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ABSTRACT

Worker Representation and Temporary Employment in Germany: The Deployment and Extent of Fixed-Term Contracts and Temporary Agency Work

This study examines the potential impact of works councils and unions on the deployment of fixed-term contracts and agency temps. We report inter al. that works councils are associated with a higher number of temporary agency workers when demand volatility is high while the opposite holds for fixed-term contracts. These disparities likely reflect differences in function, with agency work being more directed toward the protection of a shrinking core and fixed-term contacts being as much a port of entry as a buffer stock. We are also able to identify the number of new hires with a fixed-term contract as well as the number of FTC conversions (into regular employment) and renewals, the correlates of which flows are broadly consistent with the stock data.

JEL Classification: J21, J23, J41, J 48, J51, J63, K31

Keywords: agency temps, fixed-term contracts, stepping stones, buffer stocks, labor market duality, extensive/intensive margins, works councils, unions, collective bargaining, demand volatility, complementarity, Germany

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I. Introduction

In Germany, as in other countries, controversy attaches to the deployment of temporary workers. On the one hand temporary work has been linked to heightened labor market duality, and on the other to increased labor market flexibility offering improved labor market access and fostering job creation. But the tenor of the German debate has differed somewhat from that in other countries given that nation's unique performance during the Great Recession in 2008/9, when it was able to successfully negotiate economic adversity without an increase in unemployment or a decline in the number of jobs. That experience may at once have both reflected and further influenced the thinking of key players – unions, works councils, and employers – on temporary employment; with the worker side being more accepting of it and employers for a variety of reasons (including it must be said the prospect of *reregulation*) being less motivated to use temporary employment as a low-road strategy. Even if the types of 'atypical work' considered in the present treatment – temporary agency work and especially fixed-term contracts – may be less atypical than other non-standard types of employment in Germany, such as marginal part-time work, both types of temporary employment can readily be compared with their counterpart entities in other nations.

Other-country research, and typically that in the Anglo-Saxon tradition, has tended to focus upon employment transitions and whether or not temporary employment functions as a stepping stone to regular employment, with frankly pessimistic conclusions on net.[1] Although a major component of the German literature has not shied away from equating agency work in particular with precarious employment and the notion of a shrinking core (of regular employment), German research has tended more to look at issues such as the operational reasons for using different types of temporary work, issues of intensity of use, and, most recently, the role of temporary agency work in particular as a driver of labor market dynamism leading to higher productivity and enhanced job security of regular workers without impairing the job access of temps themselves.

But the fact remains that in Germany as elsewhere our knowledge of temporary employment remains partial at best. Nowhere is this more apparent than in the context of the role of institutions, the topic of the present inquiry. Only latterly have studies sought to incorporate unions and the interplay between unions and product market volatility and even to distinguish between types of temporary employment in this regard. Our treatment is firmly anchored in this new institutionalist tradition. Specifically, it seeks to examine the effect of worker representation on the use and the intensity of use of temporary employment, distinguishing between fixed-term contracts and temporary agency work. The potentially crucial role of product market volatility in shaping the response of labor market institutions is accorded special emphasis, not least since this interplay may assist in explaining the different effects of unions reported in a literature that has neglected the volatility argument.

Although our main concern is to evaluate the effect of labor institutions on the number of temporary agency workers and fixed-term contract workers within the analytical framework of a zero-inflated negative binomial model, we use that same framework to further investigate one of our temporary employment types for which we have added information. Specifically, for fixed-term contracts, we investigate the following three additional margins of adjustment: the number of new hires engaged under a fixed-term contract, the number of fixed-term contracts that are converted in to open-ended employment, and number of workers whose fixed-term contracts are renewed. Consistency of institutional effect across outcome indicators is investigated.

The main part of our analysis pertains to the decade 2006-2015. However, in an attempt to further explore the possible confounding role of unobserved factors we exploited two survey

questions asked in 2010 alone. For this single cross-section of the data, the survey inquired of the manager respondent the reasons for hiring temporary agency workers and on the actual implementation of human resource practices in those establishments. These responses were used descriptively to examine their covariation with the labor institution variables. Finally, data on union density were obtained from other data sources, and incorporated directly into the ZINB model, given that this measure of unionization is potentially correlated with works council presence and collective bargaining status on the one hand and with the relevant outcome indicator on the other.

The structure of the paper is as follows. Section II contains a thematic review of the literature on temporary employment together with some key theoretical expectations. The principal dataset employed here, the IAB Establishment Panel, is addressed in section III. Section IV contains the distinctive model used in this empirical inquiry and its justification. Detailed findings are presented in section IV and are followed by a sensitivity analysis in section VI. Section VII concludes.

II. Literature Review

The literature on temporary employment has focused on fixed-term contracts and temporary agency work without necessarily considering both or distinguishing between them. Where the two have received separate consideration, attention has tended to focus on either their contribution to flexibility in markets often characterized by tightly regulated open-ended employment or, more commonly perhaps, on their impact as stepping stones to regular employment as opposed to a being a dead end outcome associate with heightened labor market duality Our review of the *German* literature will necessarily touch upon issues that have preoccupied the wider literature not least because our sample period follows intervals of pronounced liberalization of the rules governing the two types of contract. That said, our emphasis will be upon the very much smaller literature – both German and other-country – either informing or directly investigating the impact of collective bargaining and worker representation on the occurrence and extent of fixed-term contracts and temporary agency work. We note parenthetically that by the end of our sample period there are indications of a shift back towards re-regulation.

Our opening remarks will form the necessary backdrop to the labor institution questions that motivate the present analysis. They cover the course and role of temporary agency work and fixed-term contracts over most of our sample period and are well rehearsed in survey papers by Spermann (2011) and Eichhorst and Tobsch (2013). The study by Spermann charts the major growth in agency work after the Hartz 1 reforms in Germany (see Legal Appendix). Drawing in part on Bellmann, Fischer, and Hohendanner (2009), Spermann notes that staffing agencies were the leading drivers of job creation. Even if their penetration rate (i.e. their share of all workers covered by social insurance) is only around 2.6% and procyclical, the share of temporary agency workers among individuals entering and leaving the workforce is considerable. The stepping-stone hypothesis is also addressed by Spermann, and while little general evidence favoring the argument is found it seems clear that temporary agency work has an access-to-work function improving the likelihood of the unemployed being employed in the future (Kvasnika 2009), even in open-ended employment (Lehmer and Ziegler 201).

Spermann's review is particularly useful in documenting who uses temporary agency work, the reasons for so doing, and the intensity of use. To illustrate, some 3% of enterprises used agency temps in 2008, while usage is heavily dependent upon firm size, with almost one-quarter of mid-

sized enterprise (50-249 employees) and one-half of large enterprises (≥250 employees) making use of temps between 2003 and 2005. Intensity of use also varies directly with firm size (Crimmann et al. 2009).[2] Among the structural (e.g. industry affiliation) and functional factors (e.g. firms undergoing organizational transformation), Spermann cites work by Promberger (2009) indicating that the deployment of temporary work arrangements is more likely in enterprises with a works council, the stated justification being that 'moderate' use of temporary agency work helps secure the jobs of the permanent workforce. That said, in circumstances of *strategic intensive use* (Holst, Nachtwey, and Dörre 2009) of temps by management, whereby as a deliberate company strategy temps have come to comprise an important and enduring share of the labor force, works councils and labor unions have sought to cap the number of temps that may be sent to the user company. Relatedly, IG Metall have negotiated an automatic permanent hiring of temps after 12 months under an agreement with Siemens (see Schild and Petzold 2009).[3]

Eichhorst and Tobsch (2013), while focusing on the theme of labor market segmentation more generally, seek to draw a distinction between fixed-term contracts and agency temporary work. Fixed-term contracts are said to mainly affect job entrants in the private sector, apprentices and mostly young employees in the public, academic, or social sector. Temps for their part are mainly concentrated among basic occupations in the manufacturing sector and some office services with more limited prospects for transition to permanent jobs. Fixed-term contracts have remained constant at about 7 to 8% of total employment, although this total excludes about the same share in fixed-term apprenticeship contracts. Agency work has grown since 2001 but, as noted earlier, it accounts for about 2.5% of total employment. Its growth is primarily attributed to labor market reforms and related restructuring of companies in the manufacturing sector since the mid-2000s. However, this acceleration has been dominated by the growth in other areas (e.g. part-time work and marginal part-time work). Although Eichhorst and Tobsch report that there is significant mobility out of fixed-term contracts and temporary agency work,[4] they again seek to draw a distinction between fixed-term contracts and temporary agency work. They argue that the transition from a fixed-term contract to a permanent contract is relatively frequent in Germany and in particular for young people entering the private sector for whom fixed-term contracts – abstracting from apprenticeships – are to be seen as an extended probationary period, also noting that continuous renewal of fixed-term contracts is widespread in the public, academic, and social sectors where specific conditions prevail. (See the Legal Appendix for the different rules obtaining for fixed-term contracts with and without cause/objective reasons. In general, the latter contracts may only be extended for a maximum of three terms and may not exceed two years' duration in total, whereas the former have no maximum duration or maximum number of extensions.) Mobility from temporary agency work to permanent direct employment is stated to be more problematic given the concentration of agency work among basic occupations and in firms subject to restructuring and thence exposure to greater risk of labor market duality/segmentation, leading the authors to refer pessimistically to the "distinct institutional arrangements and functional logic of agency work in Germany" (Eichhorst and Tobsch 2013: 21-22). Finally, the authors see the policy issues – and here we should note that they subscribe to a shrinking core model – raised by fixed-term contracts and temporary agency work as different in kind. As regards the former, the main problem is seen as the reluctance of public sector employers to convert temporary jobs (strictly fixed-term contracts) into permanent jobs because of the near impossibility of firing civil servants and public employees with tenure. For its part, the problem of temporary agency work is

viewed as akin to that of marginal part-time work. Here the solution is seen almost the opposite as that advocated for part-time work, namely re-regulation based on 'real' equal pay and a movement in collective bargaining towards stronger codetermination in the deployment of agency work – aspects of which were touched upon above. The latter is expected to hinge on union strength and the willingness of employers to compromise on the issue as part of a larger bargaining deal.

There is, then, some suggestion in the German literature that the consequences of fixed-term contracts and temporary agency work may differ. Thus, for example, there is some real indication that fixed contracts offer a pathway to permanent employment, particularly in those circumstances where the normal legal promotion period offers insufficient time to assess the quality of the match, as might often be the case with university graduates (Boockmann and Hagen 2008). Nevertheless, to the extent that fixed-term contracts provide a secondary market, there is obvious scope for examining both fixed-term contracts and temporary agency work, not least in the light of research on the access to work function of temporary agency work noted earlier. We note parenthetically that, among those for whom the school-to-work transition is less coordinated, a group that includes both low-skilled labor market entrants as well as the their more highly-skilled counterparts, "beginning working life with a fixed-term contract does not clearly signal a 'bad start'" (McGinnity, Mertens, and Gundert 2005: 369).

We earlier touched upon the possible role of collective bargaining and workplace representation on the deployment of temporary employment. This neglected theme is the focus of the present treatment. We conclude this review of the literature with a discussion of the two most relevant studies that directly examine these labor organizational influences on temporary employment.[5] They throw light on some disparate findings of earlier institutionalist treatments while also directly informing our own empirical inquiry.

In the first study, Salvatori (2009) uses the Establishment Survey on Working Time and Work-Life Balance (ESWT) for 2004/2005, covering 21 EU nations and a sample of more than 21,000 workplaces. In addition to this dataset, he also exploits the British Workplace Employment Relations Survey (WERS) for 2004 and 1998-2004 to assess reverse causality and other sources of union endogeneity. Beginning with the ESWT analysis, Salvatori's linear models point to a positive association between union presence and the probability of the workplace having employed fixed-term contract workers and agency temporary workers at some time in the 12 months preceding the survey. Overall, unions are associated with a 5% increase in the probability of observing the former and a 3% increase in the probability of observing the latter. Note that 'unions' encompass any form of workplace representation, and so include works councils as well as unions per se, and that results of this cross-section component of the analysis differ across old and new members of the EU and for samples stratified by the most important level of bargaining in each country. The bottom line of this part of the study is that the union encouragement of fixed-term contracts result appears more generalizable across countries than the agency worker result. Given that union status might be endogenous (e.g. where temporary workers are less likely to be union members their presence could decrease the likelihood that a workplace becomes unionized), Salvatori employs data from the British WERS to instrument union status and also to exploit variation over time and across occupations to control for workplace heterogeneity.

Salvatori's first test uses the level of employment in 1998 to instrument for union status in 2004. His estimated linear models indicate that the probability of using fixed-term contracts is very much higher in unionized firms, irrespective of the unionization measure (either presence of some

union members at the workplace or union recognition at the workplace or at a higher level in the same firm). Results for agency work, although still positive, are weaker especially for the union membership measure of unionization. In next exploiting variation over time, Salvatori's complementary longitudinal analysis of the WERS first offers first-difference estimates to remove the effect of time invariant variables that could confound the effect of unions and second a within-firm estimator based on information on occupations within workplaces to remove workplace level confounders. His fixed effects estimates produce positive and significant coefficient estimates for the union membership argument for both types of temporary employment, but mixed results for union recognition particularly in the case of fixed-term work. The within-workplace analysis yields positive but typically insignificant coefficient estimates for the union membership variable while also failing to reveal any clear evidence of a union bargaining effect outside of local bargaining where the effects are positive and significant in the case of agency work alone. Thus, there is a reversal of the strength of union impact as between the two types of temporary employment when compared with the cross-section evidence. The bottom line would appear to be that, at least for the U.K., there is little evidence of a strong effect of unionization on the use of temps and fixed-term contract workers after controlling for the endogeneity of union status. Salvatori nevertheless interprets his results as suggesting that workplace unionism increases the probability of the firm using temporary employment. That said, he cautions that this effect could arise from a buffer effect (benefitting core workers) or alternatively from the actions of employers seeking to undermine the union strength in collective bargaining.

