germany – as in most European countries –, TAW had been heavily regulated in the past, but saw a widespread deregulation in recent years. When legalising TAW in 1972, the Temporary Employment Agencies Act (*Arbeitnehmerüberlassungsgesetz*), which is the national law governing TAW in Germany, included strict regulations. This holds particularly with respect to the employment contract between the temp and the agency, which is the temp's employer hiring out the worker to the user firm. Among these regulations, there were a maximum period of assignment, a prohibition of fixed-term contracts, a ban on re-employment as well as a synchronisation ban, and – from 2002 onwards – a principle of equal treatment between temps and perms in the user firms.[3] Since the 1990s, however, there have been repeated reforms that deregulated TAW markedly. In particular, the latest reform in 2003 allowed agencies to free themselves from any of these regulations by signing sectoral collective agreements defining, among others, collectively agreed sectoral minimum wages for temps covered by the agreement, which almost all of the agencies did. Consequently, all regulations stipulated in the Temporary Employment Agencies Act ceased to have any virtual impact (cf. Antoni and Jahn, 2009).

Apart from the elimination of legal hindrances to TAW use, Germany's by international comparison rather heavily regulated labour market (e.g., OECD, 2004) provides firms with another incentive to use TAW as a means of circumventing regulations, such as strict dismissal protection (e.g., Jahn, 2009) and significant restraints on fixed-term contracts (e.g., Mitlacher, 2007), that make labour adjustments costly. It is important to bear this in mind when hypothesising about the likely impact of TAW use on the user firm's productivity.

[3] For details we refer to Antoni and Jahn (2009). For a comparison of TAW regulation and characteristics in Germany and the U.S., see Mitlacher (2007).

3 Theoretical Considerations and Review of the Literature

Apart from institutional factors influencing firms' decision to utilise TAW, one of the main reasons for employing temps is seen in the firms' attempt to meet flexibility requirements, where TAW can serve as an effective means of achieving numerical flexibility.[4] It allows firms to handle variability in demand, to buffer their regular workforce during downturns thus allowing them to sustain internal labour markets, and to carry on production when regular workers are temporarily absent. For instance, worker absenteeism is not only likely to affect productivity by underutilisation of machines, but also by thwarting other workers relying on the absentee's input. Hence, TAW may help the firm to avoid situations of underutilised capital and/or labour, thus increasing output per worker. The gain in flexibility and the reduced frictions in operational sequences following TAW use should therefore add to the user firm's productivity. Moreover, the user firm may utilise TAW as a means of screening workers before offering them a permanent job (cf. Autor, 2001), which should improve the productivity of hired perms. These two effects, however, are likely to play a minor role in firms with high shares of temps in their workforces as these already have achieved a high degree of numerical flexibility and possess several screening opportunities.

On the other hand, temps are likely to be less productive because of their lower level of specific (and also general) human capital and their potentially low commitment to the user firm. As already discussed above, TAW may also be used to circumvent labour market regulations. Hence, these firms should substitute temps for perms and make broad use of TAW which is likely to lower the motivation and commitment of perms and thus the user firm's productivity as well. We expect the latter effect to be more substantial if temps make up a large part of the firm's workforce.[5]

[4] For a detailed discussion of numerical flexibility and its different forms, see Vidal and Tigges (2009).

[5] Yet, one may also argue that temporary agency work is used as a stick to threaten perms and may thus enhance their productivity (e.g., Bryson, 2007). Hence, it is less clear whether the

In sum, we therefore expect a hump-shaped relationship between TAW use and the user firm's productivity: While modest use may add significantly to its productivity by enhancing numerical flexibility and thus allocative efficiency, more excessive use may harm the overall productivity of the firm's workforce by reducing its human and social capital.[6]

