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Can public employment subsidies render the German construction sector weather proof?

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Can public employment subsidies render the German construction sector weather proof? *

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Abstract

In order to confine excessive levels of temporary layoffs, US firms are taxed - albeit incompletely - according to the unemployment insurance benefits claimed by their laid off workers. In contrast, German construction firms are not charged according to their layoff history and should thus have much higher layoff incentives. However, in case of a weather-induced shortfall of work, a firm's workforce is eligible for a partial subsidy to their employment costs. The level of this subsidy was subject to several reforms throughout the 1990s which provides a unique opportunity for examining the empirical link between layoff incentives and layoff rates. Our analysis is based on large individual administrative data merged with information about local weather conditions and the business cycle. We observe economically plausible effects: the higher the subsidy to employment costs, the less layoffs occur and the less weather-dependent is employment.

Keywords: panel data, temporary layoffs, employment stability

JEL: J38, J48, J68

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1 Introduction

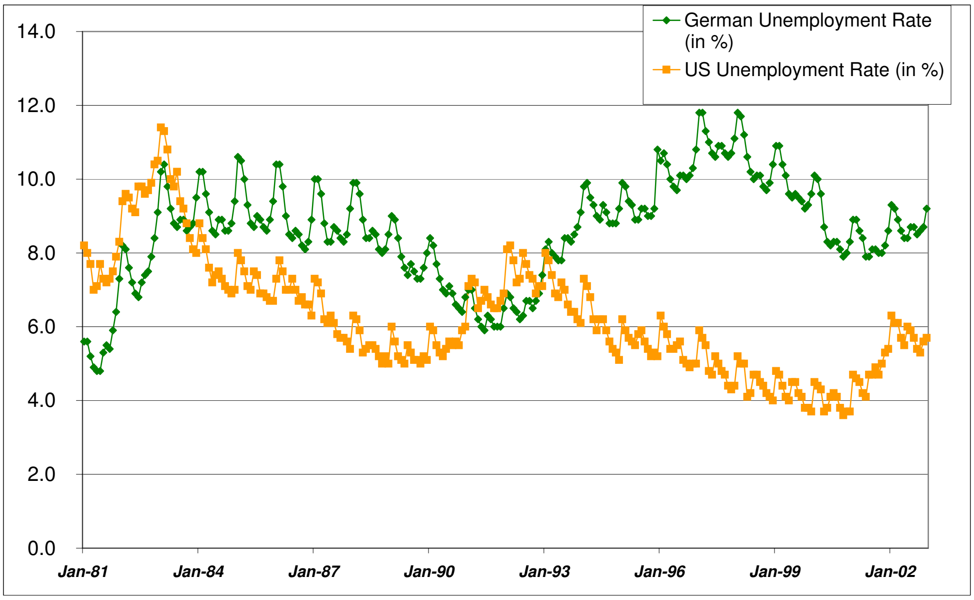
Countries with unfavorable conditions for winter construction work tend to experience seasonal fluctuations in production requirements that create an incentive for firms to temporarily lay off workers. According to the seminal paper by Feldstein (1976), such an incentive should be particularly strong if the unemployment insurance (UI) and the tax system lower the costs of temporary layoffs to firms and workers. In the US, the system of experience rating ensures that firms contribute to the financing of unemployment benefits by taxing them according to the unemployment benefit receipt of their previous employees. However, this taxing is incomplete so that firms with high layoff rates experience a cross-subsidy by firms with lower layoff rates. As a result, Feldstein (1976, 1978) and others (Saffer 1983; Card and Levine 1994) have shown both theoretically and empirically that this creates an incentive for excessive layoffs among the subsidized firms, especially in the construction sector. Moreover, lower layoff costs make recalls less likely and increase the duration until recall (Jurajda 2004). All of these US studies exploit industry- and state-specific variation in the experience rating factor in order to analyze the link between between layoff costs and layoff rates or the duration of unemployment spells. Since in Europe costs produced by the layoff history of a firm are not internalized via a system of experience rating, such a source of variation and thus similar studies, to the best of our knowledge, are non-existent. As a related exception, Røed and Nordberg (2003) analyze the effect of firms' pay liability during the periods of temporary layoffs on the length of unemployment in Norway. They show that the length of unemployment spells until a worker is recalled by an employer is highly sensitive to financial incentives for firms.

The aim of this paper is to exploit a source of variation in layoff incentives other than a system of experience rating in order to provide a first empirical assessment of the link between layoff incentives and layoff rates for a European country. In particular, construction firms in Germany are subject to an instrument that, similar to experience rating, aims at reducing the firm's incentives for temporary layoffs: partial subsidies to employment costs during the winter period that exempt a firm from paying full wages to its workers in case of a weather-induced shortfall of work. The aim of this partial subsidy is to reduce layoffs and maintain employment relationships during periods of weather-induced productivity shocks. The use of this instrument may thus explain why patterns of seasonal unemployment in Germany are not much stronger than in the US despite having no system of experience rating (see Figure 1).[1] Similarly, recall rates

[1] Gutierrez-Rieger and Podczeck (1981) and FitzRoy and Hart (1984) suggest that the lack of experience rating

of unemployed construction workers of about 60% in the US (Katz and Meyer 1991) and up to 50% in Germany (Wilke 2005) also indicate a comparable relevance of temporary layoffs in both countries.

Figure 1: Monthly unemployment rate in Germany and the US. Note: West-Germany only for years 1991 and later. Sources: Federal Employment Agency, National Bureau of Labor Statistics.



For examining the empirical link between layoff incentives and layoff rates in Germany, we exploit the variation in the level of the subsidy that has been induced by several reforms throughout the 1990s. For this purpose, we estimate the effect of subsidizing weather-induced shortfall hours on individual layoff probabilities in the construction sector. We do so based on a database that combines daily individual level administrative panel data of more than twenty consecutive years with information on the business cycle, local weather conditions at the workplace and information on institutional changes. Combining all this information is quite unique and helps us in disentangling the relevance of each of these factors as a determinant of seasonal layoffs. Our empirical approach thus improves upon earlier studies that either analyze temporary layoffs based only on individual and firm level information as in Card and Levine (1994) or the effect of weather conditions on aggregate output in the construction sector on a macro level only (Solomou and Wu 1997).

should increase the incidence of temporary layoffs in Europe.