The finding of a positive association between unionization and temporary contracts is also reported in an innovative study by Devicienti, Naticchioni, and Ricci (DNR) (2018), which is notable for its recognition and interpretation of the interplay between unions and product market volatility, in distinguishing between different types of fixed-term work (training vs. nontraining contracts), and in the attention paid to econometric identification. Using Italian firm-level data for 2005 and 2007, the authors estimate OLS, IV, and FE models regressing a firm's propensity to use fixed-term contracts on product market volatility, presence of a union in the workplace, the interaction between volatility and union presence, and a set of controls that include the share of female workers, the shares of blue-collar and white-collar workers, the firm's age, firm size dummies, sector dummies, and area dummies. Volatility is computed as the average standard deviation of log sales over the period 1997 to 2005, calculated at the three-digit industry level. In the IV models, workplace unionization is instrumented with the two-year lagged mean unionization at the industry and regional level. The FE model comprises a baseline specification absent the interaction term but maintaining the time-varying controls as in the OLS and IV models.

Results of the OLS model for the most parsimonious specification containing volatility and union presence indicate that the former is positively and the latter is negatively associated with the use of fixed-term contracts. As the authors note, the two results might conventionally, albeit superficially, be rationalized in the following manner: greater volatility encourages firms to employ temporary workers so as to adjust the labor input more easily, while unions seek to limit recourse to temporary workers on the grounds that they might dilute membership and with it union authority. But in the next iteration the interaction term is negative and statistically significant while the coefficient estimate for the union term is no longer statistically significant, suggesting that union impact is bound up with uncertainty. For their part, the corresponding IV estimates confirm the volatility result for the parsimonious equation (but the union effect is now insignificant), while

fuller specifications corroborate the finding of a negative interaction term between volatility and unions while pointing to a significantly positive union coefficient estimate. The baseline FE model is quite consistent with the previous baseline results for volatility and the now very small union coefficient estimate can be interpreted as implying that when the interaction term is omitted the union effect becomes small and insignificant as it picks up average volatility, meaning that at low (high) volatility the union effect is positive (negative).[6] When the interaction term is duly 'added back' all the previous effects obtain. Equally, the results are shown to be robust with respect to the introduction of idiosyncratic shocks that might be correlated with workplace unionism and the firm's demand for temporary workers, and to the other added controls.

In a final empirical application, the authors estimate the IV and FE variants of the model across two distinct types of fixed-term contact, namely training contracts and those not offering training. For nontraining contracts all the previous results obtain. In the case of training contracts, however, none of these arguments plays a role. The authors argue that in the presence of a core labor force that enjoys a high level of employment protection, firms will not seek to deal with a volatile market environment by offering training contracts whose investments cannot be amortized. For their part, unions are seen to have an interest in some level of nontraining contracts that act as a buffer stock and protect permanent workers to some degree, whereas training contracts cannot act as a buffer stock. In addition, firms may see in the cheaper form of temporary contracts some protection against aggressive unions. And what of the strongly negative interaction term against this backdrop? In a volatile environment, unions may also be wary of a diminution in their authority or voice through dilution. They may also have recourse to other mechanisms such as internal labor market flexibility and embrace cooperation with management.

The authors see their results as offering a framework capable of explaining disparate results reported in the literature on unions and temporary employment. To repeat, the key is the interplay between unions and volatility. Unlike volatility, which has a positive effect on fixed-term contract work, the union effect is not transparent. Rather, it depends on the degree of volatility, different degrees of which are capable in principle of explaining the different effect of unions reported in treatments that exclude the volatility argument. By the same token, outside of archetypal 'disposable' temporary employment contracts the new model offers little guidance.

The literature thus presents a disparate set of findings as regards the relationship between worker representation and the use of temporary employment, as indeed is also the case for other associations in this area.[7] The picture is further clouded insofar as the respective contributions of different types of worker representation (i.e. works councils and unions/collective bargaining) and temporary work (temporary agency work and fixed-term contracts) are concerned. With respect to worker representation, the studies of Salvatori (2009) and DNR (2018) do not distinguish between unions and works councils as their emphasis is upon workplace representation, it being argued either explicity or implicitly that the two entities produce similarly signed correlations with temporary work on the grounds that each has an interest in protecting the core and in consequence favors dual labor markets and the use of temporary employment. To be sure, *national* unions may be more sensitive than their local counterparts to the depletion of union power raised by more temporary employees but this is presumably a function of intensity of use rather than use itself – and intensity has been less well studied.[8] In any event, in Germany the local presence is assumed by works councils, collective voice agencies that may respond more favorably to the initiatives of local management.

More generally, the position taken on unions is that they represent permanent workers and use their bargaining strength to increase the wages of permanent workers. Firms may then respond by using more temporary employment. The same result follows where unions increase the expected firing costs of permanent workers. Add in uncertainty/technological change and one encounters the familiar argument that temporary workers are a buffer for permanent workers. Although all of this points to a positive relation between worker representation in unions and temporary employment in defense of the core, there can be no unanimity regarding the union effect: if temporary workers do sap union strength – as they are less unionized and less engaged in industrial relations – the opposite result might obtain.

However, if at the outset one abandons the view that the nature of employment relations is adversarial and enters a world of incomplete contracting, an efficient governance apparatus engaging unions as a central player may eschew temporary contracts under normal circumstances. One aspect of cooperation may be wage moderation and/or greater internal employment flexibility. So local unions/works councils may be associated with less atypical work because segmentation damages worker cohesion and serves to frustrate the solution to incentive compatibility problems. On this model, any tendency on the part of unionized firms to have greater recourse to temporary employment in the face of increased uncertainty is generally assumed to be less than in nonunionized firms. If this is the case, the periphery is of secondary importance throughout and the efficient contracting model deviates from its core-periphery counterpart in predicting a (consistently) negative relation between local unions/works councils and temporary employment. However, ambiguity surrounding the union effect persists because we do not know the reach of continuity labor markets and their sensitivity to change.

Nevertheless, progress has been made in integrating uncertainty in empirical applications. For DNR, as we have seen, product market volatility assumes center-stage. Here the argument is that the effect of local unions (and necessarily other forms workplace representation as well) will likely hinge on product market volatility. This volatility is likely to affect the objectives and strategies of the bargaining process between unions and firms over various aspects of the employment relationship. In particular, volatility adds an element of heterogeneity into the impact of unions on a firm's desire for temporary employment. As reviewed earlier, a generally positive effect of workplace unions on use of temporary employment contracts morphs in the presence of heighted uncertainty/volatility to a negative association. This at least is the prediction of the standard core-periphery model, and for DNR is also expected for continuity markets as well.

This inevitably brings us to potential differences in type of temporary work contract even if few studies have examined the correlates of each in a unified framework. Given that fixed-term contracts achieve a number of roles other than short term filling in, as it were, we might expect real differences in the results for the two types of temporary contract, even if there is some modest evidence in the literature of complementarity in their deployment (Pfeifer 2005: 414). For example, to the extent that FTCs provide training, we would not expect that they are used to offer protection to the core of permanent workers and firms will be unwilling to sacrifice their training investments. Also, if training contracts are offered there is the suggestion that they will be a smaller threat to a union as their incumbents will likely engage in more union activity and join unions. At first blush it may be tempting to argue that changes in the intensity of use of fixed-term contracts and agency temps will be *directionally* the same in circumstances where works councils are buffeted by increased product market volatility. However, to the extent that such entities might eschew the use

of agency temps in normal times by reason of their lower skill levels and experience they may nonetheless have to embrace them in extremis to protect the survival of a shrinking core. A secular shrinking core allied to deskilling and organizational transformation is unlikely to characterize the large majority of establishments hiring fixed-term contract workers whose use as a buffer during intervals of heightened volatility may nonetheless be viewed by a works council as a threat to the seniority unit. At such times, therefore, works councils may even seek a moderation in the use of fixed-term contracts to maintain a stable core.

For fixed-term contract workers alone our dataset contains information on more than just their number at a point in time. Specifically, over a six-month interval in each year, we can examine the association between labor institutions/volatility and the number of new hires with a fixed-term contract, the number of fixed-term contracts that are converted into permanent jobs, and the number of fixed-term contract renewals. We anticipate reduced antipathy towards FTCs on the part of works councils vis-à-vis other labor institutions and anticipate that the flows will be increasing in volatility. As for the interaction term between works councils and volatility, we see no reason to expect inconsistency in the results as between the flow and the stock measures of fixed-term employment.

A final lesson from the literature has to do with model specification. In an environment where most establishments are *non-users* of either type of temporary employment, employing a zero-inflated negative binomial model may be expected to offer a better fit to the data than the OLS models used in the literature while offering more information on the potential role of institutions. We would conjecture that an establishment's status as a user or non-user of either type of temporary work arrangement is likely to be mainly determined by plant characteristics, with labor institutions playing a less prominent role than at the intensive margin.

In short, despite its ambiguities, we find the literature on worker representation and temporary employment informative as to the arguments appropriate to any such inquiry and suggestive of (improved) model specification.

III. The Data

In this study we employ the IAB Establishment Panel, which is a large-scale representative survey dataset of establishments in Germany sponsored by the Institute for Employment Research (IAB). The IAB Establishment Panel has been available since 1993 and comprises some 15,000 to 16,000 establishment interviews per year. It provides detailed information on the demand side of the labor market as of the reference date (i.e. June 30 in each year); in particular, concerning the structure of the establishment's workforce, labor turnover, business policies (including investment and training), and performance. Apart from its strong panel dimension, with a yearly continuation response rate of over 80 percent, new establishments enter the survey in every wave to both compensate for non-responses/panel mortality and to mirror firm dynamics (i.e. births and deaths). For a more detailed description of the IAB Establishment Panel, the reader is referred to Ellguth, Kohaut, and Möller (2014) and Fischer *et al*. (2009).

In order to shed light on the different aspects of the relationship between industrial relations institutions and the employment of fixed-term and agency workers we select five separate response variables. The first is the number of agency workers employed by an establishment (Y_1), the second is the corresponding number of workers with a fixed-term contract (Y_2), while the remaining three

variables exploit additional information only available for fixed-term contracts. These comprise the number of fixed-term contracts among the new hires (Y_3), the number of fixed-term contracts which transition into a permanent contract (Y_4), and the number of workers whose fixed-term contract is renewed (Y_5). Outcomes Y_3 through Y_5 are flow variables pertaining to the first half of the year (i.e. observed from January to June), whereas Y_1 and Y_2 are stocks measured at the reference date (i.e. June 30). For most of our analyses, we shall employ an unbalanced panel covering the years 2006 through 2015, with the exception of variable Y_5, for which the required information is only available from 2009 to 2015. Only establishments with at least 5 employees are included in our estimation sample. We also restrict the sample to privately-owned, for-profit organizations, by eliminating from the raw sample all those establishments that are either publicly owned or report a budget volume when asked about their sales revenues.

The labor institution variables are flagged by 1/0 dummies indicating whether there is a works council, a sector-level collective wage agreement, or a company-level collective wage agreement. (Additional labor organizational variables will be deployed in our separate sensitivity analysis.) Throughout our investigation, the presence of a works council will be interacted with product demand volatility. This variable is, for each year and for each industry, given by the average standard deviation of establishment log sales. Specifically, $volatility_i = (\frac{1}{N_i-1}\sum_{e=1}^{N_i}\{\log(sales)_e - \overline{\log(sales)}_i\}^2)^{1/2}$, where the subscripts e and i denote establishment and industry, respectively, and N_i is the number of establishments in industry i (subscript t omitted). To further reduce the possibility of potential endogeneity of the volatility variable, we take the average of the past 6 years, so that the demand volatility measure in year t is the average over *t-1, t-2, …, t-6*. Observe that the use of an average over an industry and not the establishment's own sales is also helpful in this regard. The sample comprises a total of forty-three 2-digit level industries, which are then aggregated into 19 industries dummies.

Our set of control variables includes workforce composition (namely the share of women, part-time workers, employees hired for simple tasks that do not require any vocational training, and employees hired for complex tasks that require either a vocational training certificate, a corresponding measure of professional experience, or a university or college degree) and the sum of gross wages. In addition, dummies indicating whether competitive pressure is reported to be high, some fraction of the output/sales volume is exported, parts of the establishment's activity have been outsourced, and whether the technical standard of the capital stock is either excellent or good (versus either rather poor or completely outdated) are deployed, as well as measures of establishment age, size, industry affiliation, and location. Finally, some specifications also control for the establishment's hiring rate (defined as the number of hires divided by the total number of employees), the share of fixed-term contract workers, and the proportion of employees who received further training during the first six months of the year. A full description of the variables and the corresponding summary statistics are provided in Table 1.

[Table 1 near here]

IV. Modeling

We employ a zero-inflated negative binomial (ZINB) model to analyze the determinants of the selected discrete response variables $Y_{ji}, j = 1, 2, \dots, 5$. In this framework, subscript j denotes, respectively, the number of agency temps (Y_1), fixed-term contract/FTC workers (Y_2), new hires

with a FTC (Y_3), FTC workers converted into permanents (Y_4), and workers whose FTC has been renewed (Y_5) per establishment *i*. Again, the time subscript is omitted to simplify the notation.

A key aspect of this modeling strategy is the presence of two underlying data generation processes. In the case of agency temps (Y_1), for example, this means that on the one hand we have a process explaining an establishment's *participation* in the hiring of temps and on the other, given the probability of its being a *participant*, an alternative process determining the *extent* of its usage or subsequent probability of using *k* (integer) temps, *k = 0, 1, 2, …, m.* This approach offers the possibility of separating the so-called certain (or excess) zeros – defined as the group of establishments for which the count is expected to be zero – from the alternative group of potential users for whom any non-negative count is possible.[9]

Clearly, the ZINB offers a better fit to the data than an ordinary least squares regression: firstly, because there is a mass of zeros in the observed count; and, secondly, because the outcome variable is necessarily censored (non-negative). In turn, the ordinary Poisson model (or the negative binomial) does not tackle the issue of *endogenous participation*; that is, it does not distinguish the group of absolute zeros from the rest (i.e. the group of zeros 'by choice'). As shown in the next section below, the relative frequency of zeros in our dataset is around 80%, raising concerns that a non-zero inflated model has the potential to introduce confounding factors that will bias the estimates. Using the ZINB model we will therefore examine the role of industrial relations institutions both at the extensive (participation) and intensive (use) margins, with respect to any of the selected response variables.