Up to now, there exist only few studies investigating the relationship between TAW use and the user firm's productivity, which obtain rather mixed results.[7] The main reason for this lack of evidence probably is that data on TAW use are typically absent from enterprise data sets. Arvanitis (2005) presents evidence for Switzerland finding a positive, but insignificant effect of TAW use on average labour productivity. However, he has only cross-sectional data and is only able to utilise information on the importance of TAW use in the user firm on a five-point scale. Bryson's (2007) study uses nationally representative cross-sectional data from the UK and arrives at mixed results. He finds that TAW presence has a significantly positive effect on the sales per worker, but no impact on a subjective measure of workplace productivity and the value added per employee. Finally, Kleinknecht *et al.* (2006) make use of a small panel data set for the Netherlands. In pooled regressions, they get an insignificantly positive overall impact on firms' percentage growth rate of sales. Interestingly, they find a significantly positive effect for firms with some R&D activities and a negative one for those without. Discussing their results, they argue that innovating firms seem to utilise temps for covering temporary labour shortages, whilst non-innovating firms use them as a substitute for perms.

While the latter argument seems plausible and consistent with our argument in favour of a hump-shaped relationship, none of these studies allows for such

effect of substantial TAW use is necessarily negative. It is therefore especially important to allow for a flexible relationship between the extent of TAW use and the user firm's productivity as will be done in our empirical analysis.

6 Note that this does not imply that the firm's profits are lowered since TAW may be cost-reducing. For example, a recent case study using personnel data of a German firm finds that costs per hour are 29 per cent lower for temps than for perms with similar characteristics (cf. Oberst *et al.*, 2007), emphasising potential cost-saving effects of TAW use.

7 For a review of the empirical literature on the relationship of other forms of numerical flexibility than TAW and productivity, see, e.g., Arvanitis (2005).

a relationship as the extent of TAW use either enters linearly (Kleinknecht *et al.*, 2006) or as dummy (Arvanitis, 2005) or a group of only two dummy variables (Bryson, 2007). What is more, none of these studies is able to make use of a fixed effects estimator to get rid of time-invariant unobserved heterogeneity at the firm level, which is of prime importance to dispel or at least alleviate endogeneity concerns regarding the use of TAW. We intend to improve on both these points by making use of a large German panel data set (the IAB Establishment Panel) and fixed effects estimators and by explicitly allowing for a hump-shaped relationship between TAW use and the user firm's productivity.[8] Similar in spirit to Kleinknecht *et al.*'s point, we shall argue that modest TAW use is likely to yield improvements in productivity following enhanced numerical flexibility, whereas more excessive use means that TAW is merely used for cost-cutting reasons with adverse effects on labour relations and productivity.

4 Data

The data set used in the following empirical analysis is the German IAB Establishment Panel.[9] It consists of a random sample of establishments (not companies) from the comprehensive Employment Statistics of the German Federal Employment Agency (*Bundesagentur für Arbeit*) drawn according to the principle of optimal stratification. Strata are defined over plant sizes and industries, where all in all ten plant sizes and 16 industries are considered and large plants are oversampled. Since the survey is based on the Employment Statistics aggregated via the establishment number as of the 30th June of a year, it only includes establishments which employ at least one employee covered by social security. Every year since 1993 (1996) the IAB Establishment Panel has surveyed the same

[8] Note that studies using the IAB Establishment Panel to investigate the determinants of TAW use, such as Boockmann and Hagen (2001) and Bellmann (2004), find a positive correlation between the establishment's productivity and its propensity of using TAW. This underscores the importance of controlling for unobserved heterogeneity in TAW usage and the likely problem of reversed causality.

[9] Details about the IAB Establishment Panel are given by Kölling (2000).

establishments from all industries in western (eastern) Germany. Response rates of units which have been interviewed repeatedly exceed 80 per cent. The IAB Establishment Panel is created to serve the needs of the Federal Employment Agency, so that the focus on employment-related topics is predominant. Questions deal, among other things, with the establishment's number of employees, the composition of its workforce, its commitment to collective agreements, the existence of a works council, the establishment's performance and export share, and its technological status.