As another contribution, our study also allows for comparing the effectiveness of two of the main approaches of promoting winter employment in the European construction sector. In particular, the German construction sector during the 1990s has seen a major shift from a system based on publicly funding a weather allowance to a system that combines a weather allowance with the use of overtime accumulation.[2] Both of these approaches can be found in a number of northern and central European countries. However, to the best of our knowledge, none of these approaches has been analyzed with respect to the effectiveness in reducing layoffs. Our analysis thus also provides a first microeconometric assessment of the effectiveness of employment promotion schemes in preventing seasonal layoffs in the European construction sector. This may also shed some light on why the degree of seasonal winter unemployment strongly differs across European countries and is not clearly linked to local climate conditions as suggested by Grady and Kapsalis (2002).

Our results confirm a clear link between layoff incentives and individual layoff probabilities in the German construction sector. In particular, layoff rates decrease with rising subsidies to a firm's employment costs. Moreover, reduced employment costs due to claiming a weather allowance only after workers have compensated for an initial shortfall of work by overtime hours results in lower layoff rates compared to a pure allowance-based scheme. We also find evidence that layoff rates increase during periods of weak labor demand and adverse weather conditions, although the effects of weather conditions are less strong than generally thought by the public as most layoffs take place at fixed dates. This implies that the seasonal rise in unemployment in Germany to a large extent can be explained by planned capacity reductions rather than unfavorable weather conditions.

The paper is structured as follows. The following section describes the main features of the institutional setup for seasonal employment in Germany. We describe our data in section three and the econometric framework in section four. The empirical results are presented and discussed in section five before we conclude in section six.

2 Institutional setup for seasonal employment in Germany

Following the framework by Bentolila and Bertola (1990), the optimal employment policy of a firm is to lay off workers if the expected present value of cash flow, i.e. the expected value of the difference between the marginal revenue product of labor and the employment costs, is lower than the negative of the firing costs. In this framework, adverse weather conditions can be considered as a productivity shock that reduce the marginal revenue product of labor and thus increase a

[2]For an overview of the changes see also Bosch and Zühlke-Robinet (2003).

firm's incentive to lay off workers. In order to confine an excessive use of temporary layoffs, the system of experience rating in the US increases the costs associated with laying off a worker.

In contrast, the unemployment insurance system in Germany is fully subsidized in the terminology of Feldstein (1976) since there is no element of experience rating and unemployment benefits are not taxed. Moreover, special regulations in the construction sector generally facilitate temporary layoffs compared to other sectors. In particular, employment can be terminated at short notice.[3] Moreover, construction workers are eligible for four (three) month of unemployment benefits if they have been working at least eight (six) month in a socially insured employment during the year preceding the benefit claim.[4] Most seasonal workers are thus able to bridge winter unemployment by means of unemployment benefits.[5]

Given this institutional setting one would expect layoff incentives related to adverse weather conditions to translate into high levels of temporary seasonal unemployment in Germany. However, employment costs are partially subsidized by the unemployment insurance during periods of adverse weather conditions, thus increasing the expected present value of the cash flow associated with keeping a worker. Apart from a political interest in reducing seasonal unemployment, lower rates of temporary layoffs are mainly desirable from the perspective of the unemployment insurance since an unemployment benefit claim of a laid off worker is more costly than paying the partial subsidy. This subsidy has been subject to a number of reforms during the 1990s. In what follows we discuss the main characteristics of the different regimes which are also briefly summarised in Table 1.

Until 1995, employers could claim a bad weather allowance from the unemployment insurance fund of the FEA (Federal Employment Agency, *Bundesagentur für Arbeit*) as a compensation for a weather-induced shortfall of working hours, the so called *Schlechtwettergeld* (SWG). The allowance paid workers as if they were entitled to unemployment benefits, i.e. they received around two thirds of their previous net income while employers only had to pay social insurance contributions of around four Euro for each hour that was compensated by the bad weather allowance. This amounts to less than a fifth of the usual labor cost and thus provided a substantial subsidy to a firm's employment costs. At the same time, employers were no longer allowed to lay off workers

[3]Unlike employment in other sector, employment in the construction sector can be terminated by giving six (twelve) days' notice if job tenure has been below (above) six month. A one month' notice is necessary if job tenure exceeds three years.

[4]These regulation have been modified after our observation period in 2005.

[5]For an extensive review of the institutional setup in the German construction industry see Zühlke-Robinet (1998) and Bosch and Zühlke-Robinet (2000, 2003).

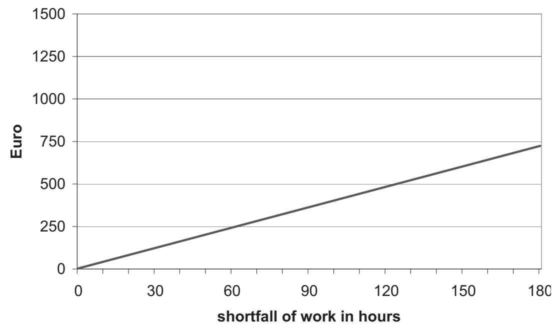
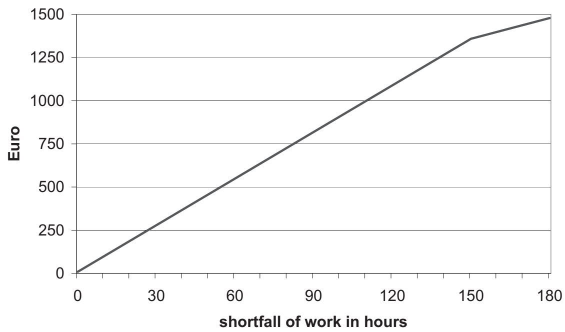
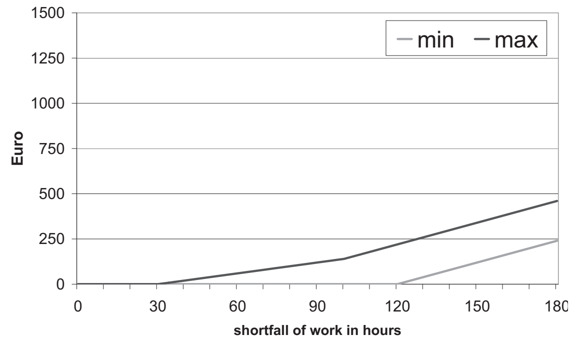
during the statutory winter period from November until March due to adverse weather conditions.

