The Productivity Effect of Temporary Agency Work

Evidence from German Panel Data

Boris Hirsch and Steffen Müller

Friedrich–Alexander–Universität Erlangen–Nürnberg

IAB/LASER Workshop on
"Increasing Labor Market Flexibility – Boon or Bane?",
19th March 2011

Motivation

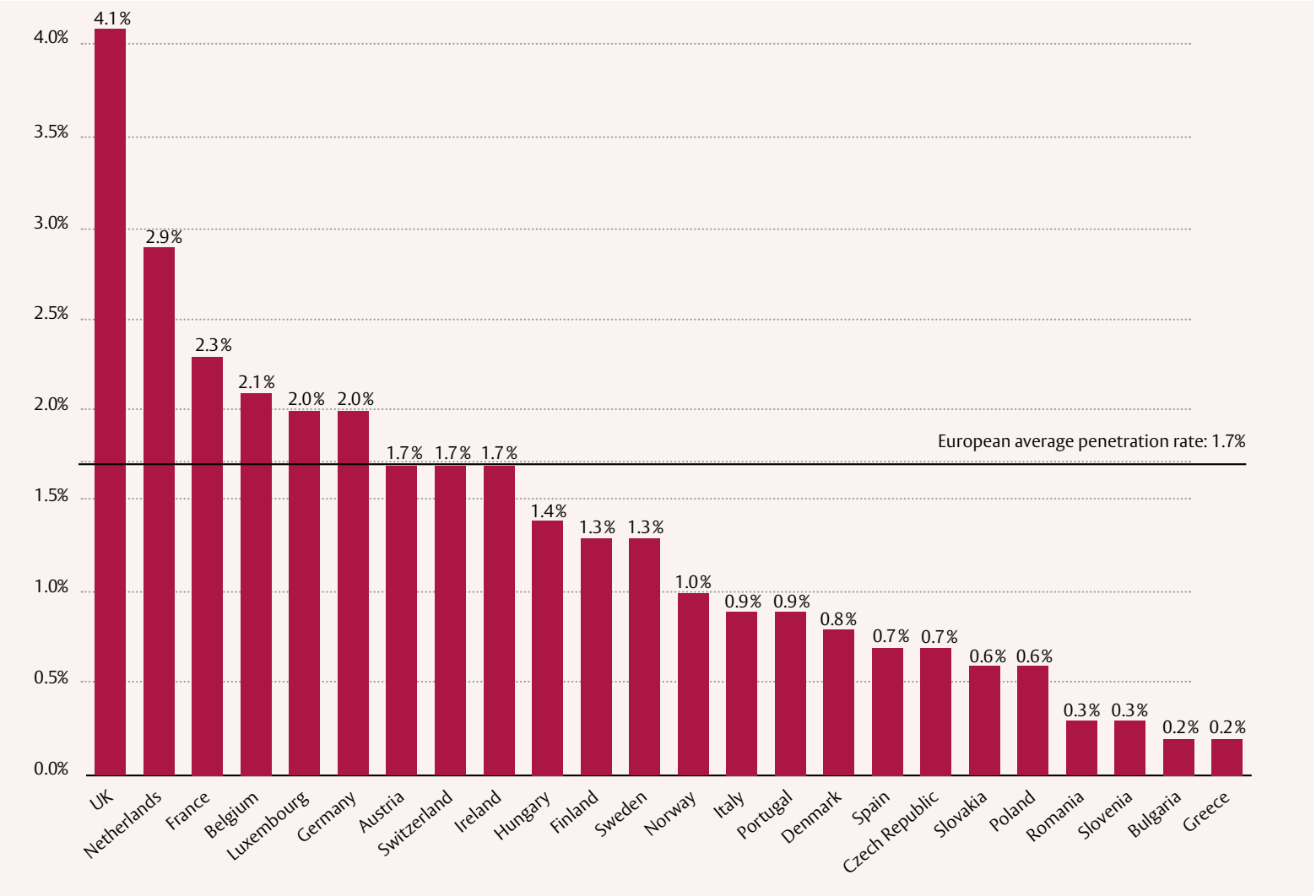
- Increased interest in temporary agency work (TAW):
  - rapid worldwide growth in TAW
  - marked deregulation of TAW in several countries
- Typical research questions:
  - determinants of TAW use (e.g., Houseman, 2001; Houseman et al., 2003; Mitlacher, 2007; Vidal & Tigges, 2009)
  - TAW as a stepping stone to regular employment (e.g., Autor & Houseman, 2006; Ichino et al., 2008; Kvasnicka, 2009)
  - wage penalty for temps (e.g., Segal & Sullivan, 1998; Forde & Slater, 2005; Jahn, 2010)
- But almost no evidence on the effect of TAW use on the user firm's productivity, exceptions being the cross-sectional studies by Arvanitis (2005), Kleinknecht et al. (2006), and Bryson (2007) and the panel study by Beckmann & Kuhn (2009), which arrive at mixed results