In the following, we shall use five waves of the IAB Establishment Panel encompassing the years 2003–2007 in order to investigate the relationship between TAW use and the establishment's gross value added.[10] Note that we do not include earlier waves because the marked regulatory changes in TAW taking place before 2003 (see Section 2) may affect our results.[11] All in all, our sample comprises 14,496 observations of 4,918 establishments. Out of these 4,918 establishments 69.3 per cent (3,409) made no use of TAW in the entire observation period, while 16.6 per cent (816) used it at least in some of the years observed and 14.1 per cent (693) in all these years. The average share of temps in the workforce is 1.5 per cent for all establishments and 6.1 per cent for those establishments making use of TAW at least sometimes in the period of observation. Among these 1,509 establishments there is quite a lot of variability in the percentage of temps in the workforce, most firms making only modest use of TAW but some of them relying much more heavily on it: The interdecile range is 11.9 percentage points (with a first decile of only 0.4 per cent and a ninth decile of 12.3 per cent), and the distribution is heavily skewed right. Among those establishments making use of TAW in every year observed, the average

[10] The sectors included in our sample are manufacturing, trade and repair, transport and communication, industrial services (excluding real estate activities) as well as hotels and restaurants. Furthermore, we exclude establishments with a workforce of less than five employees because works councils, which cannot be set up in establishments with a workforce of less than five employees, are found to be one important determinant of productivity (e.g., Addison *et al.*, 2004).

[11] Note that the implementation of the regulatory changes in the beginning of 2003 may have taken some time, so that observations for 2003 could still be affected by previous regulation. As a check of robustness, we therefore also conducted the following empirical analysis excluding those observations. However, our results remained unchanged qualitatively.

temp share is even 7.2 per cent, the interdecile range of 16.1 per cent is considerably higher (with a first decile of 0.9 per cent and a ninth decile of 17.0 per cent), and the distribution is still heavily skewed right.

5 Results

To investigate the relationship between TAW use and productivity, we now fit productivity regressions. We regress the log gross value added on a set of dummy variables reflecting the percentage of temps in the establishment's workforce and several control variables. First of all, controls capturing the composition of the establishment's workforce are included. We add the percentages of females, apprentices, and skilled workers.[12] Since other forms of flexible employment could be substitutes for or complements to TAW, the percentage of freelancers as well as the percentages of casual, marginal, part-time, and fixed-term employees in the establishment's workforce are controlled for. Furthermore, we control for the legal and organisational framework of the plant by including dummies indicating foreign ownership, non-branch establishments, and incorporated firms. We also add 25 industry and five year dummies, and a dummy indicating location in eastern Germany. The industrial relations regime is accounted for by the inclusion of dummies for the existence of a works council, a collective agreement, and the joint existence of both.[13] The logs of the establishment's capital and labour inputs enter linearly, so that we arrive at a Cobb-Douglas specification.[14] As the data set does not contain direct information on the establishments' capital stock but only on investments, we apply the approach proposed by Mueller (2008) to construct

[12] Skilled workers are those workers having completed at least an apprenticeship. This group therefore also comprises university and technical college graduates.

[13] There are several theoretical and empirical papers pointing at the importance of this interaction in productivity regressions (e.g., Freeman and Lazear, 1995; Hübler and Jirjahn, 2003).

[14] As a check of robustness, we also fitted more flexible functional forms, viz. CES and translog specifications. We could neither reject the nested Cobb-Douglas case in the fixed effects regressions, nor did our results turn out to be sensitive to these changes in specification in both the OLS and fixed effects regressions. Hence, in the following we shall only discuss the results for the Cobb-Douglas case.

it. As additional information on the quality of both inputs, we also include the percentage of employees on staff training programmes, the establishment's churning rate (calculated as in Burgess *et al.*, 2000), and a set of four dummy variables capturing the technical state of the capital stock. For descriptive statistics, see Table 1.

As a baseline, we estimate the Cobb-Douglas production function using pooled OLS with standard errors clustered at the establishment level, the results of which are presented in the left column of Table 2. While the coefficients of the control variables show no surprises, those of the TAW dummies point at a hump-shaped relationship between the extent of TAW use and the user firm's productivity. There is a significant positive effect of TAW use up to 15 per cent of temps in the workforce, with a peak between 7.5 and 15 per cent of temps.[15] This maximum productivity effect amounts to roughly 20 per cent (or 18 log points). When using more temps, however, the effect becomes small and insignificant.[16] In our eyes, the positive productivity effects are surprisingly large, likely to be overestimated as firms endogenously choose to utilise TAW.