As a reaction to its poor financial situation in the post-unification years, the FEA in the season of 1995/1996 paid a winter allowance, the so called *Winterausfallgeld* (WAG), equivalent to the weather allowance from the 151st weather-induced shortfall hour onward only. For the first 149 shortfall hours, firms had to pay workers 75% of their gross wages of which 20% were reimbursed by the unemployment insurance fund. While the level of compensation for each shortfall hour remained roughly unchanged from the perspective of the workers, employers now had to pay around nine Euro per hour for the first 149 shortfall hours and four Euro per hour from there onward. Under this new regime, subsidies to a firm's employment costs thus decreased markedly.

Since unemployment doubled with the introduction of WAG, it was already replaced by a scheme called overtime WAG (OvWAG) in the season of 1997/1998. While OvWAG again paid the same weather allowance from the 120th shortfall hour onward, the burden for the first 119 shortfall hours were now split more equally between employers and workers. In particular, a minimum of 50 shortfall hours had to be compensated by an accumulation of overtime during spring and summer and were thus cost-neutral for an employer while workers lost any additional compensation.[6] For the 51st to 119th shortfall hour, firms could either opt for continued overtime compensation or they could claim a weather allowance of the usual benefit level from a fund that was financed by a statutory winter levy of 1.7% of a firm's gross wage bill. This fund also financed a 50% deduction of an employer's social insurance contributions so that employers only had to pay reduced social insurance contributions of around two Euro per shortfall hour. Compared to the previous regime, a firm's employment costs for weather-induced shortfall hours were thus clearly reduced at the expense of somewhat lower compensation levels on the part of the workers. A minor modification of this regime was introduced in the season 1999/2000. The minimum hours that had to be compensated by overtime accumulation fell to 30 hours and the threshold above which the FEA again paid the winter allowance fell to 100 shortfall hours, thus again shifting some of the financial burden back to the FEA. In addition, the FEA started paying an additional Euro per hour that was compensated by overtime in order to promote the use of overtime accumulation beyond the first threshold. For the following analysis, we mainly focus on the comparison of the weather allowance system that was in place before 1995 and the use of a winter allowance in combination with overtime accumulation since the intermediate regime was used only for a short period of two seasons.

[6] A worker with overtime would previously receive the overtime pay including a premium and in addition receive the bad weather allowance. In the new setting, the worker only received the overtime pay including the premium.

Table 1: Employment promotion schemes between 1981 and 2004

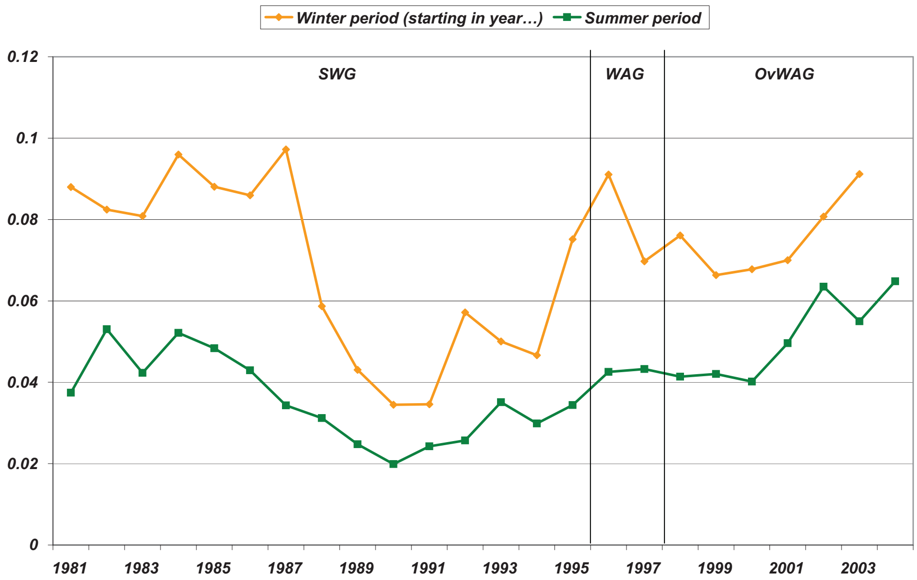
Compensation scheme	Employment costs by shortfall hours
SWG - until 1995	
• Firm pays social insurance contributions of 4 Euro for each weather-induced shortfall hour • Workers receive weather allowance corresponding to the level of unemployment benefits (two thirds of net wage) from the unemployment insurance fund	
WAG - 1995/96-96/97	
• 1.-150. shortfall hour: – Firm pays workers 75% of their gross wage, but receives 20% reimbursement by social insurance fund – Workers receive 75% of their gross wage • > 150 shortfall hours: SWG applies	
OvWAG - since 1997 (modification since 1999)	
• 1-50. (1.-30.) shortfall hour: – Workers compensate by overtime and receive no further compensation – Cost neutral for the employer • 51.-120. (30.-100.) shortfall hour: – Workers can but need not compensate hours by overtime; otherwise, workers receive allowance equivalent to SWG financed by a statutory winter levy – Firms pay 2 Euro for each shortfall hour • > 120 (100) shortfall hours: SWG applies	