Development and characteristics of TAW in Germany

- Considerable growth of the temporary work industry in Germany (CIETT, 2010):
  - In 2008, 9,465 temporary work agencies employed 760,000 full-time equivalent workers, which amounted to roughly 2.0% of the total active working population of Germany.
  - The number of employed full-time equivalent workers has quadrupled since 1998 and doubled since 2004.
  - Germany is no longer a small market for TAW by international comparison.
- Characteristics of temps in Germany (Antoni & Jahn, 2009; CIETT, 2010; Jahn, 2010):
  - predominantly male
  - typically poorly qualified
  - concentrated in manufacturing
  - considerable lower earnings than perms
  - short durations of both assignments to user firms and employment at agencies

Agency work penetration rates in Europe in 2008*

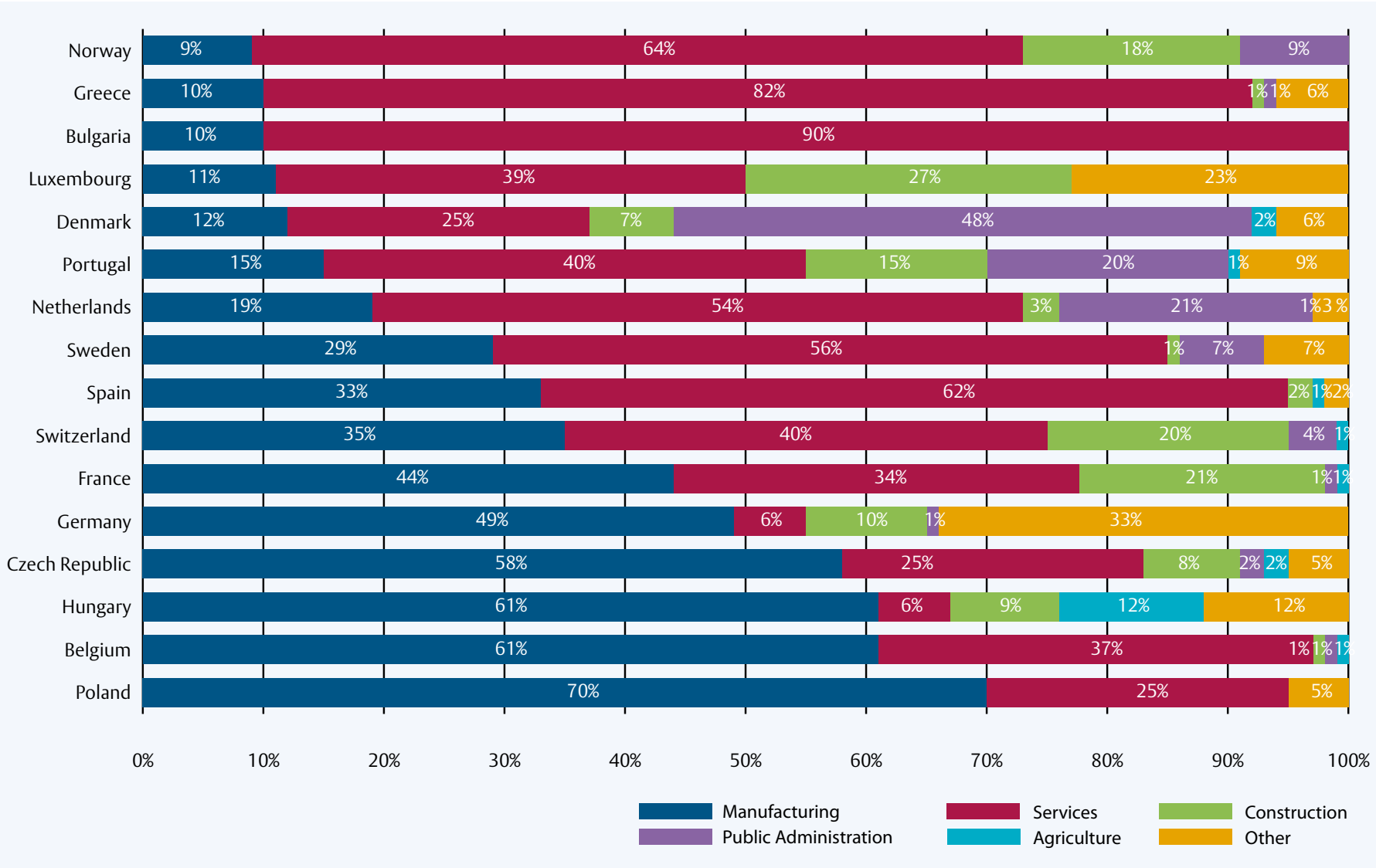
(CIETT, 2010, p. 24)



