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Firms' Use of Temporary Employment and Permanent Workers' Concerns about Job Security: Evidence from German Linked Employer-Employee Data

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Abstract: This research note addresses the question of how permanent workers perceive their individual job security if their firm employs temporary workers with fixed-term contracts and temporary agency workers. One the one hand, the core-periphery hypothesis predicts that permanent workers should have fewer concerns about job security if the firm employs temporary workers to deal with demand fluctuations. On the other hand, a counteracting substitution effect might increase concerns about job security. Using linked employer-employee data and estimating regression models at the worker level with establishment fixed effects, evidence supports the core-periphery hypothesis for temporary agency work but not for fixed-term contracts.

Keywords: core-periphery hypothesis; fixed-term contracts; job security; linked employer-employee data; temporary agency work

JEL Classification: J23; J42; M51

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1. Introduction

Firms use temporary employment for several reasons. In addition to screening new employees (Booth et al. 2002; Boockmann and Hagen 2008), two of the most important reasons are gaining external flexibility in employment and saving labor costs, which have different consequences for the job security of permanent workers employed in the same firm as temporary workers. Whereas the flexibility argument is related to the core-periphery hypothesis, saving labor costs is related to the substitution of the permanent workforce by temporary workers.

In Germany, temporary employment mainly consists of fixed-term contracts (FTC) and temporary agency work (TAW). FTCs are direct employment relationships with an employer. The abuse of consecutive FTCs is restricted by law to explicitly avoid a substitution of regular employment. FTCs without an objective reason are only allowed for up to 24 months for newly hired employees, with up to three renewals within these 24 months. If the FTC is justified by an objective reason (e.g., education) or conducted with specific employee groups (e.g., top managers, older unemployed), these restrictions do not apply. Moreover, FTCs cannot be terminated before the expiration date, otherwise severe firing costs occur (Cahuc et al. 2016). In contrast, TAW is indirect employment via agencies, which are the actual employers and are fully responsible for the employer-side obligations (e.g., payment, vacation, employment protection). In return, the agencies receive fees for sending the workers to other firms. These lending firms have a high degree of flexibility for which they pay the agencies, as they could lend workers even on a daily basis. The regulation of TAW is largely concerned with restrictions on the lending periods as well as the synchronization of lending and employment contracts. Such synchronization means

that workers would only have an employment contract with the agency as long as they are sent to a lending firm, which would transfer employment risks from the agency to the workers.

The core-periphery hypothesis postulates that firms recruit temporary workers in times of increasing temporary labor demand and release them in times of decreasing demand. These temporary workers (periphery) are employed in addition to the permanent workforce (core) and serve as a buffer in an internal dual labor market, from which permanent workers gain job security (Rebitzer and Taylor 1991; Saint-Paul 1991; Booth et al. 2003; Cappelli and Neumark 2004; Pfeifer 2009). Thus, permanent workers should have fewer concerns about their job security if their firm uses temporary workers and if the share of temporary workers increases in their firm. Because TAW can be used more flexibly than FTCs, this effect should be more pronounced for TAW than for FTCs.

Contrarily, firms might recruit temporary workers to substitute permanent workers to save labor costs and might even keep them in times of a recession if the gap in labor costs between temporary and permanent workers is large enough (Koutentakis 2008; Cahuc et al. 2016). Thus, permanent workers should have more concerns about their job security if their firm uses temporary workers and if the share of temporary workers increases in their firm. Because firms must pay for the wages of TAW as well as the fees to the agencies, cost saving is more likely with the employment of workers with FTCs, so this substitution effect should be more pronounced for FTCs than for TAW.

We test these counteracting hypotheses by using linked employer-employee data and estimating regression models at the worker level with establishment fixed effects to deal with unobserved establishment heterogeneity. By using establishment fixed effects, we also explicitly account for the within-firm perspective of internal labor markets. We use the years 2012, 2014, 2016, and 2018 of the German Linked Personnel Panel (LPP). The uniqueness of these data is that we merge establishment surveys, which include information about the shares of FTCs and TAW, with worker surveys, which include information about permanent workers' perceived job security. As far as we know, we are the first to analyze the correlation between establishments' use of FTC and TAW and the perception of individual job security by permanent workers, for which linked employer-employee data are necessary. Whereas administrative linked employer-employee data with objective wage information and basic firm and worker characteristics have been widely used over the last two decades, empirical work using data that combine establishment surveys with worker surveys is still scarce.

The remainder of this research note is organized as follows. In the next section, we give a short overview of the legal arrangements of FTCs and TAW in Germany. It is followed by a section with information about the data, variables, and estimation approach of the study. We then report and discuss our estimation results. The paper concludes with a short summary and discussion of the main findings.