Since all of the regimes only partially subsidize a firm's employment costs in case of adverse weather conditions, we first of all expect layoff incentives in case of a weather-related productivity shock to be only reduced but not eliminated by these regimes. In spite of the special dismissal protection that bans layoffs due to adverse weather conditions, layoffs should thus be related to weather conditions. In fact, this incentive may explain why we observe seasonal unemployment patterns as shown in Figure 2. As the hypothesis of main interest, we also expect layoff probabilities to vary with the legal setup that affects a firm's economic rationale of keeping a worker temporarily underemployed rather than laying off the worker. In particular, we expect the incidence of seasonal layoffs to increase c.p. with the cost of continuing employment during shortfall hours, i.e. from OvWAG to SWG to WAG.[7] Moreover, we expect any cushioning effect against weather-induced productivity shocks to weaken the longer the period of adverse weather conditions persists. This is because employers' expectations concerning the future weather conditions should be based on the available past information on the severity of the winter. Moreover, the higher the total costs associated with keeping a worker temporarily underemployed for a prolonged period of adverse weather, the higher the layoff incentive should be. Hence, a cushioning effect against bad weather conditions may be relatively strong for OvWAG.

Figure 2 does not suggest a simple relationship between the individual unemployment risk and the current regime though. Unemployment risk among construction workers doubled with the reduced subsidy levels during the winter seasons of 1995/1996 and 1996/1997 compared to the early 1990s. Yet, unemployment transitions were similarly prevalent during the 1980s. In fact, the increase in winter unemployment compared to the preceding summer period was particularly pronounced for two winter seasons: 1987/88 and 1995/96. Moreover, unemployment transitions remained at a high level under the latest regime. These observed seasonal layoffs likely result from the combined effect of the regulation of the labor market, the severity of weather conditions in a particular year as well as from business cycle conditions. Moreover, it is cheaper for firms to lay off redundant workers than keeping them if the expected length of the redundancy and the corresponding total costs of continued employment is long enough such that the costs saved from not laying off become negligible. For this reason, fixed calender times ahead of time intervals that are considered to be less productive could also increase layoffs. In order to assess the relative effectiveness of the regimes in preventing seasonal unemployment, the empirical analysis thus

[7]Due to lower compensation levels for the latest regime, workers might have incentives to voluntarily end employment and leave the sector. Our empirical analysis, however, looks at layoffs only and not at voluntary quits. For the incidence of layoffs, the firm's economic rationale should be decisive.

Figure 2: Share of workers in the construction sector that is laid off during winter and summer periods. Source: IABS 2004.

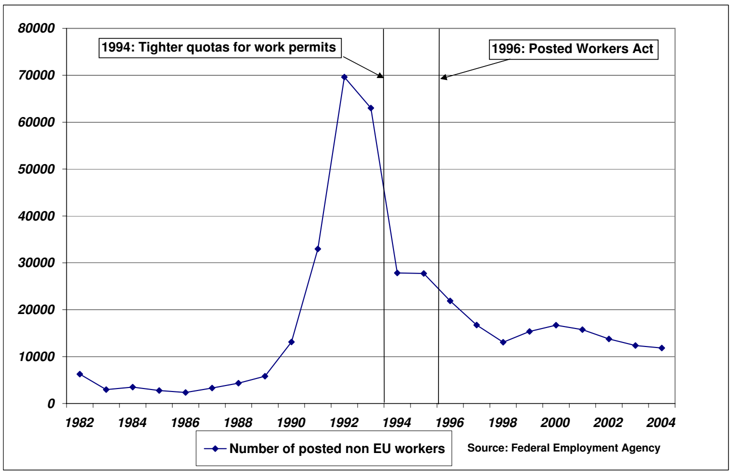


needs to disentangle the impact of weather conditions, the business environment, the relevance of certain fixed calender times as well as the legal setup. Note that we cannot evaluate the legal regimes relative to a state without any regulation because our period of analysis is restricted to 1981 until 2004. Moreover, due to the lack of information on the actual receipt of a bad weather allowance (SWG) or the winter allowance (WAG and OvWAG) on an individual level, we cannot assess the overall changes in compensation transfers in reaction to the policy reforms.

The construction sector has undergone further changes that need to be kept in mind for the following empirical analysis. In particular, the previously domestic construction industry has experienced an increasing transnationalization (Bosch and Zühlke-Robinet, 2003). While foreign workers until the early 1990s were employed at the same pay and working conditions than domestic workers, this territorial principle no longer applies within the EU member states. Foreign workers, especially from central and eastern European countries, could now be posted from their company to work in Germany on the terms that apply in their home country. Despite bilateral agreements on quotas and recommended minimum wages, posted workers in Germany reached an all time high in 1992 (see Figure 3). The Posted Workers Act in 1996 therefore introduced minimum wages for all legal workers in Germany including posted workers from abroad, but illegal employment still provides opportunities for crowding out domestic construction workers. Since data on the amount of illegal employment are not available, we cannot evaluate the effects of these accompanying developments. However, we assume that the inflow of non-domestic workers is not correlated with the four policy regimes and we control for cyclical patterns by using year dummies. Moreover, we use individual level indicators for possible effects of minimum wages in different parts of the construction sector which were introduced between 1996 and 1999.

Finally, the identification of the policy effects can also be hampered by improvements in the production technology in presence of severe weather conditions over time. This could result in a reduced weather-dependency of layoffs in later years. Since we are not aware of any data about production technology in the construction sector, we are not able to control for it. In order to identify changes in response to the policy reforms, we have to assume that such trends are of minor importance or not correlated with the policy reforms.

Figure 3: Number of officially posted non-EU construction workers in Germany.



3 Data

Our analysis is based on comprehensive administrative individual data from Germany which is merged with several regional indicators about the business cycle and weather conditions.