Formally, and for illustrative purposes using the zero-inflated Poisson (ZIP) case,[10] the response variables Y_{j1}, Y_{j2}, …, Y_{jn} follow a binary process in which, for each $j = 1, 2, \ldots, 5$, we have $Y_i \sim 0$ with probability p_i and $Y_i \sim$ Poisson (λ_i) with probability $(1 - p_i)$ so that $Y_i = 0$ with probability $p_i + (1 - p_i)e^{-\lambda_i}$, and $Y_i = k$ with probability $(1 - p_i)e^{-\lambda_i}\lambda_i^k/k!$, $k = 1, 2, \ldots$ (e.g. Lambert 1992). In practical terms, the logistic regression explains participation based on a set of covariates *A*, followed by a count model with covariates *B*. In principle, there will be little prior information on the role of covariates in the *A* and *B* subsets. It is therefore possible to have a situation in which, say, a given covariate generates both higher participation and less intensive use, or conversely. In our case, the same set of regressors will be exploited in both decisions. The set of proposed statistical tests will then shed light on the relevant empirical hypotheses.

Although the ZINB and ZIP models address the issue of endogenous participation, in the sense that each of them tackles the difficulty arising from the possibility that the observed zeros in the count model may come from two quite distinct groups, there remains the issue of endogenous treatment at the intensive margin. One possibility is that a works council may have unobserved characteristics that generate both participation *and* the number of temps in the establishment. As we lack any good instrument to control for the possibility of endogenous treatment, and the instrumental variable approach in the context of zero-inflated models is unchartered territory, we will discuss the robustness of the ZINB results by experimenting with observables that may predetermine the works council and/or collective bargaining status. To this end, we will first examine, across different groups, some descriptive statistics on the reasons why establishments hire agency temps and the corresponding occurrence of human resource management practices. Next, we will complement this inferential analysis by introducing alternative measures of unionization into our ZINB model, even if data constraints compel us to utilize a single cross-section for 2010 rather than the pooled 2006-2015 data.

V. Findings

Descriptive evidence

As intimated in section II, there has been a long-lasting discussion about the development and impact of non-standard employment in Germany, perhaps most prominently in the debate about the extent to which employment at the margin (namely, temporary agency and fixed-term contract workers) helped Germany survive the Great Recession virtually unscathed. We provide in the present subsection descriptive evidence on the relevant time series, firstly by examining the corresponding data extracted from the original IAB Establishment Panel survey, and secondly by looking at the derived outcome variables and the selected covariates using the (smaller) estimation sample. In contrast to the full sample, recall that the latter excludes publicly-owned establishments and those establishments with less than 5 employees. By construction, all our descriptive statistics are calculated at establishment level.

Observe firstly that in the IAB Survey the group of temporary agency workers, freelancers, and 1-Euro jobs is supplementary to the *personnel* structure of the establishment. Accordingly, the former constitute *external* employees, while the latter defines the group of *internal* employees or the number of employees at the establishment as defined by the IAB Survey. *Total* employment is then defined as the sum of the two components: internal and external. (Full definitions of these variables are given in Appendix Table 1.) The interesting aspect arising from this decomposition is that we are in a position to generate a unique time series, namely one that gives the number of workers – internal and external – that establishments actually have at their disposal. In other words, Figure 1 below is unique in the sense that only the IAB data contains this type of information, unavailable from typical individual-based data sources (e.g. the German Statistical Office).

Note secondly that given that internal employment is the sum of full-time and part-time work, we can define the group of internal full-time employment and by subtracting it from total employment obtain the sum of internal part-time work plus external employment. (Unfortunately, the distinction between full- and part-time work is not possible for external employment.) Panel (a) of Figure 1 shows the development of (internal) full-time employment in German establishments over the 2006-2015 interval. Despite some fluctuation, there is a clear downward trend in this variable, with the aggregate of part-time plus external employment increasing its share from 26.1% to 30.3% over the same interval.[11]

[Figure 1 near here]

Panel (b) of the figure presents the *external* employment components. Clearly, on average, temps, freelancers and 1-Euro jobs account for a rather small fraction of total employment at the establishment, with the sum of these three groups not exceeding 2.7% of the total in 2015. Temporary agency work, in particular, experienced a large decrease from the outset of the Great Recession, when the average share dropped by about 30%, from an admittedly small share of 1.3% in 2008 to 0.9% in 2009. Following a swift recovery within the following year the use of temps was again to decline. For its part, with two small dips, the pattern for freelance work is increasing, from 1.2 to 1.4%, while 1-Euro jobs are clearly declining (by 2015 they had almost vanished from the labor market scene, representing just 0.3 percent of the total).

Panel (c) of Figure 1 shows the occurrence of FTC work. Typically, the occurrence of FTCs is presented as a percentage of the establishment own workforce (i.e. the *personnel* structure). We

therefore present the corresponding 2006-2015time series using internal employment as the denominator. The profile appears quite stable over time, with (again) a slight decrease in 2009. On average, the establishment-level share of FTCs oscillates around 6%.

Panels (a) through (c) in Figure 1 are derived using establishment-level information on all German establishments with at least 1 employee, contained in the IAB survey. The reported values are obtained by computing the mean over the establishment means. They are therefore not strictly comparable with, for example, the values described by Eichhorst and Tobsch (2013) earlier in Section II, which are based on individual-level (i.e. German Statistical Office) information. But some comparisons are still possible. Regarding fixed-term contract workers, for instance, there is one constant: the percentage of FTC workers in total employment is very flat in the (common) 2006-2011 interval (in Eichhorst and Tobsch, the last year in the sample is 2011), at around 8 and 6 percent, respectively. Thus, although the percentage in the IAB survey is presumably smaller than in the entire economy, the evolution over time is very much the same. As far as agency workers are concerned, over the same interval Eichhorst and Tobsch's data point to an uptick in their use from 1.7 to 2.1 percent, while our sample records a slight decrease from 1.1. to 1.0 percent. In both cases, however, there was relatively less use of agency workers in 2008 and 2009 compared with the pre-crisis years, followed by a stronger use albeit somewhat less pronounced in the case of IAB establishments. Given that the percentage of agency workers is rather small compared with FTCs, the values for agency temps display greater sensitivity to sampling. The behavior over the cycle nevertheless exhibits strong similarity.[12]

[Figure 2 near here]

Temporary agency work is further described in panel (a) of Figure 2. Observe that between 85 and 90% of all establishments do not employ any temps at all. This percentage is comparatively stable over time, although the trough in 2009 suggests that temps may have been deployed as a buffer stock in the face of demand volatility. For users the percentage of temporary work is also rather flat over the period at around 8 to 9%.

A detailed profile on the utilization of fixed-term workers is given in the remaining three panels of Figure 2. Panel (b) shows that, for establishments with new FTC hires, an extremely high percentage of new hires are FTC workers, at approximately 80% of the total. Given that user establishments (i.e. establishments in which the new hires have a FTC) comprise less than 60% of the total, the implication is that the overall incidence of FTCs among new hires is below 50% (see the continuous line at the bottom of the panel).

Over the course of the sample period the transition from a fixed-term into an open-ended contract, shown in panel (c), is also slightly increasing and currently stands at roughly 50% (in the subsample of establishments with at least one fixed-term conversion). But a relatively small percentage of FTC users actually convert fixed-term contracts into open-ended contracts – they comprise approximately 20% of all establishments with FTC workers. Lastly, for the shorter 2009-2015 interval, information on the rate at which FTCs are renewed is shown in panel (d) of the figure. In common with the previous time-series, we have the result that renewals are very flat over time, amounting to approximately 40% for establishments with at least one FTC renewal.

We now turn to Table 2, that is, to the descriptive evidence derived from the estimation sample (i.e. establishments with at least 5 employees in the private, for profit sector), beginning with the frequency distribution of the five outcome variables, Y1 to Y5. Clearly, there is a mass

of zeros that in conjunction with the long right tail suggests (unconditional) overdispersion. Indeed, between 53.5% (in the case of the number of fixed-term contracts that transition into permanent employment, Y4) and 80.9% (in the case of the number of agency workers, Y1) of all establishment-year observations have a count equal to zero, with the number of counts greater than zero decreasing quite rapidly for all response variables. For example, in the case of Y2, the number of zeros (i.e. those situations in which establishments are non-users of FTCs) accounts for 57.5% of the total. The percentage of establishments reporting a number of FTCs greater than zero and less than 10 is 26.8%, while for the following class of 10-50 FTC workers it decreases to 11.5% of the total. This pattern holds for all the other response variables as well. Based on Table 1, it is also clear that the variance is much larger than the mean.

[Tables 2 and 3 near here]

The observed overdispersion suggests that OLS regression cannot be an adequate modeling tool. Indeed, as Table 3 demonstrates, OLS is not well-suited to describe the data in comparison with a zero-inflated count data model. Nor for that matter is the PROBIT. In this table, we compare actual frequencies with those fitted frequencies obtained by running three different models: OLS, PROBIT, and ZINB. For illustrative purposes, we only adopt counts up to 8 and present the results in separate rows, one for each model and outcome variable Y1 through Y5. Comparing the observed frequency (in the first row) with the prediction, it is obvious that the ZINB model best fits the data, plainly outperforming the OLS and PROBIT cases. As a matter of fact, for all outcomes the difference between the predicted and the actual frequency is always less than 1 percentage point in the ZINB case.

Regression analysis

As discussed in section IV, our empirical analysis relies on a zero-inflated negative binomial model. Estimates of the model are provided in Table 4. For all five outcomes, Y_1 to Y_5, a common set of regressors is deployed for both the count and logit components of the ZINB model, with exception of columns (3) through (5) where the share of FTC workers (and the hiring rate in the case of outcome Y_3) is also introduced into the model.

Beginning with the results in column (1) of the table, note that for the logit the dependent dummy variable is defined as 1 if the number of agency temps in a given year is zero and 0 if there is a strictly positive number of temps working in the establishment. The logit model thus explains the determinants of not having any temps at all, whereas the count model explains the number of temps. Summarizing, the two sets of coefficients indicate that while establishments with sector-level collective bargaining are more likely not to employ agency workers at all, firm-level collective bargaining drives up the number of agency workers for the user establishments. The existence of a works council appears not to be decisive in defining user/non-user status. Among users, however, works councils per se seemingly mitigate the number of temps, while all else constant a higher demand volatility tends to reduce it. But the positive interaction term implies that the mitigating works council effect disappears when volatility increases. In order to clarify this effect, we plot the predicted outcome Y_1 over the range of our demand volatility measure, splitting the full sample into establishments with a works council and without a works council, with all other covariates set at their corresponding sample mean.[13] As can be seen in panel (a) of Figure 3, the predicted number of agency temps increases when a works council is present and decreases when it is absent. The indication is therefore that in order to protect the core workforce from

demand shocks, works councils may be more likely to agree to form a cushion of temporary workers when volatility is high. In absolute size, the magnitude of the effect is less than 1 temporary agency worker over the range of observed volatility.

[Table 4 and Figure 3 near here]

The pattern regarding the extensive and intensive use of fixed-term contract workers shown in column (2) of the table is distinct. First, we do not report statistical significance for any of the labor institution variables in the logit model, which means that the use or non-use of FTC workers is fully determined by the (extensive) set of control variables (industry affiliation and establishment size, inter al.). We note parenthetically that the null of the negative binomial (NB) versus ZINB is clearly rejected by the data. This means that the zero-inflated model is indeed suited best for the data. (Discussion of the diagnostic tests is given below.) Second, a higher volatility of output demand increases the number of FTC workers. Third, sectoral agreements are associated with a less intensive employment of FTCs, with no statistically significant effect of firm-level agreements. Works councils are nevertheless associated with a decreased labor adjustment at the margin through FTCs when volatility increases. Again, to best illustrate this result, we plot in panel (b) of Figure 3 the predicted Y_2, following the procedure described above. As can be seen, the absolute magnitude of the effect is larger in non-works council establishments than in establishments with works councils. Observe that in the presence of works councils high demand volatility is associated with higher (lower) use of temps (FTCs). Interestingly, in both panels of Figure 3 the pattern is virtually linear with no evidence of any change in works council behavior across the different levels of demand volatility.

For the logit model given in column (3) of the table, establishments with a works council are more likely to apply a fixed-term contract in respect of at least one of their new hires. For users, both high demand volatility and the presence of works council are associated with a greater number of fixed-term contracts among new hires, at a very high level of statistical significance. The interaction term is negative, as in column (2), but the actual implication is that for both works council *and* non-works council establishments a higher volatility is associated with a higher number of new hires with a FTC. (For parsimony, the corresponding plots for the predicted values are not reported in Figure 3 but are available upon request.) Establishments with sector-level bargaining, on the other hand, appear again to rely less on adjustment at the margin in the case of new hires.

A related issue is the transition from a fixed-term into a permanent contract with the firm. The results in column (4) of the table suggest that establishments are more likely to opt for this strategy both at the intensive and extensive margins whenever a works council is present, although the statistical significance is clearly weaker than in the previous columns. The coefficient of the interaction term is negative and produces the expected reduction in the number of transitions as volatility increases for works-council establishments. Not surprisingly, a higher share of trained workers is positively associated with a higher number of FTC contracts being converted into permanent, open-ended contracts, but not at a statistically significant level. More surprising perhaps is the positive coefficient of the training variable in the logit, as it suggests that the higher the share of trained workers, the greater is the likelihood that the firm will not convert fixed-term contracts into permanent contracts. Note here that since we control for the share of FTCs in the establishment, this result cannot be rationalized by the presumption that firms favoring in-company

training are less likely to have any FTCs. More in accordance with our priors, is the result in column (5), that a higher training share reduces the number of FTC renewals, while impacting positively the chance of a firm refraining from this policy in general. Works councils in turn seem to favor to the use of FTC renewals (significant at the 5% level), but no impact is detected on the intensive margin. Neither demand volatility per se nor its interaction with the works council variable is statistically significant in the count model.

Note that all the diagnostic tests reported at the base of Table 4 perform according to our expectations. First, the hypothesis of overdispersion is confirmed because the null (i.e. alpha=0) is comfortably rejected in all five columns of the table. There is therefore no empirical evidence to suggest that an ordinary Poisson count model would be the appropriate regression vehicle. The second diagnostic is provided by the Voung test that compares the null of an ordinary negative binomial model with a zero-inflated negative binomial. Again, the null is easily rejected. Finally, in comparing the ZINB and ZIP models, the corresponding likelihood ratio test comfortably rejects the null that the latter offers a better fit than the former.