* Defined as the number of full-time equivalents - as supplied by Ciett National Federations - divided by the total active working population - as published by the ILO

Sectoral distribution of agency work in Europe in 2008

(CIETT, 2010, p. 33)



Reasons for the rapid growth in TAW in Germany

- Massive relaxation of legal hindrances to TAW use (Mitlacher, 2007; Antoni & Jahn, 2009):
  - When legalising TAW in 1972, TAW use was subject to strict regulations.
  - Repeated reforms deregulated TAW markedly.
  - Following the latest and most significant reform in 2003, almost all TAW regulations ceased to have any impact.
- Germany's by international comparison heavily regulated labour market (OECD, 2004) may stimulate TAW as a means of circumventing regulations, such as:
  - strict dismissal protection (Jahn, 2009)
  - restraints on fixed-term contracts (Mitlacher, 2007)

Positive productivity effects of TAW use

- TAW as a means of achieving numerical flexibility (Vidal & Tigges, 2009) with positive productivity effect following gains in numerical flexibility and reduced frictions in operational sequences:
  - handle variability in demand
  - buffer regular workforce during downturns thus allowing firms to sustain internal labour markets
  - carry on production when regular workers are temporarily absent
- TAW as a screening device before offering workers permanent jobs (Autor, 2001), thus improving the productivity of hired perms
- We expect these effects to play less a 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.

Negative productivity effects of TAW use

- 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.
- TAW can serve as a means of circumventing labour market regulations. These firms should substitute temps for perms and make broad use of TAW which is likely to lower the motivation and commitment of perms, i.e. the user firm's social capital and thus its productivity.
- We expect the latter effect to be more substantial if temps make up a large part of the firm's workforce.

Overall productivity effect

- Taken together, we expect a hump-shaped relationship between the extent of TAW and the user firm's productivity.
  - Improvements in productivity following enhanced numerical flexibility for modest TAW use.
  - Substantial use, however, is likely to harm the firm's overall productivity by reducing its human and social capital.