Individual data. We use the IAB employment sample 1975-2004 - regional file (IABS-R04) which is described in detail by Drews (2008). This administrative data set contains information on a 2 % sample of the population working in jobs that are subject to social insurance payments. In particular, we have daily information on employment periods and periods for which the individual received unemployment compensation from the Federal Employment Agency. Due to data quality problems in the early years of the data set, we restrict our sample to western Germany between 1981 and 2004. [8] We further restrict our sample to individuals working in the construction sector.

From a descriptive analysis of the daily information it became evident that there are mass points in the distribution of unemployment inflows at the end of each month, year and on each Friday. Moreover, there are major peaks at the last two Fridays before Christmas. Since these mass points have to be adequately modelled, we transformed the spell information into a weekly panel starting every Friday. Hence, for each individual, we have a panel of weeks that contains information on whether an individual is employed or wether there was a transition to unemployment in a particular week. We assume a transition to unemployment to occur if an individual receives unemployment compensation within two weeks after the end of the foregoing employment spell. Since workers in the construction sector are used to the administrative process of claiming unemployment compensation, workers who receive unemployment compensation with a greater lag than two weeks are likely to be temporarily suspended from unemployment compensation due to quitting the job rather than being laid off by the firm. However, we performed a sensitivity analysis by using four and twelve weeks as the limiting gap between employment and the receipt of unemployment and found stable result patterns.

Based on this panel data set, we construct dummies for the weeks that contain the end of a month, the end of a year and the two pre-Christmas Fridays in order to capture the corresponding mass points of transitions to unemployment. Moreover, we compute year dummies to capture aggregate trends and dummies for the statutory winter season between November 1 and March 30. In addition, we construct bi-weekly dummies for the period November to April to capture potential seasonal layoff patterns that are independent of weather conditions or the business cycle. On the individual level, we further compute several work history related variables such as the incidence and length of previous employment and the incidence of previous recalls or re-employment by former employers. Moreover, we compute a dummy variable if a worker's occupation suggests a particularly high dismissal risk during the winter period due to being a blue-collar worker in an outdoor activity such as a bricklayer.

The resulting sample consists of about 7.1m observations that are produced by 31,000 individ-

[8] For the period after 1991, estimates both ex- and including the eastern German counties did yield robust findings.

uals of which about 10,400 experience at least one transition to unemployment in the observation period. However, only 0.4% of our observations experience a transition to unemployment since many individuals are employed for many weeks during the year. Moreover, in an average winter season, 7.5% of all individuals working in the construction sector become unemployed of which only 1% experience a transition to unemployment twice. This indicates that individuals tend to be laid off once for the whole winter period instead of switching back and forth between employment and unemployment. Even though this suggests that the effect of weather conditions on the employment status may be limited, it does not preclude that the actual layoff time depends on current weather conditions or cumulative weather conditions in the current winter season as discussed in the previous section.

Regional data. Since the IABS-R04 provides county level information about the workplace location, we can merge regional data about weather conditions and the business cycle. In order to proxy the business cycle, we include yearly revenues in the construction sector for the sixteen German states. In order to avoid a scaling problem due to the different sizes of states, we use a state-specific index of real revenues. Moreover, we merge information on the annual percentage change of real revenues compared to the previous year to capture a changing business environment in the construction sector.

The weather data is obtained from the German meteorological service (*Deutscher Wetterdienst*, DWD) and comprises information about daily temperature intervals, the amount of snow, rain and the wind speed for a sample of 35 weather stations throughout Germany.[9] These stations were chosen by the DWD based on the criterium that weather conditions measured at these stations are representative for the densely populated areas of the surrounding county. Hence, weather stations that capture local or extreme weather conditions (e.g. hilltops) were excluded. Moreover, for many counties, the meteorologists at DWD could not identify a weather station with representative weather conditions for its surrounding county. Owing to these limitations, our sample of workers in the construction sector is limited to 35 German counties which may not be fully representative for Germany as a whole. On the other hand, the sample includes a broad mixture of rural and urban counties spread throughout Germany.

As an alternative to including weather indicators such as temperature or precipitation as covariates in our analysis, we decided to define days with severe weather conditions, in short

[9]The data is available for academic use from the DWD by paying a low administrative fee. We thank the DWD for its scientific advice and support.

DSW, that hamper outdoor construction work according to the official DWD definition. We reconstruct DSW as precise as possible based on the available weather information on temperature and precipitation. In order to make the data compatible to our weekly panel data, we define weekly weather conditions. In particular, we consider a week to have severe weather conditions, in short WSW, if at least three days fulfil the DSW criterium. While for the individual data, a weekly information reflects the employment status in the week following a Friday, the weather information merged for this week reflects weather conditions between the last Monday and the next Sunday, thus taking account of short-term expectations concerning the weather on the weekend. We tested alternative specifications but found this one to yield the sharpest estimates. In addition to the indicator concerning weather conditions in the current week, we also compute the cumulative number of DSW in a winter season in order to capture the varying severity of the winter that is likely to affect layoffs. Figure 4 reports the smallest and the largest number of DSW in the sample regions in addition to the overall average during the winter seasons from 1981 until 2003. The figure thus illustrates that we are able to exploit substantial annual and regional variation during an interval of more than 20 years.