2. Overview of Temporary Employment Regulation in Germany

Fixed-term contracts (FTCs) in Germany were highly regulated until the introduction of the Employment Promotion Act ("Beschäftigungsförderungsgesetz") in 1985. This legal change relaxed the former rule that the employer had to demonstrate the temporary nature of the work (by providing objective reasons such as seasonal fluctuations) and that FTCs had a maximum duration of only six months. The Employment Promotion Act of 1985 allowed a single FTC to last up to 18 months without justification if the employee was newly hired or if an apprentice could not be offered a regular job. In 1996, the duration of FTCs was raised to 24 months, with three renewals possible within this period. Moreover, employees could be employed unconditionally under FTCs after finishing their apprenticeship. FTCs for employees older than 60 years were allowed without any restrictions on the duration. Finally, if the FTC was justified by an objective reason, the aforementioned restrictions did not apply. In January 2001, the regulation of FTCs in Germany was again renewed and regulated in a single law ("Gesetz über Teilzeitarbeit und befristete Arbeitsverträge"). One change affected the definition of the elderly: they were defined as older than 58 years instead

of 60 years, because of the high unemployment rates among older workers. Already in 2002, a couple of further changes were introduced ("Erstes Gesetz für moderne Dienstleistungen am Arbeitsmarkt") including the prohibition of discrimination at the workplace, which refers to equal pay and treatment, and the definition of the elderly as older than 52 years. Since 2007, FTCs without restrictions on the duration need to be justified by an objective reason for older workers as is the case for younger workers, and for FTCs without objective reasons renewals are possible within five years for older workers. Note that FTCs cannot be terminated within the contract duration without severe firing costs, which makes them less flexible in the short run than permanent contracts.

In the year 1967, the federal constitutional court repealed the employment agency monopoly of the Federal Labor Office ("*Bundesanstalt für Arbeit*"), which led to the regulation of temporary agency work (TAW) in 1972 ("*Arbeitnehmerüberlassungsgesetz*"). The essence of this regulation, which is the full responsibility of the agency in all employer-side features (e.g., payments, employment protection), is still valid today. The general logic is that a worker has a labor contract with the agency, which has a contract with the lending firm in which the worker performs tasks. Several legal changes and the new legislations since 2002 (e.g., "*Job-Aqtiv-Gesetz*", "*Erstes Gesetz für moderne Dienstleistungen am Arbeitsmarkt*") have repealed restrictions on the lending periods as well as synchronization and have introduced equal pay and treatment for TAW in a lending firm. For example, the general lending period was increased from 3 months to 6 months (1985) to 9 months (1994) to 12 months (1997) to 24 months (2002) and was reduced to 18 months in 2017. Since 2017, the principle of equal pay and treatment already applies after 9 months. Note, however, that exemptions can be arranged in collective contracts.

3. Data and Estimation Approach

We use the years 2012, 2014, 2016, and 2018 of the German Linked Personnel Panel (LPP), which consists of linked questionnaires for employees and employers (Kampkötter et al. 2016; Mackeben et al. 2021). The employee questionnaire asks about job characteristics (including perceived job security), attitudes, personality, socio-demographic background, etc. The employer questionnaires, answered by the owners or top managers of the establishment, entail questions about the employment structure (including the share of FTCs and TAW), human resource management practices, general firm policies, industrial relations, etc. Note that the LPP is a representative subsample of the IAB Establishment Panel, but not of all German firms. While the IAB Establishment Panel focuses more on general management and employment structure issues, the LPP establishment survey focuses more on human resource management policies. Hence, our data entail information from the IAB Establishment Panel survey and from the LPP survey for employers. In more detail, the LPP is a sample of private sector establishments with 50 or more employees in manufacturing and service industries. The establishment sample is stratified according to four establishment size classes (50–99, 100–249, 250–499, and 500 and more employees), five industries (metalworking and electronic industries, further manufacturing industries, retail and transport, services for firms, and information and communication services), and four regions (North, East, South, and West).

After drawing the sample of establishments in a first step, a sample of employees within those establishments has been drawn in a second step. Thus, the stratification of the data is at the establishment level, not at the employee level. Nevertheless, we can perform our analysis based on the employee level using data from LPP employee surveys which we augmented with establishment level characteristics (LPP/IAB Establishment Panel). In more detail, the sampling of employees was conditioned on all employees working in the participating establishments on December 30th in the preceding year; employees were then randomly drawn and contacted via telephone interview. Note also that the establishment data are set up as an unbalanced panel, but not the employee data. Because we are interested in the relationship of the use and the employment share of FTCs and TAW to permanent workers' perceived job security, we restrict our sample to workers aged

18 to 65 years, who are in permanent employment with tenure of at least 18 months, which constitute more than 95 percent of observations in the total sample.