We next provide some robustness tests for establishment size, given that the legal rights of works councils are defined according to certain size thresholds (Addison 2009: 16-19). Specifically, we want to test whether our results hold for the subsets of establishments with 21 to 100 and 21 to 249 employees. In the interests of economy, we provide results for the latter subsample in Appendix Table 2; findings for the former subsample are given in the *online-appendix*. Despite the material reduction in sample size the results for this subset very much resemble those reported earlier in Table 4.[14] That is, we again find that works councils are positively associated with new hires with a FTC and negatively with the number of agency temps. Demand volatility and its interaction with the works council variable also maintain the signs throughout (viz. Y_1 to Y_4). Further, and by way of illustration, we can also confirm that high volatility is associated with a lower use of FTC workers in works council establishments (see the *online-appendix*). Finally, the inverse relation between the use of the two types of temporary work is also confirmed.

VI. Further Testing

In this section we provide additional data seeking to further clarify the determinants of the employment of fixed-term and agency workers. Ideally, the analysis using this enhanced information should be performed for the entire 2006-2015 sample period. Unfortunately, the data in question are available for just 2010, so that our analysis is perforce based on a single cross section for this year

The first new element offers a broader sample characterization of the hiring of temporary agency workers, using the unique information from question 49 of the 2010 IAB survey, which inquires of establishments their most important reason for hiring agency workers in the preceding two years.[12] From a descriptive point of view, we wish to ascertain whether there is any discernible pattern linking works council status and, say, 'demand uncertainty,' here defined by the answers A (i.e. 'fast availability of required labor'), B ('duration of assignment is expected to be short'), and D ('uncertainty about economic prospects'). The other reasons for hiring temps are either grouped into items E and F or C and G, descriptions of which are given in Table 5.

[Table 5 near here]

As shown in the table, *demand uncertainty* is indeed crucial to understanding agency work. In approximately 90% of the cases, either A, B, or D is reported as the most important reason in hiring decisions. This is not at all surprising giving the regression results in Table 4, where our proxy for output demand volatility plays a key role. Perhaps the main point from Table 5, however, is that there is no obvious pattern connecting the reasons for having temps with works council (or collective bargaining) status. In short, any unobserved factors associated with the reasons why establishments are hiring temps do not seem to vary materially with the labor institution variables.

A second issue pertains to human resource management (HRM) practices. At stake is the possible relationship between certain HRM practices and labor institutions, one conjecture being that these practices ultimately have the potential to impact worker representation through works councils and collective bargaining. If, for example, a given type of HRM practice results in less need for worker representation at the plant level and at the same time has an impact on the deployment of temps, omission of the argument can bias the regression results. To examine the issue, we again make use of the new information contained in the 2010 survey. Specifically, question 29 asks which of 10 practices were the most important changes implemented at the establishment in the last two years. We selected the items 'downward shifting of responsibilities and decisions,' 'introduction of team work/working groups with their own responsibilities,' and 'improvement of quality management' as indicators of the presence of HRM practices. Table 6 gives the corresponding percentage of establishments in which these practices are considered dominant (i.e. the most important). Among the 10 items the incidence of these three particular practices is quite sizeable: in 21 to 24% of the cases, establishments identified one of the three items was the most important change to have taken place over the two-year interval. Observe that the evidence also suggests that the incidence is virtually the same across works council and collective agreement groups. On this basis, any HRM practice omitted in Table 4 does not seem to be associated with any particular labor institution in any obvious manner.[15]

[Table 6 near here]

A final issue is whether the omission of any measure of unionization is also likely to be damaging to our findings in Table 4. Since unionization may be correlated with works council and collective bargaining status on the one hand and the outcome variable on the other, omission of a unionization variable might be a confounding factor. Introducing some measure of *unionism* might therefore allow us to offer an improved causal relation.

We note that in the context of the ZINB model specified in Table 4, an ideal solution would be to select a relevant instrument from the IAB survey. However, not only is there no information on trade union density in the survey but also, to our knowledge, no possibility of implementing an IV approach within the framework of a zero-inflated negative binomial model. Rather, our approach will instead amount in the first instance to deploying (lagged) sector-level union density information, extracted from the 2009 European Company Survey, and then re-running the models specified in Table 4. Given that the information on trade union density pertains to 2009, this part of our analysis will again be confined to the 2010 cross-section.

[Table 7 near here]

Table 7 shows the results of this experiment. In columns (1) we reproduce the corresponding column from Table 4 – albeit just for the count model – while in columns (2) we replicate column (1) for the 2010 cross-section. Columns (3) again employ the reduced 2010

sample and introduce the trade union density argument, while in columns (4) we add, as an alternative indicator of unionism, a lagged IAB survey-based measure of the sectoral mean incidence of industry-level and firm-level agreements (denoted by 'mean unionization sec' and 'mean unionization est'). We provide five separate sensitivity analyses, one for each outcome variable, in panels (a) through (e).

Although the marked reduction in sample size affects statistical significance, the statistically significant coefficients in columns (2) have the same signs as in column (1). Overall, although the 2010 results are statistically weaker, the two samples yield not dissimilar results. Columns (3) evaluate whether our model results are sensitive to the introduction of the union density argument. Perhaps the best example here is provided by Y_3 by reason of the great similarity across the benchmark columns (1) and (2). Observe that in column (3), although a higher union density rate is clearly associated with a lower selection of fixed-term workers among new hires (significant at the 1% level), there is little evidence to suggest that the omission of the variable biases our results in any obvious manner.

In column (4) of panel (c), inclusion of the proxies for the unionization measure produces statistically weaker results. In this case, there is also modest evidence that a higher industry mean of firm-level agreements is associated with a greater use of FTCs in recruitment. This result also obtains for Y_2 and Y_5 as well. As for the union density argument itself, recall that its coefficient estimate fails to achieve statistical significance in panels (a), (b), (d), and (e).

Taken in the round, and despite the limitation introduced by the strong reduction in sample size, experimentation with the 2010 cross-section seems to indicate that unobserved characteristics connected with unionization are not driving the results obtained in Table 4 in any overt way.

VII. Concluding Remarks

This study has provided a comprehensive analysis of the use of temporary employment, both at the extensive and intensive margins. It distinguishes between fixed-term contract workers and temporary agency workers in Germany over a period of one decade, starting in 2006. It should be recalled that even though these groups constitute a modest share of the total workforce, they have often been important sources of all new job creation in the post-Hartz years.

In a new departure, our analysis has applied a zero-inflated negative binomial model to the data to reflect the obvious but often ignored fact that most establishments are non-users of fixed-term contracts or temporary agency workers. Motivated by this empirical regularity, we sought to investigate the potential effect of two key labor institutions – works councils and collective agreements – on the use and intensity of use of temporary employment over the sample period. Our approach involved looking at separate but connected outcomes, namely two stocks (the number of agency temps and fixed-term contract workers observed at a given point in time in each year) and three flow variables associated with fixed-term contracts (the number of new hires with a fixed-term contract, conversions of fixed-term contracts into regular employment with the firm, and the extension or renewal of fixed-term contracts), calculated over a six-month interval in each year. Given the cross section nature of our data, a number of robustness checks and further tests of possible confounding factors were conducted.

Among our principal findings for the stock dependent variables are the following. First, we find strong statistical support for the ZINB model. Second, from the perspective of adjustment at the extensive margin, there is little indication that our labor institution variables are correlated with

the use/non-use of either type of temporary work, especially in the case of fixed-term contracts. Third, collective bargaining has different 'effects' on the intensity of use of temporary employment: sectoral agreements are associated with reduced intensity of use of fixed-term contracts, while firm-level agreements are associated with more intensive use of agency temps. Fourth, greater product market volatility per se does not display a unique relation with temporary employment: a positive correlation can only be found in the case of the number of fixed-term contracts. Fifth, and potentially most important of all, is the covariation between the number of temporary employees and the interaction between works councils and product market volatility. In this case, our simulation exercise using the demand volatility measure over its entire range indicates that all else constant the use of agency temps (fixed-term contracts) is expected to rise (decline) if volatility increases whenever the works council is present. In the light of these findings, there is the suggestion that works councils may tolerate increased use of agency temps in extreme circumstances when perhaps even the very survival of the core is at stake; for its part, the result for fixed-term contracts point to their fulfilling a different function, being more of a port of entry than a buffer stock and consequently being viewed as more of a threat to the core if deployed in adversarial market circumstances.

The *noncomplementarity* of the two types of contracts emerges then as the hallmark of this paper. The analysis of the flows concerning new hires with fixed-term contracts, fixed-term contact conversions into regular employment, and fixed-term contract renewals also favors this interpretation.

Endnotes

1. This is particularly true of U.S. studies of temporary agency employment (see, for example, the surveys in Addison and Surfield, 2009, and Houseman, 2014), although rather more positive findings for different types of atypical work are reported by Booth, Francesconi, and Frank (2002) for the U.K. and by Addison, Cotti, and Surfield (2014) for the U.S.

2. See also Bellmann and Kühl (2007) who report that between 1998 and 2006 the share of intensive users – those for whom temps constitute more than 20% of personnel – rose sharply from 4.8% to 10.4%.

3. Another hypothesized factor behind the increase in intensity of use with firm size is the fact that, in publicly-traded companies, temps are not counted under fixed personnel costs but are instead treated as a variable material cost. Since personnel costs are watched closely by financial analysts, they can be held artificially low without actually hiring fewer employees.

4. Reporting that, between 2008 and 2011, about one-third of fixed-term contract workers moved to open-ended contracts (including vocational education and self-employment) in successive years, with the corresponding figure for temps being approximately 30%.

5. For studies of the unionization of temporary workers in Britain, see Booth and Francesconi (2003) as well as Francesconi and Garcia-Serrano (2004) who additionally investigate the association between unionism and the adoption of temporary employment in Spanish firms. And for U.S. studies of the relationship between unionism and the probability of using temporary employees, see the wider-ranging studies of Gramm and Schnell (2001) and Houseman (2001); see also Autor's (2003) controversial suggestion that the growth of temporary agency employment has been faster in states where unions have declined more slowly.

6. The authors compute the union effect at different values of volatility. Using their IV results for the fullest specification, they report that unions increase the proportion of temporary workers by 2.7 percentage points when volatility is low (viz. at the first decile of the volatility distribution). That said, the union effect is to all intents and purposes zero if volatility is at the median, and becomes -5.1 percentage points when volatility is high (viz. at the 90^{th} percentile). Parallel results are obtained when using the FE estimates.

7. A well-known example is disagreement over the productivity of agency work (Arvanitis 2005; Kleinecht et al. 2006, 2014; Bryson 2007; Beckman and Kuhn 2009; Nielen and Schiersch 2014). However, a recent study by Hirsch (2016), who examines the effect of temporary agency work on the job stability of regular workers, casts new light on the issue. Using linked employer-employee data from the LIAB for 2002-2010, he reports that the separation rate of non-agency jobs is significantly reduced if the share of temps is greater than 5%. This effect on job stability peaks at an agency share of the workforce above 20%. In a final application, lacking data on whether job separations are voluntary or involuntary, Hirsch splits the overall separation rate into the destination states of employment and non-employment. Arguing that the latter route is indicative of temporary work offering regular workers protection against job loss, and finding that the moderating effect of temporary work on regular job separations largely occurs through a reduction in the separation rate to non-employment, he concludes that employers do after all employ

temporary agency work to buffer core workers. By way of qualification, Pfeifer (2005), using data from the 2003 Hannover Establishment Panel, suggests that temporary employment *raises* the separation rate among regular employees.

8. Besides, there is generally no clear evidence of the effect of unions where collective bargaining does not take place at the workplace (see Salvatori 2009).

9. Let us assume one wishes to establish the separate determinants of perfect and defective parts from a production line. These are unlikely to be generated by identical factors, some variables being associated with a high probability of the perfect state while others lead to defects. In both examples, the crucial point is that there is a mass of observed zeros but an unknown share of certain zeros. Typically, the distribution exhibits overdispersion; that is, its mean is substantially smaller than its standard deviation.

10. The ZIP model is rather less cumbersome than the corresponding ZINB and is offered here for didactic purposes only. As will be shown below, the ZIP model is easily rejected against the ZINB alternative in our data.

11. Here we are describing the selected sample. Interpolation for the entire population of German establishments requires the use of cross-section weights. The corresponding weighted statistics are available upon request. They reveal virtually the same patterns as shown in Figures 1 and 2.

12. The computations for Eichhorst and Tobsch are based on our calculations from their Appendix Table A2.

13. We are indebted to an anonymous referee for suggesting this approach. This approach turns out to be quite an adequate procedure to evaluate the impact of the interaction term, given the non-linearity of the ZINB model (see Ai and Norton, 2003).

14. No results are available for the Y_5 outcome.

15. Following the suggestion of an anonymous referee, we expanded our analysis contained in Tables 5 and 6 to allow for further disaggregation by establishment size and location. We used two separate size intervals (21 to 100 and 21 to 249 employees) and two regional categories (western and eastern Germany). As shown in Appendix Tables 2 and 3 of the *online-appendix*, there is no indication that the inferences derived from Tables 5 and 6 are sensitive either to establishment size or region.

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Legal Appendix: The Law on Fixed-Term Contracts and Temporary Agency Work

Fixed-Term Contracts

Prior to 1985, a fixed-term contract could only last for 6 months and the employer had to demonstrate that the work was by its nature temporary. The 1985 Employment Promotion Act (*Beschäftigungsförderungsgesetz*) allowed fixed-term employment contracts for new contracts, or employment contracts immediately following vocational training if no permanent job was available, up to a length of 18 months with no justification required. Within newly-founded establishments the length of the fixed-term contract could be extended up to 24 months if the new contract was not connected to another one, fixed-term or otherwise, that had been settled within the last 4 months.

This regulation ran initially until December 1989 and was extended on two occasions (1990 and 1994) to 1995 and 2000, respectively. In 1996 a new labor law on employment promotion (*Arbeitsrechtliches Beschäftigungsförderungsgesetz*) allowed the conclusion of fixed-term contracts for up to 24 months' duration without the employer having to provide any reason, and shorter contracts could be renewed three times up this limit. These limitations did not apply in the case of fixed-term contracts with a valid or objective reason (*mit Sachgrund*). The conditions of a first contract and the non-availability of a permanent job were abolished, while for employees aged 60 years or more fixed-term contracts could be applied without restriction.