Figure 4: Number of days with severe weather conditions (DSW) per winter season: min, mean and max taken over weather stations. Source: German meteorological service

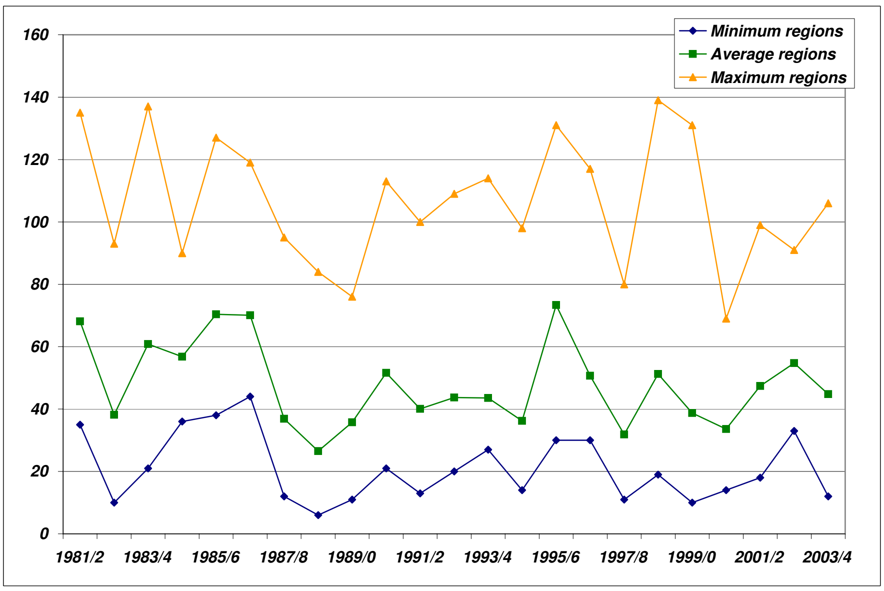
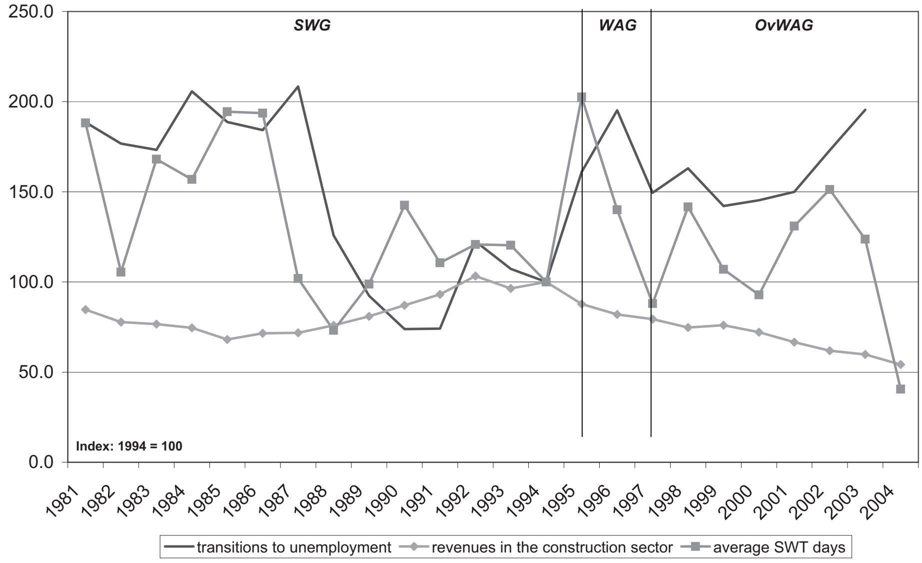
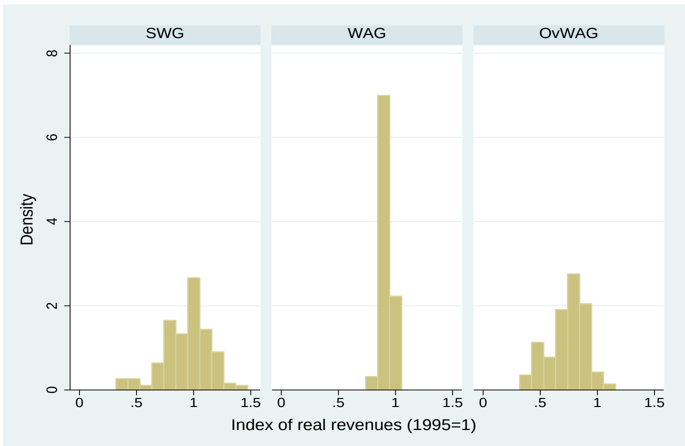


Figure 5: Macro developments and institutional regimes.

Time Series of indicators. Sources: Federal Employment Agency, DWD, IABS 2004.



Histogram on state-level revenues by employment promotion regime. Source: IABS 2004.



Aggregate time series. For the aggregate time series in Figure 5 we find the expected negative relationship between revenues and unemployment transitions in the winter ($\rho = -0.6$) and the expected positive relationship between unemployment transitions and the average number of days with severe weather conditions ($\rho = 0.4$). Note, however, that there is no clear link between the regime and the unemployment risk in a particular winter. In order to assess the effectiveness of the different regimes in preventing seasonal layoffs, the empirical analysis thus needs to disentangle the impact of the institutional regime, weather conditions and the business cycle.

Since we only have time series variation in the institutional setting, our identification strategy relies on observing the different regimes under similar business and weather conditions. While Figure 4 suggests a sufficient variation of weather conditions on the county level across the regimes, Figure 5 (top) indicates that we observe the SWG regime during both prosperous and declining business conditions while the subsequent WAG regulations were implemented in rather declining market environments. Including the less prosperous early 1980s in our analysis is thus important to observe the different legal regimes under similar business conditions. Moreover, with the state-level information on the business conditions, we can exploit more variation than suggested by Figure 5 (top). In fact, Figure 5 (bottom) shows that state-level business conditions observable for the SWG regime and the OvWAG regime are largely overlapping, while the intermediate WAG regime is observed only for a narrow range of business cycle conditions. The subsequent analysis thus mainly focuses on the comparison of the SWG and the OvWAG regime.