Our dependent variable for a worker's perceived job security has three ordinal outcomes, which are (1) not concerned at all (65%), (2) somewhat concerned (29%), and (3) very concerned (6%) about own job security. Additionally, we dichotomize the dependent variable to (0) no concerns and (1) low/high concerns about own job security. For both dependent variables, we estimate ordinary least squares (OLS) linear regressions with establishment fixed effects. Because of the ordinal and binary characters of our dependent variables, we additionally estimate ordered probit and binary probit models with establishment fixed effects as robustness checks. The basic regression equation looks as in equation (1), which is estimated for worker i in establishment j in year t. α denotes the constant. β's are the estimated coefficients for our explanatory variables of interests. γ's are the coefficients for the set of control variables X. μ_t denotes time fixed effects. ν_j denotes the establishment fixed effects. ε_{ijt} is the idiosyncratic error term of worker i in establishment j in year t.

$$JobSecurity_{ijt} = \alpha + \beta_1 FTCdummy_{ijt} + \beta_2 FTCshare_{ijt} + \beta_3 TAWdummy_{ijt} + \beta_4 TAWshare_{ijt} + \gamma X_{ijt} + \mu_t + \nu_j + \varepsilon_{ijt} \quad (1)$$

The explanatory variables of interest are at first the use of FTCs and TAW, which are specified as two dummy variables taking the value one if an establishment uses FTCs and TAW and the value zero if FTCs and TAW are not used. Moreover, we are interested in the intensity of FTCs and TAW, so we include the shares of FTCs and TAW in total employment at the establishment level. We estimate three specifications. The first specification includes dummies indicating if the establishment in which the permanent worker is employed uses FTCs and TAW in a given year. The second specification includes the employment shares of FTCs and TAW in a given year. The third specification combines the dummies and shares. Even though FTCs and TAW are establishment characteristics, their means are computed for workers employed in these establishments (see Table 1 for descriptive statistics). About 86 percent of workers are employed in establishments that use FTCs, with an average FTC employment share of 5.6 percent. About 67 percent of workers are employed in establishments that use TAW, with an average TAW employment share of 4.1 percent.

We control for a wide range of differences in socio-demographic characteristics (age, education, sex, having a partner, having children), personality based on multi-item scales (Big Five, trust), individual employment and job characteristics (labor income, working hours, managerial responsibilities, out-of-hours demand, decision autonomy, task autonomy, interdependence with co-workers, physical loading), some time-varying establishment characteristics (profit situation, workforce composition, establishment size categories), and the survey years (time fixed effects). Table 1 provides an overview and the descriptive statistics of the used variables. Additionally, we include establishment fixed effects in all regressions that control for time-invariant establishment characteristics (e.g., sector, region), because unobserved idiosyncratic factors at the establishment level can influence the potential to use temporary workers as well as workers' perceptions of individual job security (e.g., specific production technology, complementary HRM practices, necessary skills, incentive structures, competition, norms). Note also that we treat works councils, collective agreements, etc. as quasi time-invariant and argue that their potential impact is included in the establishment fixed effects, because status changes within the establishments are a very rare event. Thus, we estimate regressions at the worker level and include dummies for the establishments as establishment fixed effects. The variation of establishment characteristics such as the share of FTCs and TAW stems from the observation of establishments over the four-year unbalanced establishment panel, in which we only include establishments that are observed for at least two years. Moreover, we only use worker observations, if within-establishment variance exists for both dependent variables. In total, our estimation sample contains 12,288 observations of workers nested in 637 establishments.

Table 1. Descriptive statistics.

	Mean	Std. Dev.	Min	Max
Job security concerns categories (increasing)	1.406	0.595	1	3
Job security concerns dummy (no vs. low/high)	0.349		0	1
FTC dummy	0.860		0	1
TAW dummy	0.667		0	1
FTC share	0.056	0.086	0	0.974
TAW share	0.041	0.074	0	0.939
Monthly net salary in thousand Euros	2.456	2.284	0.001	170.000
Age in years	44.345	10.303	18	65
Male	0.749		0	1
Having partner	0.848		0	1
Number of children < 14 years	0.389	0.749	0	5
University degree	0.256		0	1
German citizenship	0.979		0	1
Number of actual weekly working hours	40.582	8.575	0.500	90.000
Management position	0.295		0	1
Available outside working time (increasing)	2.041	1.126	1	5
Decision autonomy (increasing)	3.971	0.993	1	5
Task variety (increasing)	4.179	0.948	1	5
Dependence on co-worker (increasing)	3.761	1.219	1	5
Co-worker depend on me (increasing)	3.351	1.268	1	5
Physical work environment (increasing)	2.291	1.429	1	5
Agreeableness (increasing)	4.047	0.573	1	5
Consciousness (increasing)	4.355	0.481	1.667	5
Neuroticism (increasing)	2.698	0.768	1	5
Openness (increasing)	3.637	0.630	1	5
Extraversion (increasing)	3.654	0.737	1	5
Trust (increasing)	3.504	0.784	1	5
Profit situation categories (increasing)	3.528	0.967	1	5
Share female employees	0.264	0.203	0	0.985
Share high skilled employees	0.139	0.147	0	0.875
Share medium skilled employees	0.656	0.213	0	1
Establishment size dummies				
50–99 regular employees	0.110		0	1
100–249 regular employees	0.231		0	1
250–499 regular employees	0.246		0	1
>499 regular employees	0.407		0	1
Year dummies				
2012	0.291		0	1
2014	0.304		0	1
2016	0.231		0	1
2018	0.174		0	1