To address time-invariant unobserved heterogeneity as source of endogeneity, we also estimate the Cobb-Douglas production function using a fixed effects within estimator (for the results, see the right column of Table 2).[17] Although all the coefficients of the TAW dummies are, as expected, reduced markedly in magnitude, we still find a hump-shaped relationship. The peak now shows up between 7.5 and 10 per cent of temps in the workforce, with a maximum productivity effect of 10.4 per cent; and establishments that have more than 20 per cent temps now

[15] Note that we also fitted quantile regressions to evaluate the effect of TAW not only at the conditional mean of log value added but also at different deciles of the regressand's distribution. Our results do not change qualitatively, as it shows up that there is a hump-shaped relationship for all of the deciles.

[16] Note also that including the percentage of temps in the workforce just linearly instead of the set of dummies gives an insignificant and small positive TAW coefficient. This is in line with the findings of Kleinknecht *et al.* (2006) and not surprising given the hump-shaped effect of TAW use on productivity we find.

[17] We are aware of the fact that our results remain biased as long as TAW use is correlated with the time-varying component of the error term. Therefore, the productivity effects may still be overestimated. Yet, it is less clear that this would affect the robust hump-shaped relationship found in our empirical analysis.

experience a significantly negative productivity effect. To us, these results appear much more plausible in magnitude than the OLS results.[18] What is more, they are more reliable as they dispel endogeneity concerns stemming from time-invariant unobserved heterogeneity at the establishment level.

6 Conclusions

In this paper, we have estimated the link between the establishment's productivity and its use of TAW. Theoretically, we argued that modest TAW use serves as a means of achieving productivity gains from augmented numerical flexibility, whilst more excessive use is a strategy that utilises less (specific) human and social capital and avoids costly labour market regulations at the detriment of the establishment's productivity. We therefore expected a hump-shaped relationship. Estimating a Cobb-Douglas production function with both pooled OLS and establishment fixed effects, we indeed found a robust hump-shaped relationship. Due to endogeneity concerns regarding the OLS results, we prefer the fixed effects estimates that point at an earlier peak at 7.5 to 10 per cent of temps in the workforce and a considerably smaller maximum productivity effect of 10.4 per cent.

With respect to our theoretical considerations, the fixed effects results imply that only 1.8 per cent (257) of our observations belong to establishments relying on TAW to such an extent that the productivity effect was negative. This amounts to about 5.4 per cent of the observations of establishments using TAW at least once during our observation period. Among these observations, roughly two thirds (164) belong to establishments using TAW in every year observed. At first sight, one might wonder

[18] As another check of robustness, we also estimated productivity regressions for manufacturing establishments only. This yields a more homogenous sample and allows a more detailed look at the sector where temps are traditionally concentrated in Germany. (Accordingly, TAW is present for about one third of the observations in the manufacturing sample as opposed to approximately one fifth in the whole sample.) Again, both the OLS and the fixed effects results, which are presented in Appendix Table A, point at a hump-shaped relationship. Note also that small establishments with, say, five employees cannot have a temp share of less than 20 per cent. Therefore, part of the productivity effect of TAW may just reflect establishment size effects. To assess whether our results are driven by this, we also repeated our analysis excluding establishments with less than 50 employees. Though this reduces our sample markedly, the results (presented in Appendix Table B) affirm our previous findings.

why establishments should use TAW to such an extent that productivity suffers. One explanation of this would be that these establishments use TAW as a low-road strategy that primarily aims at circumventing labour market regulations, with the loss in productivity being compensated by lower labour costs. Notwithstanding, the majority of establishments employs temps to a modest extent throughout the entire period of observation and increases its productivity through TAW, which is presumably mirroring gains in numerical flexibility.