The next piece of domestic legislation was occasioned by EU law on fixed-term work. The 2001 Part-Time-and-Fixed-Term Employment Act (*Teilzeit- und Befristungsgesetz*/TzBfG), extended the previous legislation for an unlimited period. That is, it continued the practice of allowing fixed-term contracts without objective justification for up to 24 months and provided for three prolongations but again only for a maximum of two years in total. One exception to the rule was business startups, which could use fixed-term contracts up to 4 years after their formation, during which time multiple extensions were possible beyond the three occasions permitted in other circumstances. Under the Act, a non-exhaustive set of justifications for fixed-term contracts was now given, in which cases, as before, there were no restrictions on their deployment. Objective justifications for fixed-term contracts are that the demand for workers is temporary (e.g. for seasonal work); that the period of employment is to provide a young person with work experience and where the temporary job may lead to a permanent one; that the employee is employed to cover an absent permanent employee (e.g. on maternity leave); that the fixed term serves as probationary period; and that the employee's personal situation creates some intrinsic periodicity (e.g. a short-term work visa). While not exhaustive, any (other) reason put forward as justification by a company had to be considered by employers and trade unions to be as credible as those adumbrated in the Act.)

The 2001 Act also contained a prohibition on previous employment: if the employee had been employed by the employer at any time in the past it was not acceptable to employ that worker on a fixed-term basis without objective reason irrespective of whether the previous contract was fixed-term or open ended – although pre-employment training or on-the-job training did not constitute employment under the terms of the Act. (A decision by the Federal Labor Court in 2011 (*Bundesarbeitsgericht* or *BAG; docket number 7 AZR 716/09*) also determined that the prohibition on previous employment would not apply if three years had elapsed since the start of the new fixed-term contract.) Another exception covered situations in which the employee was employed previously by another company in the same group, or by a company that was subsequently taken

over or merged with the company in question. Finally, the conclusion of (unrestricted) fixed-term contracts for older employees was now possible in the case of employees aged 58 years or more rather than 60 years and above, as previously. In 2003, the age limit for unrestricted fixed-term contracts was temporarily lowered to 52 years until end-2006. Subsequently, in March 2006, it was decided that a fixed-term contract could be concluded for up to 5 years if the worker is (a) older than 52 years and (b) has been unemployed for at least 4 months immediately before the fixed-term contact, with successive fixed-term contracts being allowed as long as the period of 5 years is not exceeded. The analog here is the case of start-ups where fixed-term contracts could be repeatedly extended up to a total duration of four years.

Between 2006 and the end of our sample period, only minor changes to the law on fixed-term contracts were introduced. However, in February 2018 the then prospective Union-SPD coalition announced plans to limit the number of fixed-term contracts without a valid reason (*ohne Sachgrund*) to fixed proportions of the workforce according to firm size, while shortening the maximum duration of such contracts to 18 months including just one extension of term. For objectively justified contracts, it was proposed to curb multiple extensions or chain contracting by imposing a maximum total duration of five years. Once this period has elapsed, a new contract can only be negotiated after a three-year waiting period.

Temporary Agency Work

In Germany temporary agency employment is regulated by the Labor Leasing Act (*Arbeitnehmerüberlassungsgesetz*/AÜG), which was introduced in 1972 and amended on several occasions since then. Initially, temporary agency employment was permitted only on the basis of a permanent employment contract. Relaxation of this principle of open-ended employment was introduced but to prevent abuse the new legislation included the re-employment ban and the synchronization ban. The re-employment ban prohibited temporary employment agencies from dismissing a temporary worker and reinstating him/her within three months of the dismissal. The synchronization ban required the length of an employment contract with a temporary worker toexceed the length of the first assignment by at least 25%. Finally, the maximum period of assignment was 3 months.

In 1985, the maximum period of assignment at the same user firm was extended to 6 months, and in 1994 from 6 to 9 months. By way of contrast, the law on regular employment contracts stipulated that once the period of employment exceeded the probationary period of 6 months its termination required justification.

The next shift in legislation in 1997 again saw an extension of the maximum period of assignment (to 12 months) but went further in first allowing temporary help agencies to conclude fixed-term contracts – for the distinct law on which, see above – and, second, in permitting the temporary help agency to set the employment contract for the duration of the first assignment, permitting dismissal at the termination of that assignment and thereby effectively sidestepping the synchronization ban.

Starting in 2002, the maximum assignment or posting period was again increased – this time to 24 months. Also, the principle of equal treatment was to apply from the thirteenth month of an assignment period; that is, agency temps were to have the right to the same pay and working conditions as comparable workers employed directly by the user firm.

More fundamental reforms of a deregulatory nature were introduced in January 2004 under the aegis of the Hartz 1 reform package. Although the rights of temps were strengthened by applying the principle of equal pay from the first day of an assignment, the new law allowed two derogations: first, in respect of the hiring of unemployed individuals; and, second, where the agency was following the terms and conditions laid down in its own collective agreements. Observe that by end-2003 no less than 97% of temporary help agencies operated under the terms of their own (sectoral) collective agreements (Antoni and Jahn 2009: 234). Further, the maximum period of assignment was abolished and the bans on synchronization and re-employment were scrapped. Limitations on the use of temporary employment in the construction industry were also eased somewhat.

Only after the end of our sample period was the agency temp industry subject to re-regulation. In October 2016 the AÜG was reformed and the new rules were enacted into law in April 2017. The key changes are eightfold. First, the host company is now required to terminate the temporary employee after 18 months; otherwise, that worker becomes an employee of the host business. After 18 months the agency or leasing company may provide a different employee to the same hirer – but not the same temporary employee except in the case of deployments that are interrupted by more than three months in which case the maximum period starts afresh. The maximum leasing term can be extended to 24 months via a works agreement (*Betriebsvereinbarung*), and there is no time limit under where the hirer is bound by a collective agreement. Second, after nine (uninterrupted) months, agency workers have to be put on an equal footing with comparable permanent employees of the host business. Under certain circumstances, however, sectoral collective agreements can provide for a longer delay of 15 months. Third, there is a crackdown on so-called *precautionary licenses* or permits, a loophole that has allowed employers to characterize contracts as service contracts, when they should have been described as temporary contracts.

Sham contracts took the following form: the employer (the agency) would enter into an agreement with a client to undertake a specific project (i.e. a contract for work or service) but lease its employees to the client to perform the services. Since the hirer is now assuming the rights of an employer to give directions to employees, and given the legal consequences that flow from such a relationship, the agency would at the same time apply for a *secondment permit* as a precautionary device, which would be silent on which employees were to be seconded. This device would free the hirer-turned-employer from the consequences of being an employer and the agency for the unauthorized supply of temporary employees/illegal employee leasing. In effect, the permit retrospectively legalized the bogus contractual situation without any sanctions. The new legal position is that mere possession of an AÜG license will not prevent the legal consequences of illegal employee leasing. The outcome, abstracting from financial penalties to the agency and the client, is that an employment contract between the worker and the host business or end user will have been created *force majeure*. The corollary is a new duty to provide information to the temporary employee; that is, before each and every hire, the employment agency has to inform the agency worker that he or she is going to be working as an agency worker.

Fourth, there is a prohibition on the use of agency workers as strike breakers; that is, temps can only be employed during a strike if they do not carry out work previously undertaken by employees currently participating in the strike. Breach of these terms by the hiring company is punishable by a fine of up to €500,000. Fifth, the law gives new information rights to the works

council (*Betriebsrat*) at the host business regarding the extent, scope, place, and timing of the placement of temporary workers, including the underlying contracts themselves. Sixth, temporary workers whose deployment is 6 months or more are to count towards the employment thresholds at the host business at which certain legal obligations are triggered under the Works Constitution Act (*Betriebsverfassungsgesetz*), including codetermination at company level. The sole exception concerns the thresholds for social plans in relation to reductions in force. Seventh, there is a ban on chain leasing; that is, there must not be more than one supplier between worker and end hirer. Finally, a new section 611a of the German Civil Code (*Bürgerliches Gesetzbuch*) will be implemented that legally defines the term *employee*. Although it is unlikely that this will involve material changes in respect of agency workers, this legal innovation might bring statement-of-work type consultancies within the ambit of the law; that is, they might in the future be interpreted as dependent work.

Table 1: Variable Definition and Establishment-Level Summary Statistics

Variable	Definition	Obs.	Mean	S.D.
Y_1	Number of temporary agency workers	97,060	5.72	69.73
Y_2	Number of FTC workers in the establishment	97,538	9.62	50.59
Y_3	Number of new hires with a FTC (from Jan. to June)	97,311	3.59	22.02
Y_4	Number of FTC workers converted into permanents (from Jan. to June). Sample restricted to establishments employing at least 1 FTC.	43,876	3.00	12.69
Y_5	Number of workers with a FTC renewed in the Jan-June interval. Sample restricted to establishments employing at least 1 FTC.	28,575	2.47	12.86
Works council	1/0 dummy: 1 if a works council is present	97,920	0.281	0.450
Sectoral agreement	1/0 dummy: 1 if the establishment is bound by an industry-wide wage agreement	97,769	0.372	0.483
Firm-level agreement	1/0 dummy: 1 if the establishment is bound by a company-level wage agreement	97,769	0.070	0.256
Product demand volatility (volatility)	For each year and for each industry, demand volatility is given by the average standard deviation of establishment log sales; that is, $volatility_i = (\frac{1}{N_i-1}\sum_{e=1}^{N_i}\{\log(sales)_e - \overline{\log(sales)}_i\}^2)^{1/2}$, where subscripts *e* and *i* denote establishment and industry, respectively, and N_i the number of establishments in industry *i* (and where subscript *t* is omitted). In a second step, we take the average of the past 6 years, so that the demand volatility measure in year *t* is the average over *t-1*, *t-2*, …, *t-6*. The sample comprises a total of forty-three, 3-digit level industries.	98,160	1.93	0.298
Establishment size:				
5-9	1/0 dummy: 1 if the establishment has 5 to 9 employees	98,160	0.234	0.424
10-19	1/0 dummy: 1 if the establishment has 10 to19 employees	98,160	0.177	0.382
20-49	1/0 dummy: 1 if the establishment has 20 to 49 employees	98,160	0.226	0.418
50-99	1/0 dummy: 1 if the establishment has 50 to 99 employees	98,160	0.127	0.334
100-249	1/0 dummy: 1 if the establishment has 100 to 249 employees	98,160	0.123	0.328
250+	1/0 dummy: 1 if the establishment has at least 250 employees	98,160	0.112	0.315
Establishment age:				
Before 1990	1/0 dummy: 1 if the establishment was founded before 1990	96,993	0.453	0.498
1990-1999	1/0 dummy: 1 if the establishment was founded between 1990 and 1999	96,993	0.309	0.462
After 1999	1/0 dummy: 1 if the establishment was founded after 1999	96,993	0.238	0.426
Workforce composition:				
Share of women	Share of female employees	98,107	0.396	0.291
Share of part-time	Share of part-time employees	94,935	0.109	0.178
Share of unskilled workers	Share of employees hired for simple tasks that do not require any vocational training certificate or corresponding professional experience	98,143	0.191	0.257
Share of skilled workers	Share of employees hired for complex tasks that require either a vocational training certificate, a corresponding measure of professional experience, or a university or college degree	98,140	0.696	0.259
Western Germany	1/0 dummy: 1 if the establishment is located in Western Germany	98,160	0.629	0.483
Wage bill	Sum of gross wages paid in June (in logs)	82,640	11.00	1.80
Export	1/0 dummy: 1 if the establishment engages in exporting	98,160	0.306	0.461
Outsourcing	1/0 dummy: 1 if parts of the establishment's activities have been outsourced	97,419	0.012	0.109
State-of-art technology	1/0 dummy: 1 if the overall technical state of the plant, machinery, and equipment of the establishment is state-of-the-art, compared with other establishments in the same industry (1 or 2 in the 1 to 5 Likert scale)	97,780	0.683	0.465
Competitive pressure	1/0 dummy: 1 if competitive pressure is reported to be high	78,040	0.446	0.497
Training	Share of employees with further training (from January through June)	86,321	0.234	0.279
Hiring rate	Number of hires divided by the total number of employees	97,742	0.065	0.130
Share of fixed-term contracts	Share of employees with a fixed-term contract	97,538	0.056	0.129
Variables specific to the 2010 cross-section:				
Trade union density (Union density)	Sector-average trade union density. The establishment-level information on union density is extracted from the 2009 European Company Survey (ECS). To harmonize sector classification in the ECS and IAB surveys, the original 19 sectors in the latter were aggregated into 8 groups.	9,545	0.284	0.116
Mean unionization sec	Mean incidence of sector-level collective bargaining for each of 43 sectors	8,184	0.364	0.147
Mean unionization est	Mean incidence of company-level collective bargaining for each of 43 sectors	8,184	0.070	0.036

Note: The sample comprises all the establishments with at least 5 employees in the private, for profit sector. They are grouped in 19 separate industries. See also Appendix Table 1 for additional definitions.
Source: IAB Establishment Panel, 2006-2015.

Table 2: Frequency Distribution of the Selected Five Response Variables (in percent)

	Count					
	0	1-9	10-49	50-99	100-999	≥1000
Relative frequency: Y_1	80.9	11.2	5.6	1.3	1.0	0.04
Y_2	57.5	26.8	11.5	2.2	1.9	0.04
Y_3	70.4	22.3	5.9	0.8	0.6	0.004
Y_4	53.5	39.6	6.1	0.5	0.3	–
Y_5	69.6	24.7	4.9	0.5	0.3	–

Note: Y_1 through Y_5 are defined in Table 1.
Source: IAB Establishment Panel, 2006-2015.