Notes: Number of worker-year observations is 12,288 nested in 637 establishments. Standard deviations for dummy variables are not displayed. Data: LPP 2012, 2014, 2016, and 2018.

4. Regression Results

We have estimated three specifications for the ordinal as well as for the binary dependent variables. The first specification includes dummies indicating if the establishment in which the permanent worker is employed uses FTCs and TAW in a given year. The second specification includes the employment share of FTCs and TAW in a given year. The third specification combines both. The OLS as well as the ordered and binary probit regression results for our main explanatory variables of interest (use and share of FTCs and TAW) in Table 2 show robust findings across all specifications and regression techniques. First, the use and the share of FTCs are correlated with more concerns about permanent workers' own job security. However, the coefficients are not statistically significant in any specification. Thus, permanent workers do not have on average a significantly higher probability of having concerns about their own job security if their firm uses FTCs. It

should also be noted, however, that permanent workers do not have a lower probability of having concerns about job security if their firm uses FTCs. Hence, our findings for FTCs give neither support for the substitution hypothesis (more concerns about job security among permanent workers) nor the core-periphery hypothesis (fewer concerns about job security among permanent workers).

Table 2. Summary of regression results for permanent workers' concerns about own job security.

	Ordinal Concerns (OLS)			**Binary Concerns (OLS)**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
FTC dummy	0.0229		0.0162	0.0184		0.0157
	(0.364)		(0.535)	(0.351)		(0.441)
	[0.025]		[0.026]	[0.020]		[0.020]
FTC share		0.1993	0.1724		0.0901	0.0644
		(0.290)	(0.382)		(0.513)	(0.655)
		[0.188]	[0.197]		[0.138]	[0.144]
TAW dummy	−0.0355		−0.0226	−0.0296		−0.0190
	(0.164)		(0.384)	(0.178)		(0.394)
	[0.026]		[0.026]	[0.022]		[0.022]
TAW share		−0.3389 **	−0.3031 **		−0.2825 **	−0.2522 **
		(0.026)	(0.049)		(0.022)	(0.045)
		[0.151]	[0.154]		[0.123]	[0.123]
All control variables + establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.219	0.220	0.220	0.191	0.191	0.191
Adjusted R squared	0.174	0.175	0.175	0.144	0.145	0.145
Mean dep. var.	1.406	1.406	1.406	0.349	0.349	0.349
	Ordinal Concerns (Ordered Probit)			**Binary Concerns (Binary Probit)**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
FTC dummy	0.0450		0.0304	0.0567		0.0482
	(0.386)		(0.570)	(0.308)		(0.400)
	[0.052]		[0.053]	[0.056]		[0.057]
FTC share		0.4198	0.3665		0.2921	0.2107
		(0.220)	(0.299)		(0.429)	(0.580)
		[0.343]	[0.353]		[0.369]	[0.380]
TAW dummy	−0.0790		−0.0506	−0.0916		−0.0602
	(0.133)		(0.353)	(0.105)		(0.303)
	[0.053]		[0.055]	[0.056]		[0.058]
TAW share		−0.6894 **	−0.6062 *		−0.8156 **	−0.7219 **
		(0.026)	(0.059)		(0.015)	(0.037)
		[0.310]	[0.322]		[0.335]	[0.346]
All control variables + establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R squared	0.147	0.147	0.147	0.161	0.161	0.161

Notes: OLS coefficients with *p*-values for clustered standard errors at the establishment level in parentheses and clustered standard errors at the establishment level in squared brackets. Ordered and binary probit coefficients with p-values in parentheses and standard errors in squared brackets. ** $p < 0.05$, * $p < 0.10$. Number of worker-year observations is 12,288 nested in 637 establishments in all regressions. Complete results are displayed in Table 3 for the OLS regressions and in Table 4 for the ordered and binary probit regressions. Data: LPP 2012, 2014, 2016, and 2018.

Table 3. Complete OLS regression results.