- But: TAW as a stick to threaten perms and thus to improve their productivity
  $\Rightarrow$ effect of substantial TAW use less clear
  $\Rightarrow$ flexible relationship between the extent of TAW and the user firm's productivity needed

Empirical evidence

- Sparse evidence on the productivity effect of TAW with mixed results
- The studies by Arvanitis (2005), Kleinknecht et al. (2006), and Bryson (2007) are cross-sectional (with no attempt of controlling for unobserved firm heterogeneity) and impose an inflexible relationship between the extent of TAW use and productivity, not allowing for a hump-shaped relationship.
- Beckmann & Kuhn (2009) use German panel data and IV methods.
  - In their regressions, the share of temps in the workforce enters linearly and quadratic to allow for a nonlinear relationship.
  - Their baseline results point at an inversely u-shaped relationship.
  - Instrumenting firms' temp share with a group-specific mean of temp shares (groups according to plant size, sectors, and the like) yields the same pattern though implausibly large effects (e.g., a maximum productivity effect of roughly 400 per cent in their IV fixed effects estimations).
  - What is more, their sample comprises the years 2002–2005 and thus a significant discontinuity in the regulatory environment of TAW.

Our contribution

We intend to contribute to the literature on the productivity effect of TAW use in several ways:

(1) We use current information from a large German panel data set comprising the years 2003–2007 and thus a stable regulatory environment.

(2) Applying fixed effects estimators and a control function approach similar in spirit to Vella & Verbeek (1999), we address both time-invariant and time-varying unobserved firm heterogeneity by exploiting exogenous variation in TAW use induced by (supply-side) changes in the share of temps among the employed at the municipality level.

(3) Since our theoretical considerations suggest a hump-shaped but not in the least symmetric relationship between TAW use and productivity, we allow for a very flexible relationship by adding a group of nine dummy variables.

Main data source: the IAB Establishment Panel

- Five waves of the IAB Establishment Panel encompassing the years 2003–2007, i.e. the period after the latest massive deregulation of TAW in Germany:
  - Statified random sample of establishments (not companies) employing at least one employee covered by social security
  - Since 1993 (1996) the same establishments from all industries in western (eastern) Germany have been surveyed annually.
  - Response rates of units which have been interviewed repeatedly exceed 80%.
- Sample restrictions:
  - sectors included: manufacturing, trade and repair, transport and communication, industrial services (excluding real estate activities), as well as hotels and restaurants
  - exclusion of establishments with less than five employees

TAW use in our sample

- 14,496 observations of 4,918 establishments
  - 69.3% (3,409) no TAW use in the entire period of observation
  - 16.6% (816) TAW use in some of the years observed
  - 14.1% (693) TAW use in all these years
- Average share of temps in the workforce:
  - 1.5% for all establishments
  - 6.1% for those using TAW in at least some of the years observed
- Large variability in the temp share among user plants and heavily right-skewed distribution:
  - Most plants use TAW to a modest extent, but some rely more heavily on it.
  - interdecile range: 11.9 percentage points
  - first decile of the temp share: 0.4%
  - ninth decile of the temp share: 12.3%

Second data source: the Sample of Integrated Labour Markt Biographies of the IAB (SIAB)

- The SIAB contains daily information on employment periods subject to social security contributions and an industry classification code, allowing us to identify employment spells in agency firms.
- Together with information on workers' place of residence, we can use this information to calculate the share of temps among all employed covered by social security at the municipality level.
- But: We cannot distinguish temps from perms employed by agencies.
- Share of temps among the employed at the municipality level:
  - average share: 1.5%
  - interdecile range: 2.0 percentage points
  - first decile: 0.6%
  - ninth decile: 2.6%
  - considerable time variation: mean share only 1.0% in 2003 but 2.0% in 2007

Fixed effects productivity regression

- Linear regression model with establishment fixed effects controlling for time-invariant unobserved plant heterogeneity:

$$\ln y_{it} = \mathbf{TAW}_{it}^{\top}\boldsymbol{\alpha} + \mathbf{x}_{it}^{\top}\boldsymbol{\beta} + e_t + v_i + \varepsilon_{it} \tag{1}$$

$\ln y_{it}$: establishment i's log gross value added in period t

$\mathbf{TAW}_{it}$: set of nine dummy variables reflecting the percentage of temps in plant i's workforce in period t