4 Econometric Model

As discussed before, layoffs tend to take place only once per winter season with almost no multiple transitions between the two labour market states. We therefore consider a framework in which an employed individual $i = 1, \ldots, N$ can either continue employment or experience a transition to unemployment at period $t = 1, \ldots, T$. Thus, unemployment risk is examined as a binary outcome with $y_{it} = 1$ if there is a transition to unemployment and $y_{it} = 0$ otherwise. Using this transition indicator, we explore the determinants of experiencing a layoff by modeling the transition probability as a function of $k = 1, \ldots, K$ explanatory variables x_{kit}. In particular, we assume

$$Pr[y_{it} = 1|x_{it}] = F(\beta_0 + x'_{it}\beta)$$

with F is a monotone function ranging from 0 to 1, β_0 is an unknown coefficient, β is a $K \times 1$ vector of unknown coefficients, and x_{it} is a $K \times 1$ vector. In most applications and textbooks, F is the cumulative logistic or normal distribution function and we follow this literature by assuming that the true function F is logistic. The explanatory variables are a combination of individual, regional information and calender time dummies. Note that x_{it} does not include a common constant. In our empirical analysis we estimate the β coefficients by means of different methods and model specifications using STATA. In particular, we apply pooled and fixed effects methods.

Pooled Model. Pooled estimation of the logit model is mainly attractive because of its convenience. Moreover, it delivers an estimate for the constant β_0 and for time invariant regressors such as gender. See Wooldridge (2002) for a detailed review of this approach. Although convenient, the model has several important disadvantages. For this reason, we do not present full estimation results in our empirical part. However, since this model provides interesting insights on the effects of time constant individual specific explanatory variables, we briefly list them in a table in the Appendix. Our specific model setup faces the additional problem of rare event data (King and Zheng, 2001) which can lead to a finite sample bias. Rare event data is characterised by a huge amount of zeros (no transition) and just very few ones (transitions) in the dependent variable. Even though we have about 7m observations in our pooled sample, we checked these potential issues by using the STATA code of King and Zheng (*relogit*). As the corrections resulted in very minor changes only, we concluded that our sample is indeed not small.

Fixed Effects Model. The Fixed effect (FE) model gains its popularity from the fact that it produces consistent estimates even in presence of an unobserved individual time constant effect which is allowed to have a non zero population covariance with the observed regressors. The logit FE panel estimator gains its convenience mainly from its computational convenience as it is a conditional maximum likelihood estimator. In contrast to the linear FE panel estimator it uses period data from individuals only, for which the value of the dependent variable switches between two periods. For the observations generated by these individuals, it is essentially a pooled logit estimator with period changes of regressors (Baltagi, 2005). Therefore, similar to the linear FE model, it does not yield estimates for time constant variables such as gender and it does not reveal any information about the individual fixed effect. In contrast to the linear FE model and pooled logit model, it is not possible to compute changes in conditional probabilities as the constant and the fixed effects are unknown. Given this limitation for interpretation, we also considered a linear FE model as an alternative specification. As up to 20% of the fitted values of this model do not fall in the unit interval we decided not to pursue in this direction and results are therefore not reported. Moreover, we also considered the estimation of a random effect panel model but we were not able to obtain results in a reasonable amount of time. Since our main coefficients of interest are time varying (policies, weather, business cycle), we apply the fixed effect logit estimator and mainly report results and statistics for this model. Our main empirical findings are, however, robust with respect to the choice of the econometric method (pooled logit, linear FE model). Moreover, as estimated asymptotic standard errors and robust standard errors are very similar in our application, we do not report the latter.

We emphasize that our sample is representative for the employment in the construction sector. If it is not random in the sense that unemployed, inactive and employees in other business sector differ systematically from the observations in our sample, our results are not valid for the entire German population.

Choice of regressors. In our empirical exercise we use different sets of regressors to explore and determine the effect of weather conditions and the legal setup on unemployment risks in the construction sector. We do not include region dummies and most of the individual level regressors since the use of fixed effects requires time varying regressors. However, in Table 5 (Appendix) we summarize the pooled logit estimates for the individual level covariates. These include a low wage variable to explore the effect of minimum wages in the construction sector which was introduced in the late 1990s. Moreover, we use age group dummies for older unemployed to capture the effects of different early retirement regulations during the 1980s and 1990s. As some of these variables are time varying, we also included them in the FE logit model but as the main results were unsensitive we decided to omit them in the panel analysis.

To analyse the effect of the policy changes on unemployment risks we will report results for three models (A, B and C) which are summarised in Table 2. All models contain year dummies and several calender time dummies, such as the end of month, end of year, pre-Christmas period and bi-weekly dummies during the whole winter period. These dummies capture the effects due to the calender time only and help in disentangling the effects of severe weather conditions and calender time. Model A is a simple approach to illustrate the main variation in layoff risks during the observation period. Estimates for year and winter dummy coefficients can be related to the descriptive results in Figure 2, but differ from the pure descriptive findings by controlling for a changing composition among construction workers across time. Model B does not contain winter dummies. Instead it controls for weather conditions, the changes in the business cycle and allows for different effects of the three policy regimes (SWG, WAG, OvWAG). It is therefore a first attempt to disentangle the effect of weather conditions and policy regimes while controlling for the business cycle (real revenue, change in revenue, year dummies). In order to capture both short-term and long-term effects of the local weather conditions, model B includes both a dummy variable on whether the current week had severe weather conditions as well as four dummy variables for the number of DSW during the current winter season. Model C contains interactions between weather conditions and policy regimes to allow for heterogeneous treatment patterns depending on the regime, the current weather conditions and the cumulative bad weather period during a season.