	Job Security Concerns Ordered Categories (OLS)			Job Security Concerns Dummy (OLS)		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
FTC dummy	0.0229		0.0162	0.0184		0.0157
	(0.364)		(0.535)	(0.351)		(0.441)
TAW dummy	−0.0355		−0.0226	−0.0296		−0.0190
	(0.164)		(0.384)	(0.178)		(0.394)
FTC share		0.1993	0.1724		0.0901	0.0644
		(0.290)	(0.382)		(0.513)	(0.655)
TAW share		−0.3389 **	−0.3031 **		−0.2825 **	−0.2522 **
		(0.026)	(0.049)		(0.022)	(0.045)
Monthly net salary in thousand Euros	−0.0006	−0.0007	−0.0006	−0.0019	−0.0020	−0.0019
	(0.888)	(0.873)	(0.892)	(0.424)	(0.408)	(0.435)
Age in years	0.0002	0.0002	0.0002	−0.0005	−0.0005	−0.0005
	(0.751)	(0.748)	(0.747)	(0.434)	(0.434)	(0.434)
Male	−0.0321 *	−0.0321 *	−0.0321 *	−0.0271 *	−0.0271 *	−0.0271 *
	(0.080)	(0.080)	(0.079)	(0.072)	(0.072)	(0.071)
Having partner	−0.0140	−0.0142	−0.0143	0.0055	0.0053	0.0053
	(0.391)	(0.382)	(0.382)	(0.657)	(0.667)	(0.668)
Number of children < 14 years	0.0279 ***	0.0278 ***	0.0279 ***	0.0189 ***	0.0187 ***	0.0188 ***
	(0.002)	(0.002)	(0.002)	(0.008)	(0.008)	(0.008)
University degree	0.0092	0.0089	0.0087	0.0020	0.0018	0.0016
	(0.513)	(0.527)	(0.535)	(0.861)	(0.875)	(0.886)
German citizenship	−0.0543	−0.0537	−0.0536	−0.0247	−0.0244	−0.0243
	(0.235)	(0.240)	(0.240)	(0.460)	(0.466)	(0.467)
Number of actual weekly working hours	0.0004	0.0004	0.0004	−0.0001	−0.0001	−0.0001
	(0.584)	(0.592)	(0.592)	(0.877)	(0.863)	(0.863)
Management position	−0.0136	−0.0137	−0.0134	−0.0060	−0.0060	−0.0059
	(0.335)	(0.334)	(0.341)	(0.608)	(0.609)	(0.619)
Available outside working time (increasing)	0.0144 **	0.0144 **	0.0144 **	0.0140 ***	0.0140 ***	0.0140 ***
	(0.025)	(0.025)	(0.025)	(0.005)	(0.005)	(0.005)
Decision autonomy (increasing)	−0.0484 ***	−0.0482 ***	−0.0483 ***	−0.0360 ***	−0.0358 ***	−0.0359 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Task variety (increasing)	−0.0017	−0.0018	−0.0017	−0.0041	−0.0042	−0.0041
	(0.796)	(0.783)	(0.792)	(0.424)	(0.411)	(0.418)
Dependence on co-worker (increasing)	0.0072	0.0072	0.0072	0.0037	0.0037	0.0037
	(0.126)	(0.125)	(0.123)	(0.315)	(0.308)	(0.304)
Co-worker depend on me (increasing)	0.0189 ***	0.0189 ***	0.0189 ***	0.0133 ***	0.0134 ***	0.0133 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Physical work environment (increasing)	0.0280 ***	0.0280 ***	0.0280 ***	0.0188 ***	0.0187 ***	0.0187 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Agreeableness (increasing)	0.0084	0.0084	0.0084	0.0042	0.0042	0.0042
	(0.465)	(0.464)	(0.464)	(0.656)	(0.654)	(0.654)
Consciousness (increasing)	0.0072	0.0073	0.0073	0.0017	0.0018	0.0017
	(0.598)	(0.595)	(0.595)	(0.882)	(0.877)	(0.879)
Neuroticism (increasing)	0.1194 ***	0.1191 ***	0.1192 ***	0.0910 ***	0.0908 ***	0.0908 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Openness (increasing)	0.0046	0.0044	0.0045	−0.0034	−0.0035	−0.0034
	(0.658)	(0.669)	(0.660)	(0.678)	(0.668)	(0.679)
Extraversion (increasing)	−0.0256 ***	−0.0256 ***	−0.0256 ***	−0.0293 ***	−0.0293 ***	−0.0294 ***
	(0.004)	(0.004)	(0.004)	(<0.001)	(<0.001)	(<0.001)
Trust (increasing)	−0.0524 ***	−0.0524 ***	−0.0524 ***	−0.0348 ***	−0.0348 ***	−0.0348 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Profit situation categories (increasing)	−0.0284 **	−0.0293 **	−0.0285 **	−0.0180 *	−0.0186 **	−0.0178 *
	(0.023)	(0.020)	(0.023)	(0.052)	(0.049)	(0.055)