Table 3: Observed and Fitted Frequencies (in percent)

		Count								
		0	1	2	3	4	5	6	7	8
Y_1	Relative frequency (actual probability)	81.3	3.1	2.5	1.6	1.1	1.0	0.7	0.4	0.6
	OLS fitted (Predicted OLS)	42.1	3.7	3.7	3.7	3.6	3.4	3.3	3.2	3.1
	PROBIT fitted (Predicted PROBIT)	87.3	12.7							
	ZINB fitted (Predicted ZINB)	81.3	3.4	2.1	1.5	1.1	0.9	0.7	0.6	0.5
Y_2	Relative frequency (actual probability)	58.1	8.1	5.4	3.6	2.7	2.4	1.6	1.1	1.2
	OLS fitted (Predicted OLS)	38.1	3.3	3.3	3.3	3.2	3.0	3.1	2.9	2.9
	PROBIT fitted (Predicted PROBIT)	62.3	37.7							
	ZINB fitted (Predicted ZINB)	58.2	8.1	5.1	3.6	2.7	2.1	1.7	1.4	1.2
Y_3	Relative frequency (actual probability)	70.7	7.5	4.7	3.0	2.2	1.7	1.2	0.8	0.8
	OLS fitted (Predicted OLS)	48.4	7.5	6.5	5.3	4.1	3.3	2.6	2.1	1.7
	PROBIT fitted (Predicted PROBIT)	76.1	23.9							
	ZINB fitted (Predicted ZINB)	71.7	7.1	4.3	2.9	2.1	1.5	1.2	1.0	0.8
Y_4	Relative frequency (actual probability)	52.4	14.7	10.4	5.6	3.2	2.8	1.6	0.9	1.1
	OLS fitted (Predicted OLS)	33.9	12.5	10.1	7.8	6.0	5.0	4.6	4.0	3.7
	PROBIT fitted (Predicted PROBIT)	54.3	45.7							
	ZINB fitted (Predicted ZINB)	53.0	15.2	8.4	5.2	3.5	2.5	1.9	1.4	1.1
Y_5	Relative frequency (actual probability)	69.2	9.2	5.9	3.3	2.3	1.9	1.1	0.5	0.8
	OLS fitted (Predicted OLS)	37.7	13.4	9.9	7.2	6.2	6.0	5.3	4.2	3.1
	PROBIT fitted (Predicted PROBIT)	93.3	6.7							
	ZINB fitted (Predicted ZINB)	69.2	10.0	5.2	3.2	2.1	1.6	1.2	0.9	0.7

Notes: For the OLS results, for example, Count=2 denotes the share of observations with a predicted value between 1.50 and 2.49. In the PROBIT case, Count=0 (1) if the predicted probability is less than (greater than or equal to) 0.5. The predicted ZINB is obtained using the *countfit* command in Stata. The full list of covariates is provided in Table 4.
Source: IAB Establishment Panel, 2006-2015.

Table 4: Zero-Inflated Negative Binomial (ZINB) Model Estimates

	Dependent variable				
	Y_1 (1)	Y_2 (2)	Y_3 (3)	Y_4 (4)	Y_5 (5)
Count model:					
Works council	-1.013 (0.336)***	0.110 (0.191)	0.647 (0.153)***	0.156 (0.244)	-0.244 (0.306)
Sectoral agreement	0.055 (0.065)	-0.073 (0.032)**	-0.045 (0.021)**	0.009 (0.040)	0.015 (0.048)
Firm-level agreement	0.208 (0.074)***	0.010 (0.044)	-0.007 (0.031)	0.001 (0.047)	0.062 (0.060)
Product demand volatility	-0.291 (0.149)*	0.202 (0.087)**	0.546 (0.067)***	0.191 (0.117)	0.111 (0.137)
Volatility *works council	0.476 (0.163)***	-0.248 (0.097)**	-0.400 (0.076)***	-0.224 (0.120)*	0.089 (0.151)
Training				0.049 (0.053)	-0.122 (0.073)*
Logit:					
Works council	-0.276 (0.420)	-0.678 (0.478)	-0.754 (0.428)*	-0.679 (0.489)	-0.938 (0.405)**
Sectoral agreement	0.271 (0.066)***	-0.071 (0.056)	0.012 (0.070)	0.076 (0.123)	0.039 (0.080)
Firm-level agreement	0.042 (0.098)	-0.117 (0.104)	-0.110 (0.108)	-0.048 (0.153)	-0.010 (0.105)
Product demand volatility	0.179 (0.148)	-0.070 (0.124)	-0.038 (0.168)	0.217 (0.236)	-0.045 (0.185)
Volatility *works council	-0.165 (0.207)	-0.001 (0.244)	0.332 (0.217)	0.587 (0.250)**	0.464 (0.207)**
Training				0.644 (0.209)***	-0.335 (0.120)***
Outcome-specific controls			Share of FTCs; Hiring rate	Share of FTCs	Share of FTCs
Diagnostic tests:					
(H0) No overdispersion (or alpha=0); versus (H1) overdispersion	alpha =1.95 95% interval: (1.85; 2.05)	1.19 (1.15; 1.22)	0.69 (0.67; 0.71)	1.13 (1.07; 1.20)	1.29 (1.19; 1.40)
(H0) Negative binomial model versus (H1) ZINB; Vuong test	z = 27.60 [p-value: 0.000]	32.69 [0.0000]	61.40 [0.0000]	15.46 [0.0000]	15.52 [0.0000]
(H0) ZIP model versus (H1) ZINB	chibar2(1)= 2.8e+05 [p-value: 0.0000]	0.3e+05 [0.0000]	1.0e+05 [0.0000]	4.8e+04 [0.0000]	3.4e+04 [0.0000]
Log Pseudo-Likelihood	-59,276.28	-11,0572.3	-60,613.94	-43,725.32	-27,828.98
Number of observations	61,668	61,420	61,039	26,476	21,652

Notes: The alpha statistic tests whether there is evidence of overdispersion. If alpha=0 is not rejected, then there is no overdispersion and an ordinary count (Poisson) model is appropriate. The Vuong test compares the null of a standard negative binomial model vis-à-vis a zero-inflated negative binomial, while the likelihood ratio test, in the third row of the diagnostic block, compares the ZIP model (the null) against the ZINB model. In both cases, rejection of the null implies that ZINB is the preferred specification. The model includes industry, year, establishment size (employment), and location dummies. Further controls include establishment age, the share of women/of part-time workers/of employees hired for simple tasks that do not require any vocational training/of employees hired for complex tasks that require either vocational training or a university degree, the logarithm of the wage bill, and dummies for exports, outsourcing, state of technology and competitive pressure. Robust (cluster) standard errors are in parentheses.

Source: IAB Establishment Panel, 2006-2015.

Table 5: The Most Important Reason for Hiring Agency Workers (in percent)

		A, B or D	E or F	C or G
Works council:	1	88.2	6.0	5.7
	0	86.6	5.2	8.2
Type of collective /agreement:	No collective agreement	86.5	6.3	7.2
	Firm-level agreement	87.3	6.3	6.3
	Sector-level agreement	88.7	4.7	6.6

Notes: The reported percentages are based on questions 49b of the 2010 IAB Establishment Panel questionnaire. Items A through G denote the most important reason for hiring agency workers: *speedy availability of required labor* [A]*; duration of assignment is expected to be short* (e.g. seasonal work, cover of peaks in demand) [B]; *required qualification is hard to find on the regular labor market* [C]; *uncertainty about economic prospects* [D]; *avoidance of costs and work involved in staff acquisition and separations* [E]; *ascertaining the worker's aptitude with a view to recruitment* [F]; *other reasons* [G]. These items are mutually exclusive.

Table 6: Indicator of Changes in Human Resource Management (HRM) Practices

		HRM practices (E, F or I)	Other changes A, B, C, D, G, H, or J	No change
Works council:	1	23.3	45.1	31.6
	0	20.6	25.6	53.8
Type of collective agreement:	No collective agreement	21.3	29.2	49,5
	Firm-level agreement	23.5	38.3	38.3
	Sector-level agreement	20.7	33.1	46.2

Notes: The reported percentages are based questions 29b of the 2010 IAB Establishment Panel questionnaire. Items A through J denote the most important change within the last two years: *More reliance on internal labor* [A]; *expansion of purchase of products and services from external sources* [B]*; restructuring of procurement and distribution channels and/or of customer relations* [C]*; restructuring of departments or areas of activities* [D]*; downward shifting of responsibilities and decisions* [E]*; introduction of team work/working groups with their own responsibilities* [F]*; introduction of units/departments carrying out their own cost and result calculations* [G]*; ecological measures in enterprise (e.g. eco, product and materials balances, eco audit)* [H]*; improvement of quality management* [I]*; others* [J]. These items are mutually exclusive.

Table 7: Replication of the ZINB Model Using the 2010 Cross-Section and Union Density Indicators

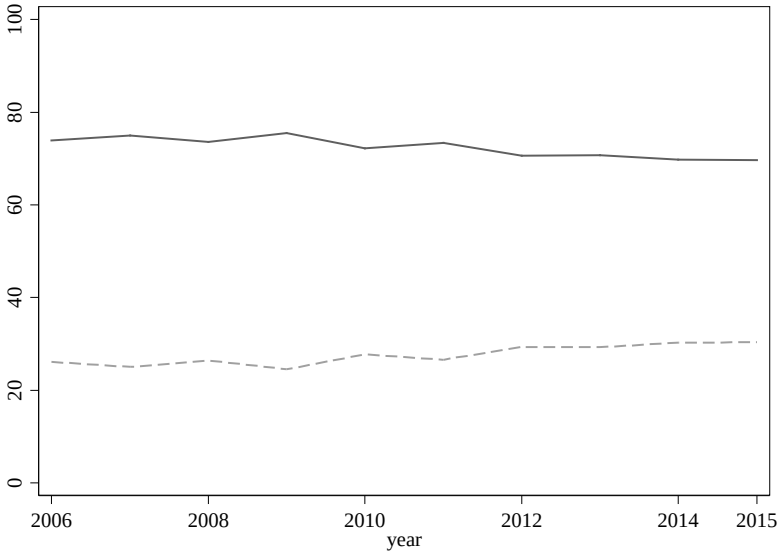
	2006-2015 Sample	2010 Cross-section		
	Replication of Table 4, column (1) (1)	(2)	(3)	(4)
Panel (a): Y_1 (Number of temporary agency workers)				
Count model:				
Works council	-1.013 (.336)***	-.694 (.535)	-.720 (.538)	-.231 (.579)
Sectoral agreement	.055 (.065)	-.238 (.110)**	-.245 (.111)**	-.316 (.122)**
Firm-level agreement	.208 (.074)***	.285 (.145)**	.286 (.144)**	.245 (.154)
Product demand volatility	-.291 (.149)*	-.078 (.225)	-.076 (.225)	.150 (.263)
Volatility *works council	.476 (.163)***	.308 (.254)	.321 (.255)	.082 (.275)
Union density (lagged)		–	-.638 (.999)	
Mean unionization sec (lagged)				-.099 (.737)
Mean unionization est (lagged)				2.325 (2.226)
Number of observations	61,420	7,197	7,197	6,323
Panel (b): Y_2 (Number of fixed-term contract workers)				
	Replication of Table 4, column (2) (1)	(2)	(3)	(4)
Count model:				
Works council	.110 (.191)	-.096 (.350)	-.136 (.352)	.133 (.349)
Sectoral agreement	-.073 (.032)**	-.126 (.071)*	-.116 (.071)	-.173 (.072)**
Firm-level agreement	.010 (.044)	.071 (.090)	.071 (.090)	-.005 (.093)
Product demand volatility	.202 (.087)**	-.019 (.145)	-.065 (.150)	.108 (.143)
Volatility*works council	-.248 (.097)**	-.226 (.180)	-.207 (.181)	-.297 (.178)*
Union density (lagged)			.702 (.461)	
Mean unionization sec (lagged)				.654 (.263)
Mean unionization est (lagged)				11.189 (1.268)***
Number of observations	61,420	7,177	7,177	6,306
Panel (c): Y_3 (Number of new hires with a fixed-term contract)				
	Replication of Table 4, column (3) (1)	(2)	(3)	(4)
Count model:				
Works council	.647 (.153)***	.591 (.312)*	.800 (.321)**	.373 (.326)
Sectoral agreement	-.045 (.021)**	-.036 (.046)	-.041 (.046)	-.019 (.049)
Firm-level agreement	-.007 (.031)	.087 (.074)	.078 (.074)	.098 (.078)
Product demand volatility	.546 (.067)***	.472 (.107)***	.625 (.124)***	.491 (.122)***
Volatility*works council	-.400 (.076)***	-.383 (.155)**	-.480 (.159)***	-.286 (.161)*
Union density (lagged)			-.913 (.305)***	
Mean unionization sec (lagged)				-.215 (.215)
Mean unionization est (lagged)				1.299 (.671)*
Number of observations	61,039	7,282	7,134	6,270

	2006-2015 Sample	2010 Cross-section		
	Replication of Table 4, column (4) (1)	(2)	(3)	(4)
Panel (d): Y_4 (Number of fixed-term contract workers converted into permanents)				
Count model:				
Works council	.156 (.244)	.733 (.681)	.712 (.802)	
Sectoral agreement	.009 (.040)	.008 (.093)	.007 (.098)	
Firm-level agreement	.001 (.047)	-.065 (.193)	-.052 (.374)	
Product demand volatility	.191 (.117)*	.298 (.363)	.334 (.587)	
Training (share of trained employees)	.049 (.053)	.088 (.301)	.111 (.579)	
Volatility*works council	-.224 (.120)*	-.527 (.298)*	-.524 (.292)*	
Union density (lagged)			-.335 (.837)	
Mean unionization sec (lagged)				
Mean unionization est (lagged)				
Number of observations	26,476	3,121	3,121	
Panel (e): Y_5 (Number of workers with a fixed-term contract renewed)				
	Replication of Table 4, column (4) (1)	(2)	(3)	(4)
Count model:				
Works council	-.244 (.306)	.550 (.614)	.536 (.615)	.348 (.753)
Sectoral agreement	.015 (.048)	-.050 (.110)	-.030 (.112)	-.075 (.124)
Firm-level agreement	.062 (.060)	.048 (.154)	.060 (.156)	.161 (.259)
Product demand volatility	.111 (.137)	.212 (.253)	.187 (.253)	.440 (.306)
Training (share of trained employees)	-.122 (.073)*	-.013 (.203)	-.034 (.206)	.297 (.213)
Volatility*works council	.089 (.151)	-.190 (.309)	-.186 (.309)	-.133 (.375)
Union density (lagged)			.663 (.846)	
Mean unionization sec (lagged)				.098 (.544)
Mean unionization est (lagged)				7.839 (4.245)*
Number of observations	21,652	2,975	2,975	2,676

Notes: The union density variable in column (3) comprises 8 industry-level variables flagging the corresponding trade union density rate. This information is based on the 2009 European Company Survey. In column (4), trade union density is replaced by survey-based information on industry-level coverage of sectoral and firm-level agreements. In panel (c) of the table, convergence problems forced us to reduce the number of industry-level union density variables in column (3) to 4; and similarly for column (4). Due to convergence problems in the estimation procedure, no results are reported in column (4) for *Panel (d).* In each case, the diagnostic statistics are similar to those reported in Table 4, and are available from the authors upon request.
Source: IAB Establishment Panel, 2006-2015.