While we believe that we have improved on earlier contributions studying the effect of TAW use on the user firm's productivity, in particular by utilising panel data and exploiting their structure via fixed effects within estimators as well as by allowing the productivity effect to be non-linear, future research should address remaining endogeneity concerns stemming from unobserved time-variant heterogeneity at the level of the firm. This would require a convincing instrumental variable for TAW use, which is unfortunately absent in our data set. What is more, it would be interesting to check the robustness of our results for other countries and time periods.

Table 1: Descriptive Statistics (Whole Sample)

Variable	Mean	St.dev.
Percentage of temps in workforce	1.456	4.834
Percentage of temps in workforce (dummies)		
$= 0$	0.787	0.409
$\in (0, 2.5]$	0.076	0.266
$\in (2.5, 5]$	0.044	0.205
$\in (5, 7.5]$	0.029	0.168
$\in (7.5, 10]$	0.018	0.133
$\in (10, 12.5]$	0.013	0.113
$\in (12.5, 15]$	0.007	0.086
$\in (15, 17.5]$	0.008	0.086
$\in (17.5, 20]$	0.005	0.069
> 20	0.013	0.113
Log value added	14.444	1.868
Log employment	3.821	1.418
Log capital	14.149	2.187
Works council (dummy)	0.331	0.471
Collective agreement (dummy)	0.464	0.499
Works council $\times$ collective agreement	0.252	0.434
Churning rate (in per cent)	4.232	10.581
Percentage of women in workforce	35.613	25.815
Percentage of apprentices in workforce	5.309	7.092
Percentage of skilled workers in workforce	77.046	27.806
Percentage of part-time employees in workforce	17.982	20.179
Percentage of fixed-term employees in workforce	4.171	9.670
Percentage of freelancers in workforce	0.813	4.513
Percentage of casual workers in workforce	1.893	4.759
Percentage of marginal workers in workforce	2.696	7.913
Percentage of employees on staff training programmes	20.347	24.987
Technical state of capital stock excellent (dummy)	0.172	0.377
Technical state of capital stock good (dummy)	0.503	0.500
Technical state of capital stock fair (dummy)	0.295	0.456
Technical state of capital stock poor (dummy)	0.031	0.173
Located in eastern Germany (dummy)	0.370	0.483
Exporter (dummy)	0.410	0.492
Single establishment (dummy)	0.742	0.437
Incorporated firm (dummy)	0.727	0.446
Foreign ownership (dummy)	0.072	0.258
Observations	14,496	

Notes: The data set used is the IAB Establishment Panel for the years 2003–2007.

Table 2: Productivity Regressions (Whole Sample)

Variable	OLS		Fixed Effects	
Percentage of temps in workforce (dummies)				
$= 0$ (ref. group)	—		—	
$\in (0, 2.5]$	.1325	(.0306)	.0224	(.0219)
$\in (2.5, 5]$	.1079	(.0362)	.0590	(.0223)
$\in (5, 7.5]$	.1299	(.0344)	.0509	(.0249)
$\in (7.5, 10]$	.1681	(.0423)	.0992	(.0364)
$\in (10, 12.5]$	.1889	(.0518)	.0529	(.0390)
$\in (12.5, 15]$	.1748	(.0629)	.0795	(.0428)
$\in (15, 17.5]$	.0312	(.0617)	.0242	(.0678)
$\in (17.5, 20]$	.0357	(.0597)	–.0470	(.0461)
> 20	.0185	(.0587)	–.1039	(.0513)
Log employment	.8574	(.0156)	.5000	(.0427)
Log capital	.1103	(.0096)	.1304	(.0284)
Works council (dummy)	.0756	(.0352)	.0301	(.0433)
Collective agreement (dummy)	–.0141	(.0249)	–.0185	(.0211)
Works council × collective agreement	.1334	(.0419)	–.0267	(.0386)
Churning rate (in per cent)	–.0019	(.0008)	.0007	(.0005)
Percentage of women in workforce	–.0013	(.0006)	–.0016	(.0008)
Percentage of apprentices in workforce	–.0081	(.0014)	–.0031	(.0014)
Percentage of skilled workers in workforce	.0034	(.0004)	.0010	(.0004)
Percentage of part-time employees in workforce	–.0071	(.0007)	–.0016	(.0006)
Percentage of fixed-term employees in workforce	–.0013	(.0010)	–.0003	(.0008)
Percentage of freelancers in workforce	–.0108	(.0031)	–.0039	(.0020)
Percentage of casual workers in workforce	–.0092	(.0017)	–.0037	(.0011)
Percentage of marginal workers in workforce	–.0037	(.0011)	.0008	(.0008)
Percentage of employees on staff training programmes	.0012	(.0004)	.0001	(.0003)
Technical state of capital stock excellent (ref. group)	—		—	
Technical state of capital stock good (dummy)	–.0758	(.0231)	–.0136	(.0180)
Technical state of capital stock fair (dummy)	–.1364	(.0266)	–.0196	(.0219)
Technical state of capital stock poor (dummy)	–.2027	(.0546)	–.0430	(.0419)
Located in eastern Germany (dummy)	–.2863	(.0234)	–.0654	(.0760)
Exporter (dummy)	.1275	(.0224)	.0368	(.0211)
Single establishment (dummy)	–.1408	(.0236)	–.0180	(.0194)
Incorporated firm (dummy)	.1821	(.0240)	.0158	(.0259)
Foreign ownership (dummy)	.1621	(.0384)	—	
Observations	14,496		14,496	
R^2	.8494		.8197	