Table 3. *Cont.*

	Job Security Concerns Ordered Categories (OLS)			Job Security Concerns Dummy (OLS)		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Share female employees	−0.0941	−0.1002	−0.0947	0.0042	−0.0012	0.0032
	(0.567)	(0.540)	(0.562)	(0.972)	(0.992)	(0.979)
Share high skilled employees	0.1333	0.1329	0.1393	0.1662	0.1632	0.1693
	(0.520)	(0.513)	(0.496)	(0.288)	(0.287)	(0.274)
Share medium skilled employees	−0.0692	−0.0642	−0.0656	0.0136	0.0176	0.0164
	(0.384)	(0.416)	(0.405)	(0.809)	(0.754)	(0.770)
Establishment size dummies (ref. <50)						
50–99 regular employees	0.4352 ***	0.4284 ***	0.4310 ***	0.2474 ***	0.2399 ***	0.2425 ***
	(<0.001)	(<0.001)	(<0.001)	(0.001)	(0.001)	(0.001)
100–249 regular employees	0.4874 ***	0.4803 ***	0.4814 ***	0.2888 ***	0.2815 ***	0.2827 ***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
250–499 regular employees	0.5562 ***	0.5430 ***	0.5432 ***	0.3416 ***	0.3293 ***	0.3298 ***
	(<0.001)	(<0.001)	(<0.001)	(0.001)	(0.001)	(0.001)
>499 regular employees	0.6926 ***	0.6801 ***	0.6809 ***	0.4568 ***	0.4452 ***	0.4461 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Year dummies (ref. 2012)						
2014	−0.0533 ***	−0.0547 ***	−0.0543 ***	−0.0444 ***	−0.0459 ***	−0.0455 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(<0.001)	(0.001)
2016	−0.0549 ***	−0.0571 ***	−0.0564 ***	−0.0485 ***	−0.0509 ***	−0.0503 ***
	(0.007)	(0.005)	(0.005)	(0.003)	(0.002)	(0.002)
2018	0.0167	0.0135	0.0151	0.0107	0.0077	0.0091
	(0.617)	(0.683)	(0.650)	(0.707)	(0.783)	(0.745)
Establishment fixed effects (637)	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.9513 ***	0.9642 ***	0.9590 ***	0.1064	0.1225	0.1162
	(<0.001)	(<0.001)	(<0.001)	(0.427)	(0.353)	(0.384)
Number of observations	12,288	12,288	12,288	12,288	12,288	12,288
R-squared	0.219	0.220	0.220	0.191	0.191	0.191
Adjusted R-squared	0.174	0.175	0.175	0.144	0.145	0.145

Notes: OLS coefficients with *p*-values for clustered standard errors at the establishment level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Number of worker-year observations is 12,288 nested in 637 establishments. Data: LPP 2012, 2014, 2016, and 2018.

Second, the use and the share of TAW are correlated with fewer concerns about the job security of permanent workers. Whereas the use of TAW is statistically significant between the 10 and 18 percent level only in the first specifications, the share of TAW is statistically significant at least at the 6 percent level in all specifications. We provide a simple quantitative interpretation based on the coefficients of specification three of the OLS regressions for the binary dependent concern variable (last column in the upper part of Table 2), which has a mean of 0.35, i.e., 35 percent of permanent workers in our sample have low or high concerns, and 65 percent have no concerns about their own job security. The use of TAW in an establishment reduces the probability of having (low or high) concerns about job security among permanent workers by about two percentage points. A one percentage point higher share of TAW in the establishment reduces the probability of having (low or high) concerns about the own job security among permanent workers by additional 0.25 percentage points. Thus, permanent workers in a firm with a 10 percent TAW share would have on average a 4.4 percentage point ($-0.0190 - 0.1 \times 0.2522 = -0.04422$) lower probability of having concerns about their own job security compared to the situation in which the firm does not use TAW. Hence, our findings for TAW give on average more support to the core-periphery hypothesis than for the substitution hypothesis, i.e., core employees with permanent employment contracts benefit if firms can use TAW.

Table 4. Complete ordered and binary probit regression results.