$\mathbf{x}_{it}$: vector of control variables

e_t: period fixed effect

v_i: plant fixed effect

Control function approach: first step

- To address the problem of time-varying unobserved heterogeneity, we decided to follow Jahn & Pozzoli (2010) by using a control function estimator similar in spirit to Vella & Verbeek (1999).
- First-step ordered probit model with latent variable representation

$$TAW_{it}^{*} = \mathbf{x}_{it}^{\top}\gamma + \mathbf{z}_{it}^{\top}\boldsymbol{\pi} + \zeta_t + u_{it} \tag{2}$$

with

$$TAW_{it}^{j} = 1 \;\Leftrightarrow\; \theta^{j-1} < TAW_{it}^{*} \leqslant \theta^{j} \qquad (j = 1, \ldots, J)$$

$\mathbf{z}_{it}$: vector of instruments

ζ_t: period fixed effect

θ^{j-1}, θ^{j}: threshold values ($\theta^{0} := 0$ and $\theta^{J} := \infty$)

Control function approach: second step

- Assumption of joint normality for the error terms in (1) and (2):

$$\begin{pmatrix} \varepsilon_{it} \\ u_{it} \end{pmatrix} \sim \mathsf{N}\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{pmatrix} \right)$$

- Conditional expectation of log gross value added

$$\mathsf{E}[\ln y_{it} | \mathbf{TAW}_{it}, \mathbf{x}_{it}, \mathbf{z}_{it}] = \mathbf{TAW}_{it}^{\top} \boldsymbol{\alpha} + \mathbf{x}_{it}^{\top} \boldsymbol{\beta} + \rho\sigma \lambda_{it}^{j(i,t)} + e_t + v_i \qquad (3)$$

with the generalised residual $\lambda_{it}^{j(i,t)}$ from the ordered probit model:

$$\begin{aligned} \lambda_{it}^{j(i,t)} &= \mathsf{E}[u_{it} | TAW_{it}^{j} = 1, \mathbf{x}_{it}, \mathbf{z}_{it}] \\ &= \frac{\varphi(\theta^{j-1} - \mathbf{x}_{it}^{\top}\boldsymbol{\gamma} - \mathbf{z}_{it}^{\top}\boldsymbol{\pi} - \zeta_t) - \varphi(\theta^{j} - \mathbf{x}_{it}^{\top}\boldsymbol{\gamma} - \mathbf{z}_{it}^{\top}\boldsymbol{\pi} - \zeta_t)}{\Phi(\theta^{j} - \mathbf{x}_{it}^{\top}\boldsymbol{\gamma} - \mathbf{z}_{it}^{\top}\boldsymbol{\pi} - \zeta_t) - \Phi(\theta^{j-1} - \mathbf{x}_{it}^{\top}\boldsymbol{\gamma} - \mathbf{z}_{it}^{\top}\boldsymbol{\pi} - \zeta_t)} \end{aligned}$$

Implementation of the control function estimator

(1) We estimate an ordered probit model for the level of the temp share chosen with $\mathbf{x}_{it}$ and $\mathbf{z}_{it}$ as regressors and use the estimated coefficients and threshold values to predict the selection term $\lambda_{it}^{j(i,t)}$.

- We take up the idea of Jahn & Pozzoli (2010) by using exogenous variation in plants' TAW use induced by variation of the *lagged* share of temps among the employed at the municipality level.
- This provides us with a suitable (and strong) supply-driven instrument of plants' temp share.

(2) In the second step, we add the predicted selection terms $\widehat{\lambda}_{it}^{j(i,t)}$ as additional regressors to our fixed effects productivity regression, thereby accounting for both time-invariant and time-varying unobserved heterogeneity.

(3) Standard errors for our two-step estimations are provided by the bootstrap.