Notes: The data set used is the IAB Establishment Panel for the years 2003–2007. The regressand is the log gross value added. Standard errors (adjusted for intra-establishment correlations) are given in parentheses. Industry and year dummies are included.

Table A: Productivity Regressions (Manufacturing)

Variable	OLS		Fixed Effects	
Percentage of temps in workforce (dummies)				
$= 0$ (ref. group)	—		—	
$\in (0, 2.5]$	.0898	(.0323)	–.0021	(.0207)
$\in (2.5, 5]$	.0544	(.0395)	.0390	(.0233)
$\in (5, 7.5]$	.1035	(.0368)	.0520	(.0269)
$\in (7.5, 10]$	.1451	(.0439)	.0622	(.0378)
$\in (10, 12.5]$	.1507	(.0518)	.0628	(.0423)
$\in (12.5, 15]$	.0668	(.0620)	.0516	(.0478)
$\in (15, 17.5]$	–.0102	(.0650)	–.0076	(.0770)
$\in (17.5, 20]$	–.0073	(.0611)	–.0706	(.0515)
> 20	.0678	(.0560)	–.1081	(.0580)
Log employment	.8834	(.0182)	.5025	(.0514)
Log capital	.1259	(.0123)	.1750	(.0359)
Works council (dummy)	.0368	(.0414)	–.0437	(.0599)
Collective agreement (dummy)	–.0277	(.0318)	–.0093	(.0260)
Works council × collective agreement	.1360	(.0494)	.0120	(.0447)
Churning rate (in per cent)	–.0009	(.0012)	–.0002	(.0009)
Percentage of women in workforce	–.0043	(.0008)	–.0013	(.0010)
Percentage of apprentices in workforce	–.0130	(.0021)	–.0035	(.0019)
Percentage of skilled workers in workforce	.0024	(.0005)	.0004	(.0005)
Percentage of part-time employees in workforce	–.0075	(.0012)	–.0024	(.0009)
Percentage of fixed-term employees in workforce	–.0022	(.0013)	.0001	(.0011)
Percentage of freelancers in workforce	–.0027	(.0046)	–.0053	(.0024)
Percentage of casual workers in workforce	–.0073	(.0024)	–.0020	(.0017)
Percentage of marginal workers in workforce	–.0029	(.0017)	.0005	(.0012)
Percentage of employees on staff training programmes	.0009	(.0005)	.0002	(.0005)
Technical state of capital stock excellent (ref. group)	—		—	
Technical state of capital stock good (dummy)	–.0686	(.0299)	–.0071	(.0261)
Technical state of capital stock fair (dummy)	–.0975	(.0333)	.0086	(.0294)
Technical state of capital stock poor (dummy)	–.1301	(.0611)	.0046	(.0550)
Located in eastern Germany (dummy)	–.2690	(.0288)	–.1687	(.1990)
Exporter (dummy)	.0771	(.0277)	.0161	(.0279)
Single establishment (dummy)	–.1244	(.0286)	–.0024	(.0255)
Incorporated firm (dummy)	.1634	(.0324)	.0347	(.0335)
Foreign ownership (dummy)	.0594	(.0428)	—	
Observations	7,722		7,722	
R^2	.8931		.8752	