	Job Security Concerns Categories (Ordered Probit)			**Job Security Concerns Dummy (Binary Probit)**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
FTC dummy	0.0450		0.0304	0.0567		0.0482
	(0.386)		(0.570)	(0.308)		(0.400)
TAW dummy	−0.0790		−0.0506	−0.0916		−0.0602
	(0.133)		(0.353)	(0.105)		(0.303)
FTC share		0.4198	0.3665		0.2921	0.2107
		(0.220)	(0.299)		(0.429)	(0.580)
TAW share		−0.6894 **	−0.6062 *		−0.8156 **	−0.7219 **
		(0.026)	(0.059)		(0.015)	(0.037)
Monthly net salary in thousand Euros	−0.0021	−0.0022	−0.0020	−0.0063	−0.0065	−0.0062
	(0.692)	(0.667)	(0.695)	(0.269)	(0.254)	(0.275)
Age in years	0.0002	0.0002	0.0002	−0.0014	−0.0013	−0.0014
	(0.864)	(0.857)	(0.858)	(0.350)	(0.354)	(0.352)
Male	−0.0829 **	−0.0832 **	−0.0831 **	−0.0879 **	−0.0879 **	−0.0879 **
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)
Having partner	−0.0173	−0.0179	−0.0179	0.0246	0.0242	0.0242
	(0.633)	(0.622)	(0.623)	(0.527)	(0.535)	(0.535)
Number of children < 14 years	0.0687 ***	0.0684 ***	0.0686 ***	0.0617 ***	0.0612 ***	0.0614 ***
	(<0.001)	(<0.001)	(<0.001)	(0.001)	(0.001)	(0.001)
University degree	0.0232	0.0229	0.0226	0.0071	0.0068	0.0063
	(0.456)	(0.461)	(0.468)	(0.829)	(0.836)	(0.850)
German citizenship	−0.1069	−0.1062	−0.1057	−0.0808	−0.0798	−0.0794
	(0.196)	(0.199)	(0.201)	(0.369)	(0.375)	(0.377)
Number of actual weekly working hours	0.0007	0.0007	0.0007	−0.0004	−0.0004	−0.0004
	(0.682)	(0.673)	(0.675)	(0.836)	(0.836)	(0.833)
Management position	−0.0388	−0.0393	−0.0388	−0.0262	−0.0266	−0.0261
	(0.208)	(0.203)	(0.208)	(0.424)	(0.416)	(0.426)
Available outside working time (increasing)	0.0409 ***	0.0408 ***	0.0408 ***	0.0480 ***	0.0481 ***	0.0480 ***
	(0.002)	(0.002)	(0.002)	(<0.001)	(<0.001)	(<0.001)
Decision autonomy (increasing)	−0.1144 ***	−0.1140 ***	−0.1143 ***	−0.1133 ***	−0.1127 ***	−0.1131 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Task variety (increasing)	−0.0090	−0.0094	−0.0092	−0.0145	−0.0150	−0.0147
	(0.521)	(0.502)	(0.513)	(0.334)	(0.318)	(0.328)
Dependence on co-worker (increasing)	0.0173	0.0175	0.0176	0.0126	0.0128	0.0129
	(0.123)	(0.117)	(0.117)	(0.291)	(0.284)	(0.279)
Co-worker depend on me (increasing)	0.0488 ***	0.0488 ***	0.0488 ***	0.0446 ***	0.0447 ***	0.0447 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Physical work environment (increasing)	0.0684 ***	0.0681 ***	0.0681 ***	0.0610 ***	0.0608 ***	0.0609 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Agreeableness (increasing)	0.0165	0.0167	0.0167	0.0141	0.0143	0.0142
	(0.474)	(0.468)	(0.468)	(0.565)	(0.561)	(0.563)
Consciousness (increasing)	0.0097	0.0099	0.0100	0.0002	0.0006	0.0005
	(0.733)	(0.728)	(0.727)	(0.994)	(0.984)	(0.986)
Neuroticism (increasing)	0.2962 ***	0.2958 ***	0.2960 ***	0.2927 ***	0.2921 ***	0.2923 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Openness (increasing)	0.0060	0.0055	0.0058	−0.0146	−0.0150	−0.0146
	(0.780)	(0.800)	(0.789)	(0.527)	(0.515)	(0.526)
Extraversion (increasing)	−0.0691 ***	−0.0690 ***	−0.0690 ***	−0.0973 ***	−0.0975 ***	−0.0976 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Trust (increasing)	−0.1253 ***	−0.1254 ***	−0.1254 ***	−0.1108 ***	−0.1109 ***	−0.1109 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Profit situation categories (increasing)	−0.0650 ***	−0.0674 ***	−0.0656 ***	−0.0558 **	−0.0578 ***	−0.0554 **
	(0.002)	(0.001)	(0.002)	(0.012)	(0.009)	(0.013)