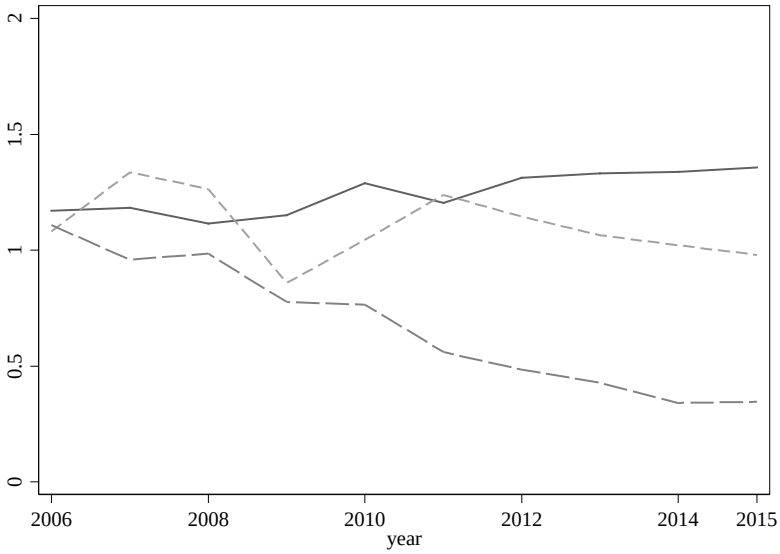
Figure 1: Internal, External, and Fixed-Term Contract Employment (unweighted)

(a) Internal full-time versus internal part-time plus external employment as a percentage of total employment



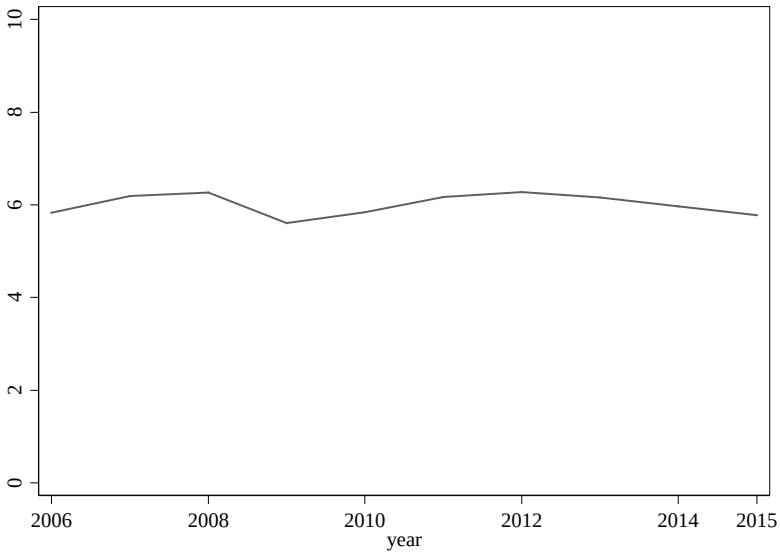
_____ Internal full-time employment
- - - - - Internal part-time plus external employment

(b) Freelancers, temporary agency workers, and 1-Euro jobs as a percentage of total employment



_____ Freelancers
- - - - - - Temporary agency workers
– – – – 1-Euro jobs

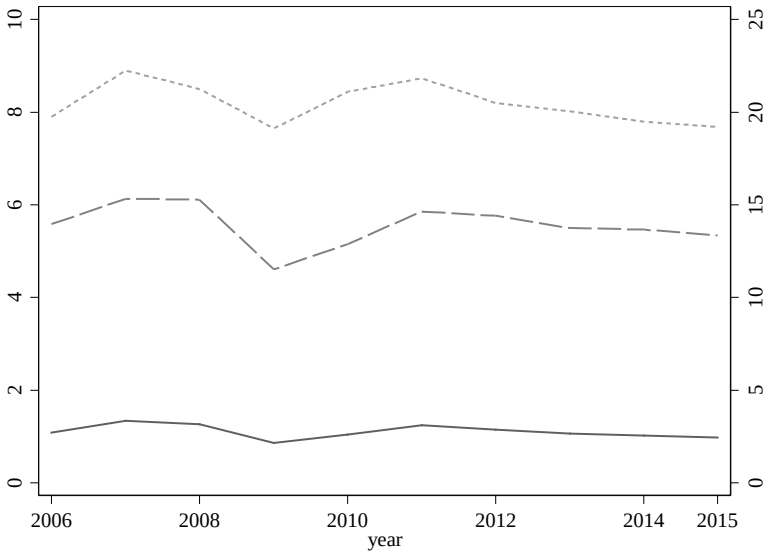
(c) F*ixed-term contract workers as a percentage of internal employment*



Notes: *External* employment is defined as the sum of freelancers, temporary agency workers, and 1-Euro jobs. *Internal* employment is given by the total number of employees at the establishment and is equivalent to the 'personnel structure' as defined by the IAB survey. *Total* employment is given by the sum of *internal* and *external* employment. Given that internal employment is also the sum of full- and part-time employment, we can then define the group of internal full-time employees and generate the difference between total employment and internal full-time employment, which is then equal to the sum of internal part-time plus external employment. The reported percentage values are obtained by computing the mean over the establishment means. As described in Appendix Table 1, these computations use all establishments with at least 1 employee.

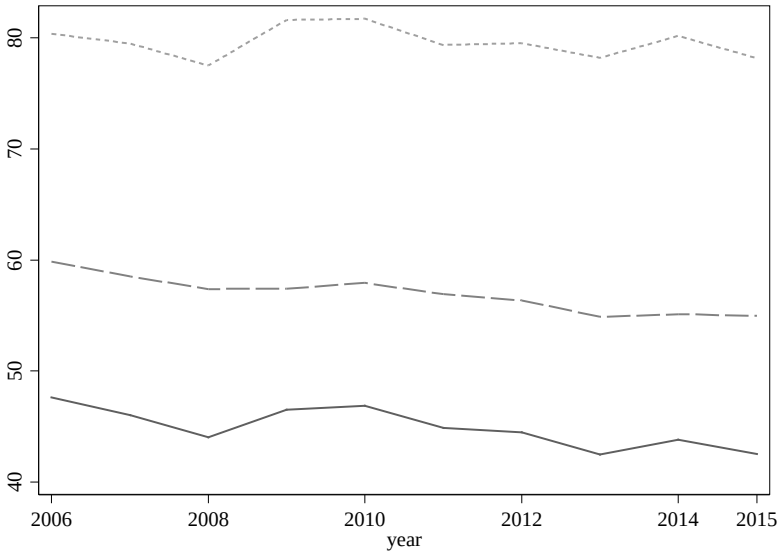
Figure 2: Temporary Agency Work, New Hires with a Fixed-Term Contract (FTC), FTC Conversions, and FTC Renewals (in percent) (unweighted)

(a) Temporary agency workers (in percent)



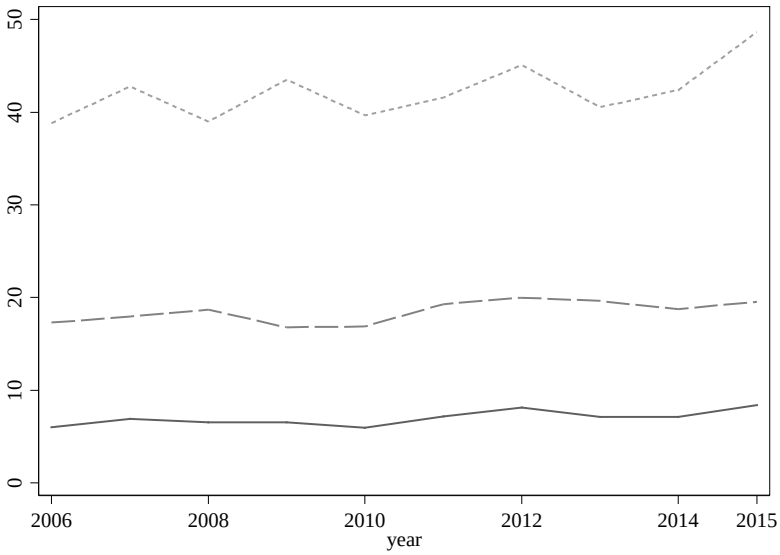
_____ Temps in establishment's workforce (left scale)
- - - - - - Temps in establishment's workforce in establishments with at least one temp (left scale)
– – – – Establishments with at least one temp (right scale)

(b) New hires with a fixed-term contract in establishments with new hires



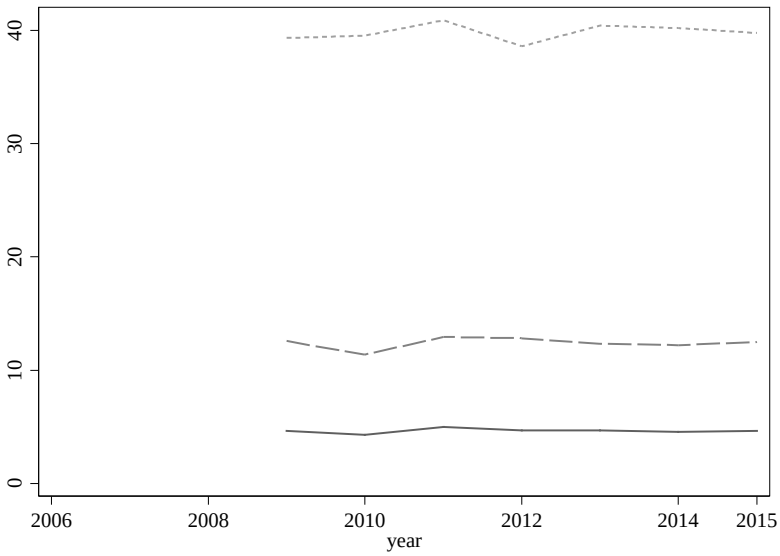
_____ New hires with a FTC in establishments with new hires
- - - - - - New hires with a FTC in establishments with at least one new hire with a FTC
– – – – Establishments with at least one new hire with a FTC

(c) FTC conversions into open-ended contracts *(OECs) in establishments with FTC workers*



_____ Conversions of FTCs into OECs in establishments with FTC workers
- - - - - - Conversions of FTCs into OECs in establishments with at least one FTC conversion
– – – – Establishments with at least one FTC conversion

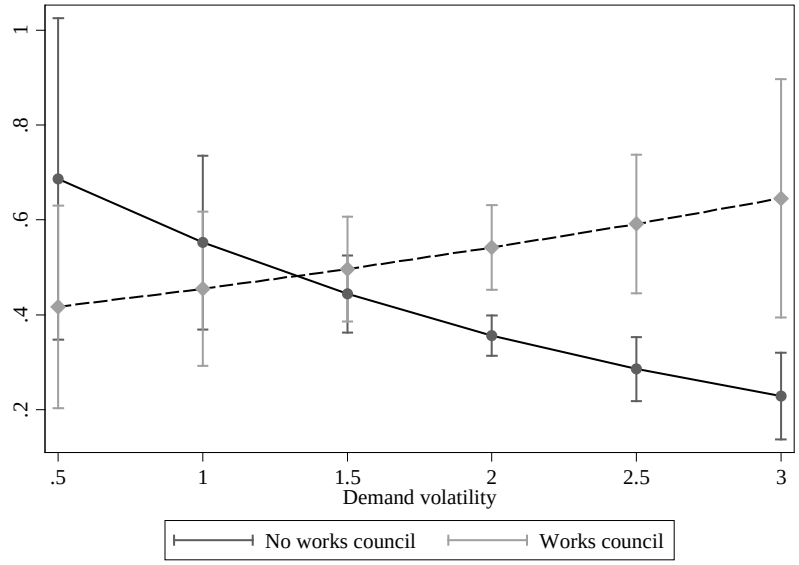
(d) FTC renewals in establishments with FTC workers



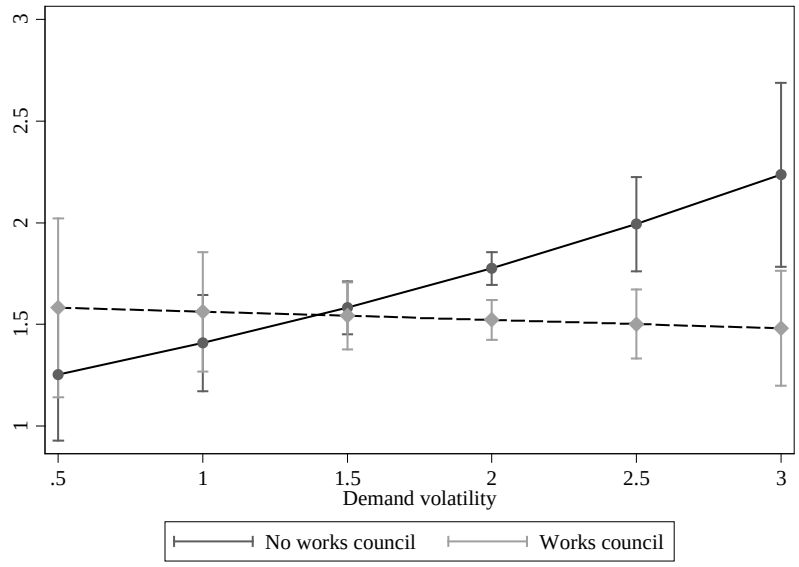
_____ FTC renewals in establishments with FTC workers
- - - - - - FTC renewals in establishments with at least one FTC renewal
– – – – Establishments with at least one FTC renewal

Figure 3: Predicted Number of Agency Temps and Fixed-Term Contract Workers in Establishments with and without Works Council

(a) Predicted number of temporary agency workers



(b) Predicted number of fixed-term contract workers



Notes: Establishments with at least 5 employees. The vertical bar denotes the 95% confidence interval for the corresponding level of product demand volatility. All other covariates included in the regression are set at their respective sample mean.