Control variables

- Composition of the workforce: percentages of females, apprentices, and skilled workers in the establishment's workforce
- Other forms of flexible employment: percentages of freelancers, casual, marginal, part-time, and fixed-term employees in the plant's workforce
- Legal and organisational framework: dummies indicating foreign ownership, non-branch plants, and incorporated firms
- Industrial relations regime: dummies for works council and collective agreement existence and their interaction
- 24 industry dummies, four year dummies, and a dummy indicating location in eastern Germany

Control variables
(continued)

- Logs of capital and labour inputs
  - Construction of capital stock information following Müller's (2008) perpetual inventory approach
  - Cobb-Douglas specification
  - We also checked CES and translog specifications, neither rejecting the nested Cobb-Douglas case nor arriving at qualitatively different results.

- Quality of inputs: percentage of employees on staff training programmes, churning rate, and a set of three dummy variables capturing the technical state of the capital stock

Descriptive statistics

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
Non-branch establishment (dummy)	0.742	0.437
Incorporated firm (dummy)	0.727	0.446
Foreign ownership (dummy)	0.072	0.258
Observations	14,496	

Productivity regressions

(whole sample; regressand: log value added; standard errors clustered at the establishment level in parentheses; industry and year dummies included)

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 $\times$ 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)
Non-branch 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	

Control function approach

(whole sample; regressand: log value added; bootstrapped standard errors with 200 replications in parentheses; industry and year dummies included; controls are the same as before)

Variable	dummies		selection terms	
Percentage of temps in workforce				
$= 0$	—		.0624	(.1096)
$\in (0, 2.5]$	−.0194	(.0978)	.0061	(.0600)
$\in (2.5, 5]$	−.0116	(.1165)	.0397	(.0654)
$\in (5, 7.5]$	.0014	(.1278)	.0100	(.0622)
$\in (7.5, 10]$	.0423	(.1547)	.0153	(.0756)
$\in (10, 12.5]$	.0641	(.1551)	−.0341	(.0742)
$\in (12.5, 15]$	−.1501	(.2239)	.1202	(.0988)
$\in (15, 17.5]$	−.2408	(.2192)	.1313	(.0897)
$\in (17.5, 20]$	−.0683	(.2087)	−.0093	(.0746)
> 20	.0166	(.3288)	−.0665	(.1204)
Observations	14,496			
Wald test for overall significance of selection terms	$p = .826$			

Main results

- Pooled productivity regression: clear hump-shaped relationship between the extent of TAW use and the user firm's productivity
  - significantly positive effect up to 15% of temps in the workforce
  - peak between 7.5 and 15% of temps with maximum productivity effect of roughly 20%, which seems implausibly high
  - when using more temps, insignificantly positive effect
- Fixed effects productivity regression: clear hump-shaped relationship with negative productivity effect for extensive users
  - all coefficients reduced markedly in magnitude
  - peak between 7.5 and 10% of temps in the workforce with maximum productivity effect of 10.4%
  - significantly negative productivity effect if temp share exceeds 20%
- Hump-shaped relationship is pretty robust:
  (1) quantile regressions
  (2) manufacturing plants only
  (3) plants with at least 50 employees only

Main results
(continued)

- Control function estimator: confirmation of the hump-shaped effect of TAW use on productivity previously found – with the exception of a small positive productivity effect of substantial TAW use
  - coefficients similar in magnitude as before
  - low precision of the estimates, no single statistically significant effect remains
  - share of temps among the employed at the municipality level strong instrument for plants' temp share in the first-step ordered probit regression (z-value of 5.6)
  - selection terms' coefficients insignificant at conventional levels in the second-step fixed effects regressions (p-value of a Wald test of 0.826)

- Conclusion: Standard fixed effects results are not suffering from endogeneity bias and give reliable productivity effects of TAW use.

Discussion of the results

- Clear and robust hump-shaped effect of the extent of TAW on the user firm's productivity
- The fixed effects results imply that only 1.8% (257) of our observations, which amounts to 5.4% of the observations of establishments using TAW at least once during our observation period, belong to plants relying on TAW to such an extent that the productivity effect was negative.
  - $\longrightarrow$ likely to follow a low-road strategy that primarily aims at avoiding 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.
  - $\longrightarrow$ presumably mirroring productivity gains following enhanced numerical flexibility