Table 4. *Cont.*

	Job Security Concerns Categories (Ordered Probit)			Job Security Concerns Dummy (Binary Probit)		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Share female employees	−0.3091	−0.3266	−0.3103	−0.0398	−0.0586	−0.0401
	(0.404)	(0.377)	(0.402)	(0.921)	(0.883)	(0.920)
Share high skilled employees	0.3481	0.3534	0.3661	0.4787	0.4734	0.4902
	(0.329)	(0.322)	(0.305)	(0.217)	(0.222)	(0.206)
Share medium skilled employees	−0.1376	−0.1247	−0.1293	0.0505	0.0645	0.0587
	(0.404)	(0.449)	(0.433)	(0.777)	(0.717)	(0.742)
Establishment size dummies (ref. <50)						
50–99 regular employees	0.8935 ***	0.8724 ***	0.8787 ***	0.7776 ***	0.7507 ***	0.7604 ***
	(<0.001)	(<0.001)	(<0.001)	(0.003)	(0.004)	(0.003)
100–249 regular employees	1.0096 ***	0.9859 ***	0.9890 ***	0.9005 ***	0.8707 ***	0.8764 ***
	(<0.001)	(<0.001)	(<0.001)	(0.002)	(0.003)	(0.003)
250–499 regular employees	1.1619 ***	1.1234 ***	1.1239 ***	1.0499 ***	1.0046 ***	1.0071 ***
	(<0.001)	(<0.001)	(<0.001)	(0.001)	(0.002)	(0.002)
>499 regular employees	1.4654 ***	1.4264 ***	1.4289 ***	1.3974 ***	1.3521 ***	1.3568 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Year dummies (ref. 2012)						
2014	−0.1323 ***	−0.1353 ***	−0.1341 ***	−0.1441 ***	−0.1484 ***	−0.1473 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
2016	−0.1398 ***	−0.1437 ***	−0.1418 ***	−0.1615 ***	−0.1681 ***	−0.1661 ***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
2018	0.0439	0.0385	0.0418	0.0344	0.0264	0.0304
	(0.327)	(0.391)	(0.353)	(0.471)	(0.581)	(0.525)
Establishment fixed effects (637)	Yes	Yes	Yes	Yes	Yes	Yes
Cut point 1	1.9138	1.9038	1.8971			
Cut point 2	3.3639	3.3544	3.3478			
Constant				−1.7443	−1.7240	−1.7296
Number of observations	12,288	12,288	12,288	12,288	12,288	12,288
Pseudo R-squared	0.147	0.147	0.147	0.161	0.161	0.161

Notes: Ordered and binary probit coefficients with *p*-values in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Number of worker-year observations is 12,288 nested in 637 establishments. Data: LPP 2012, 2014, 2016, and 2018.

Finally, we look at significant coefficients estimated for our control variables. Table 3 contains the complete results for the OLS regressions, and Table 4 contains those for the ordered and binary probit regressions. A comparison of the different specifications with ordinal and binary dependent variables for own job concerns as well as a comparison of the estimates using OLS and probit regressions do not reveal noteworthy differences, so we give an overall interpretation. The results for the socio-demographic control variables reveal that men have on average fewer concerns about their own job security than women and that workers with children younger than 14 years have on average more concerns about their own job security. Note that the estimated coefficients for the number of young children contain the probability (having young children at all) as well the number of young children. One reason why parents have more concerns about job security might be that a job loss affects not only oneself but the entire family. Moreover, our results indicate that job-related characteristics are important. Workers with higher decision autonomy in a firm are less concerned about their own job security. However, workers have more concerns about their job security if they state a higher availability outside regular working time, a higher dependence of co-workers on oneself, and a more physical work environment. Some personality characteristics of workers are also significantly correlated with concerns about job security, which stresses their importance as control variables. Whereas workers with higher levels of neuroticism report more concerns about job security, workers with higher levels of extraversion and trust report fewer concerns. Although we have included establishment fixed effects, results for time varying establishment characteristics show that workers in larger firms and in firms with a better profit situation have on average fewer

concerns about job security. Due to the inclusion of establishment fixed effects (within instead of between perspective) both results can be plausibly interpreted in the way that job security is larger if firms increase employment and improve their profit situation.

5. Concluding Remarks

Cappelli and Neumark (2004, p. 177) have analyzed turnover rates in a cross-section of establishments in the US and concluded: "*the evidence paints a rather clear picture regarding the core-periphery hypothesis because we find that contingent work [use of any contract, leased, or temporary agency workers (page 158)] and involuntary turnover of the permanent workforce are positively and significantly related, contradicting the core-periphery hypothesis*". However, their correlations between turnover rates and the use of temporary employment might be driven by unobserved factors at the establishment level, which we consider by the inclusion of establishment fixed effects in our regressions. Moreover, involuntary turnover rates at the establishment level are only one implication of the core-periphery hypothesis. More central to the core-periphery hypothesis is the question of how permanent workers perceive their job security, because this also affects the willingness to accept compensating wage differentials and to stay in the establishment.

Our results support the core-periphery hypothesis for TAW, i.e., permanent workers perceive their job security as larger when firms use TAW. We find, however, no evidence for the core-periphery hypothesis for FTCs. However, the non-significant estimates for FTCs also indicate that substitution is not that pronounced, as is indeed intended by German labor law, which restricts consecutive FTCs. Although the permanent (core) workforce might benefit by using an additional temporary (peripheral) workforce in internal dual labor markets, an overall welfare perspective would need to include an additional assessment if temporary jobs are stepping-stones for better permanent jobs or if temporary workers are stuck in dead-end jobs with low job security, low pay, and few career advancement opportunities (Booth et al. 2002; Jahn and Rosholm 2014).

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