Appendix Table 1: Definition of the Additional Variables in the Original IAB Establishment Panel Sample As Used in the Construction of Figures 1 and 2

Variable	Definition
N_ft	Number of full-time workers
N_pt	Number of regular part-time workers (without marginal employees)
N_marg	Number of marginal part-time workers
N_total	N_total = N_ft + N_pt + N_marg Full-time workers + Part-time workers (regular and marginal), or Full-time workers + Regular part-time workers + Marginal part-time workers. This aggregate gives the *internal* employment, that is, the number of employees at the establishment as defined by the IAB Survey.
N_freel	Number of freelancers
N_temp	Number of temporary agency workers
N_1eu	Number of 1 Euro job holders
N_total2	N_total2 = N_total + N_freel + N_temp + N_1eu This aggregate defines *total* employment, and is equivalently defined as the sum of *internal* and *external* employment.
sh_freel	N_freel / N_total2 (Share of freelancers)
sh_1eu	N_1eu / N_total2 (Share of 1 Euro jobs)
sh_temp	N_agency / N_total2 (Share of temps)
sh_reg_pt	Number of regular part-time workers / N_total2 (Share of regular part-time workers)
sh_marg_pt	Number of marginal part-time workers / N_total2 (Share of marginal part-time workers)
sh_ft	Number of full-time workers / N_total2 (Share of full-time workers)
sh_non_ft	(N_pt + N_marg + N_freel + N_temp + N_1eu) / N_total2 (Share of non-full-time workers)
sh_ftc	N_fixed / N_total (Share of fixed-term contract workers)
sh_ftc_renew	N_ftc_perm / N_fixed (Share of FTC workers with a contract converted into an open-ended contract)
sh_ftc_prolong	N_ftc_prolong / N_fixed (Share of FTC workers whose contract was renewed)

Note: The variables are extracted from the original IAB Establishment Panel survey, 2006-2015. The original sample contains the publicly-owned establishments and includes those establishments with less than 5 employees.

Appendix Table 2: Zero-Inflated Negative Binomial (ZINB) Model Estimates for the Subsample of Establishments with 21 to 249 Employees

	Dependent variable				
	Y_1 (1)	Y_2 (2)	Y_3 (3)	Y_4 (4)	Y_5 (5)
Count model:					
Works council	-1.033 (0.413)**	0.110 (0.223)	0.593 (0.154)***	-0.014 (0.279)	*No convergence*
Sectoral agreement	0.075 (0.081)	-0.016 (0.036)	-0.044 (0.023)*	0.012 (0.054)	
Firm-level agreement	0.215 (0.089)**	0.079 (0.052)	0.026 (0.032)	0.085 (0.059)	
Product demand volatility	-0.381 (0.183)**	0.152 (0.101)	0.411 (0.062)***	0.052 (0.118)	
Volatility *works council	0.478 (0.203)**	-0.198 (0.113)*	-0.344 (0.077)***	-0.121 (0.140)	
Training				0.052 (0.067)	
Logit:					
Works council	-0.455 (0.512)	-0.321 (0.534)	0.022 (0.601)	-0.159 (0.635)	
Sectoral agreement	0.185 (0.083)**	-0.036 (0.082)	0.120 (0.089)	0.127 (0.181)	
Firm-level agreement	0.005 (0.124)	0.014 (0.135)	-0.078 (0.136)	0.140 (0.186)	
Product demand volatility	0.148 (0.176)	0.020 (0.158)	-0.207 (0.221)	0.482 (0.283)*	
Volatility *works council	-0.038 (0.253)	-0.155 (0.277)	-0.068 (0.304)	0.225 (0.327)	
Training				-0.842 (0.294)***	
Outcome-specific controls			Share of FTCs; Hiring rate	Share of FTCs	
Number of observations	28,766	28,639	28,440	16,598	

Note: In each column, the diagnostic statistics are similar to those reported in Table 4.

Online-Appendix

(*Worker Representation and Temporary Employment in Germany: The Deployment and Extent of Fixed-Term Contracts and Temporary Agency Work*)

NOT FOR PUBLICATION

Appendix Table 1: Product Demand Volatility by Sector, 2006-2015

2-digit industry level (43 groups)	Freq.	Mean	Min	Max
agriculture/forestry	1,934	1.49	1.46	1.52
mining	421	2.21	2.09	2.34
energy	1,507	2.24	2.19	2.33
food/luxury	3,667	2.32	2.25	2.37
textiles/clothing	1,138	2.11	2.00	2.31
paper/printing/wood sector	2,708	2.24	2.18	2.27
chemical/pharmaceutical sector	1,939	2.33	2.23	2.46
plastics sector	1,907	1.84	1.74	1.92
glass/stones/ore extraction	1,840	2.01	1.95	2.08
manufacture of basic metals	2,242	2.35	2.25	2.40
manufacture of fabricated metal	4,287	1.95	1.90	1.99
manufacture of electrical equipment, off	1,357	2.13	2.03	2.19
precision and optical equipment	1,657	2.21	1.97	2.36
machinery and equipment	4,154	1.96	1.91	2.04
other vehicle production	2,160	2.82	2.74	2.88
furniture, jewelry/toys	2,271	2.04	1.91	2.14
reparation/installation	947	1.74	1.67	1.80
main building sector	3,002	1.78	1.73	1.83
building/installation	5,545	1.46	1.41	1.51
Sales, maintenance, repair of motor vehicles	3,219	1.97	1.92	2.02
wholesale trade	4,646	2.05	1.98	2.12
Retail Trade	8,021	1.90	1.84	2.01
Transport and Warehousing	4,705	2.06	2.03	2.13
Information and communication publishing	2,037	1.92	1.88	1.99
hotel business and gastronomy	4,529	1.55	1.51	1.62
financial and insurance sector	2,577	1.67	1.58	1.78
real estate activities	1,020	2.31	2.28	2.35
accounting, advertising	2,060	1.52	1.40	1.64
consulting	571	1.98	1.92	2.03
architecture, technical/physical/chemical	2,453	1.77	1.65	1.82
research/development	563	1.66	1.59	1.81
marketing, design, translation	376	1.62	1.44	1.70
veterinary sector	112	0.79	0.63	0.84
renting	186	1.62	1.51	1.71
placement and temporary provision of lab	1,847	1.20	1.09	1.26
itinerant trading, landscaping	2,538	1.92	1.85	1.95
Education	1,292	1.62	1.55	1.68
Human health	8,139	1.97	1.93	1.99
culture/sports/entertaining	612	2.22	2.06	2.35
Reparation of computer, consumer goods	167	1.81	1.69	1.97
Other services	1,551	1.75	1.74	1.78
activities of membership	155	2.08	1.92	2.22
civil service/social insurance	101	1.38	1.15	1.90

Appendix Table 2: Zero-Inflated Negative Binomial (ZINB) Model Estimates for the Subsample of Establishments with 21 to 100 Employees

	Dependent variable				
	Y_1 (1)	Y_2 (2)	Y_3 (3)	Y_4 (4)	Y_5 (5)
Count model:					
Works council	-1.010 (0.603)*	0.331 (0.345)	0.363 (0.228)	-0.026 (0.361)	*No convergence*
Sectoral agreement	0.269 (0.117)**	-0.011 (0.045)	-0.029 (0.029)	0.098 (0.067)	
Firm-level agreement	0.324 (0.117)***	0.073 (0.073)	-0.027 (0.043)	0.049 (0.071)	
Product demand volatility	-0.499 (0.234)**	0.152 (0.130)	0.368 (0.078)***	-0.038 (0.147)	
Volatility *works council	0.465 (0.304)	-0.305 (0.176)*	-0.230 (0.116)**	-0.087 (0.180)	
Training				0.025 (0.088)	
Logit:					
Works council	-0.911 (0.759)	-0.694 (0.886)	0.087 (0.897)	0.687 (1.110)	
Sectoral agreement	0.189 (0.114)*	-0.018 (0.097)	-0.009 (0.119)	0.268 (0.307)	
Firm-level agreement	-0.117 (0.165)	-0.001 (0.175)	-0.084 (0.187)	0.039 (0.297)	
Product demand volatility	0.223 (0.224)	-0.014 (0.191)	-0.330 (0.275)	0.378 (0.442)	
Volatility *works council	0.203 (0.377)	0.012 (0.467)	-0.068 (0.450)	0.378 (0.568)	
Training				-1.338 (0.574)**	
Outcome-specific controls			Share of FTCs; Hiring rate	Share of FTCs	
Number of observations	21,418	21,329	21,197	10,849	

Note: In each column, the diagnostic statistics are similar to those reported in Table 4 and are not included here.

Appendix Table 3: The Most Important Reason for Hiring Temporary Agency Workers by Establishment Size and Location (in percent)

		A, B or D			E or F			C or G		
		>=5	21-100	21-249	>=5	21-100	21-249	>=5	21-100	21-249
Works council:	1	88.2	85.3	87.2	6.0	6.6	6.9	5.7	8.2	5.9
	0	86.6	86.2	86.5	5.2	4.9	4.9	8.2	9.0	8.6
Type of collective agreement:	No collective agreement	86.5	85.9	86.3	6.3	6.2	6.5	7.2	8.0	7.2
	Firm-level agreement	87.3	83.0	87.2	6.3	4.6	5.2	6.3	12.5	7.6
	Sector-level agreement	88.7	86.3	87.5	4.7	4.4	5.1	6.6	9.4	7.4

(cont.)

		A, B or D			E or F			C or G		
		Germany	Western Germany	Eastern Germany	Germany	Western Germany	Eastern Germany	Germany	Western Germany	Eastern Germany
Works council:	1	88.2	89.0	86.4	6.0	5.6	7.1	5.7	5.4	6.6
	0	86.6	84.0	89.8	5.2	7.0	3.0	8.2	9.0	7.3
Type of collective agreement:	No collective agreement	86.5	84.2	88.9	6.3	8.2	4.2	7.2	7.6	6.9
	Firm-level agreement	87.3	85.3	90.6	6.3	7.1	5.1	6.3	7.7	4.3
	Sector-level agreement	88.7	89.5	86.1	4.7	4.5	5.2	6.6	6.0	8.8

Note: See notes to Table 5.

Appendix Table 4: Indicator of Changes in Human Resource Management (HRM) Practices by Establishment Size and Location (in percent)

		HRM practices (E, F or I)			Other changes A, B, C, D, G, H, or J			No change		
		>=5	21-100	21-249	>=5	21-100	21-249	>=5	21-100	21-249
Works council:	1	23.3	22.5	23.3	45.1	39.0	42.7	31.6	38.5	34.1
	0	20.6	24.8	24.9	25.6	31.0	32.1	53.8	44.2	43.0
Type of collective agreement:	No collective agreement	21.3	25.5	25.6	29.2	34.0	35.9	49.5	40.5	38.4
	Firm-level agreement	23.5	21.8	23.7	38.3	35.2	39.7	38.3	43.1	36.6
	Sector-level agreement	20.7	22.0	22.0	33.1	31.7	35.6	46.2	46.2	42.5

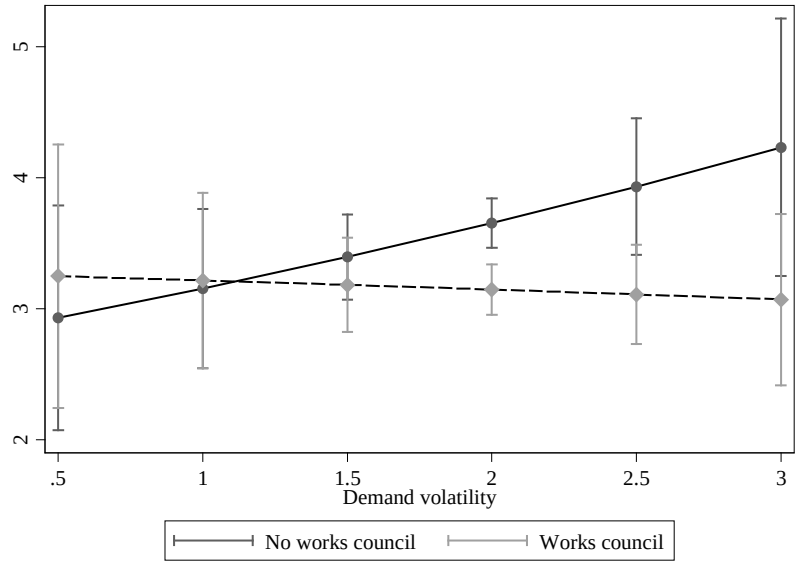
(cont.)

		HRM practices (E, F or I)			Other changes A, B, C, D, G, H, or J			No change		
		Germany	Western Germany	Eastern Germany	Germany	Western Germany	Eastern Germany	Germany	Western Germany	Eastern Germany
Works council:	1	23.3	21.8	26.6	45.1	47.5	39.6	31.6	30.7	33.8
	0	20.6	19.5	22.2	25.6	25.7	25.5	53.8	54.8	52.3
Type of collective agreement:	No collective agreement	21.3	19.8	23.1	29.2	30.4	27.9	49,5	49.8	49.1
	Firm-level agreement	23.5	22.6	24.6	38.3	42.3	33.0	38.3	35.1	42.4
	Sector-level agreement	20.7	20.2	22.2	33.1	34.0	30.3	46.2	45.7	47.5

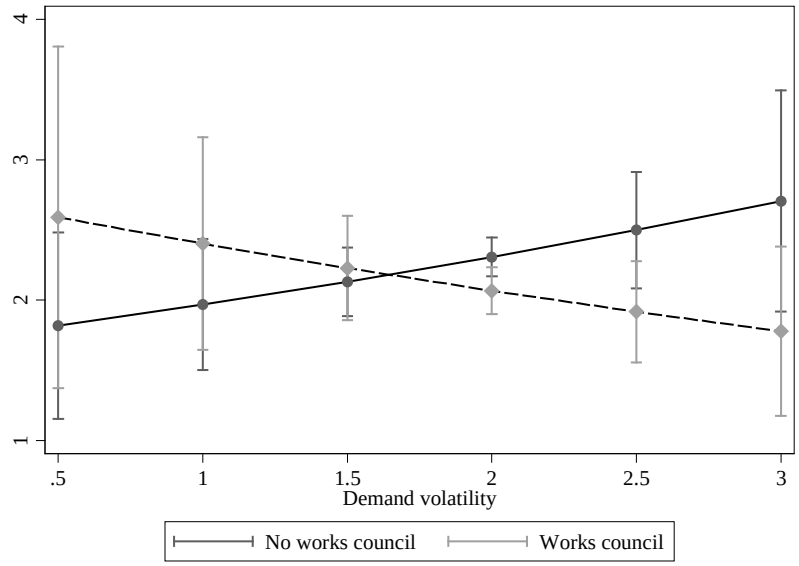
Note: See notes to Table 6.

Appendix Figure 1: Predicted Number of Fixed-Term Contract Workers in Establishments with and without Works Councils.

(a) Establishments with 21 to 249 employees



(b) Establishments with 21 to 100 employees



Note: See notes to Figure 3.