Notes: The data set used is the IAB Establishment Panel for the years 2003–2007. The regressand is the log gross value added. Standard errors (adjusted for intra-establishment correlations) are given in parentheses. Industry and year dummies are included.

Table B: Productivity Regressions (Whole Sample, Establishments with at least 50 Employees in all Observations)

Variable	OLS		Fixed Effects	
Percentage of temps in workforce (dummies)				
$= 0$ (ref. group)	—		—	
$\in (0, 2.5]$	.1433	(.0325)	.0155	(.0245)
$\in (2.5, 5]$	.0971	(.0459)	.0519	(.0282)
$\in (5, 7.5]$	.1509	(.0425)	.0589	(.0346)
$\in (7.5, 10]$	.2004	(.0501)	.0850	(.0442)
$\in (10, 12.5]$	.2793	(.0673)	.0841	(.0507)
$\in (12.5, 15]$	.1017	(.0785)	.0296	(.0614)
$\in (15, 17.5]$	–.0106	(.0769)	–.0312	(.1111)
$\in (17.5, 20]$	–.0432	(.0678)	–.0971	(.0673)
> 20	.0625	(.0698)	–.1644	(.0688)
Log employment	.8724	(.0292)	.6546	(.0987)
Log capital	.1071	(.0179)	.1598	(.0550)
Works council (dummy)	.0924	(.0473)	.0428	(.0639)
Collective agreement (dummy)	–.0445	(.0552)	.0535	(.0526)
Works council × collective agreement	.1424	(.0655)	–.0570	(.0614)
Churning rate (in per cent)	–.0015	(.0018)	.0013	(.0011)
Percentage of women in workforce	–.0006	(.0012)	–.0005	(.0015)
Percentage of apprentices in workforce	–.0052	(.0042)	–.0069	(.0053)
Percentage of skilled workers in workforce	.0031	(.0007)	.0010	(.0008)
Percentage of part-time employees in workforce	–.0083	(.0013)	–.0020	(.0015)
Percentage of fixed-term employees in workforce	–.0030	(.0016)	–.0009	(.0017)
Percentage of freelancers in workforce	–.0194	(.0070)	–.0022	(.0073)
Percentage of casual workers in workforce	–.0117	(.0046)	–.0063	(.0032)
Percentage of marginal workers in workforce	–.0057	(.0027)	.0025	(.0022)
Percentage of employees on staff training programmes	.0015	(.0006)	–.0006	(.0005)
Technical state of capital stock excellent (ref. group)	—		—	
Technical state of capital stock good (dummy)	–.1177	(.0382)	–.0206	(.0281)
Technical state of capital stock fair (dummy)	–.1551	(.0448)	–.0155	(.0360)
Technical state of capital stock poor (dummy)	–.2129	(.0900)	–.0089	(.0787)
Located in eastern Germany (dummy)	–.2925	(.0399)	–.0219	(.1800)
Exporter (dummy)	.1011	(.0376)	.0145	(.0404)
Single establishment (dummy)	–.1066	(.0300)	–.0084	(.0249)
Incorporated firm (dummy)	–.0067	(.0516)	.0227	(.0414)
Foreign ownership (dummy)	.1489	(.0469)	—	
Observations	5,595		5,595	
R^2	.7409		.6828	

Notes: The data set used is the IAB Establishment Panel for the years 2003–2007. The regressand is the log gross value added. Standard errors (adjusted for intra-establishment correlations) are given in parentheses. Industry and year dummies are included.

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