Table 2: Regressor sets in models A B and C.

variable	description	in model
end year, end month, pre Xmas, bi-weekly dummies during winter, year dummies	calender time dummies	**A B C**
season81 - season04	winter season dummies	**A**
SWG, WAG, OvWAG	dummies for the policy regime in the statutory winter period	**B C**
revenue	revenue in the construction sector (index, state level)	**B C**
change revenue	annual % change in *revenue*, winter period only (state level)	**B C**
WSW	$\geq$ 3 days with severe weather conditions in current winter week (dummy, county level)	**B C**
WSWw1 - WSWw4	*WSW* in current week and total number of DSW during the current winter period amounts to 1, 2, 3 or $\geq$4 weeks (dummies, county level)	**B**
SWG, WAG, OvWAG X WSWw1 - WSWw4	*WSWw1 - WSWw4* interacted with each policy regime SWG, WAG and OvWAG	**C**

All indicators are dummy variables except for *revenue* and *change revenue.*

DSW: days with severe weather conditions; WSW: weeks with severe weather conditions

5 Empirical Results

Table 3 shows estimates for the three specifications of the fixed effects logit model as described in the previous section. Year and winter season dummies are not reported to ease the reading of the table. Instead, Figure 6 shows the corresponding odds ratios for model A which resemble the purely descriptive evidence from Figure 2 in many but not all respects. In particular, unemployment risks during the summer period have been constantly increasing since the early 1980s according to Figure 6. Moreover, unemployment risks during the winter period have always exceeded those during the summer, but the difference temporarily vanishes during the boom period after German reunification. The largest increase of unemployment transitions compared to the summer level can be found during the mid 1980s, mid 1990s and the last three years, thus spanning all major policy regimes. Without taking account of weather and business cycle conditions, there is thus no clear prediction as to the effectiveness of the policy regimes in reducing layoffs. Note that we do not report year dummy estimates for models B and C because year dummy coefficients are similar across the three specifications and have already been shown in Figure 6.

Table 3: Estimated odds ratios for unemployment obtained by fixed-effects logistic regression model.

	Model A	Model B	Model C
Calender time			
End month	2.535***	2.516***	2.524***
End year	4.563***	4.998***	4.969***
Pre Xmas	1.432***	1.352***	1.344***
Weeks 45-46	1.171***	1.385***	1.394***
Weeks 47-48	1.544***	1.771***	1.786***
Weeks 49-50	2.524***	2.757***	2.796***
Weeks 51-52	2.073***	2.251***	2.287***
Weeks 53+	3.864***	3.959***	3.979***
Weeks 1-2	3.268***	3.092***	3.170***
Weeks 3-4	2.193***	2.056***	2.094***
Weeks 5-6	1.736***	1.607***	1.642***
Weeks 7-8	1.803***	1.620***	1.648***
Weeks 8-9	1.239***	1.228***	1.243***
Weeks 10-11	0.829***	0.864**	0.873*
Business cycle			
Revenue		0.291***	0.288***
Change revenue		3.263***	3.330***
Bad weather			

Continued on next page

Table 3 – continued from previous page

	Model A	Model B	Model C
WSW		1.118	1.194***
WSWw1		1.015	
WSWw2		1.246***	
WSWw3		1.197**	
WSWw4		1.435***	
Policy regime base effect			
SWG		1.618***	1.603***
WAG		1.703***	1.772***
OvWAG		1.486***	1.417***
Interaction of policy regime and bad weather			
SWG × WSW			0.919
WAG × WSW			0.555
OvWAG × WSW			1.025
SWG and ...			
WSWw1			1.019
WSWw2			1.250**
WSWw3			1.254**
WSWw4			1.466***
WAG and ...			
WSWw1			1.678
WSWw2			1.914
WSWw3			1.694
WSWw4			2.135*
OvWAG and ...			
WSWw1			0.950
WSWw2			1.047
WSWw3			0.974
WSWw4			1.293**
Number of obs = 2,750,395			

Continued on next page

Table 3 – continued from previous page

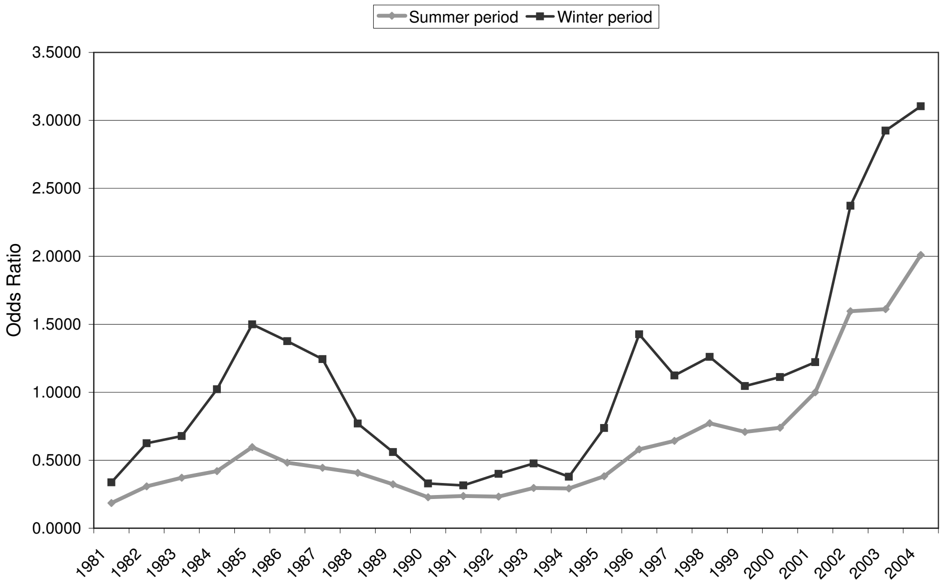
	Model A	Model B	Model C
Number of groups = 10,426			
Obs per group: min = 2, avg = 263.8, max = 1,251			
Log Likelihood	-74,850	-74,887	-74,890
Significance levels: ***: 1% **: 5% *: 10%			
Note: results for year dummies not reported (all models)			
results for season dummies shown in Figure 6 (model A)			

Model A also suggests another interesting finding. The odds of experiencing a transition to unemployment is much higher at fixed calender times such as the end of a month or week as well as the one to two weeks prior to Christmas. We also find a strong bi-weekly pattern of unemployment inflows during the winter period. Of course these patterns could to some extent reflect the effects of weather conditions, which are not accounted for in model A. However, theses strong result patterns with regard to these fixed calender times remain robust when including the relevant indicators (as done in models B and C). Therefore, consistent with our hypothesis in section 2, we find strong evidence for layoffs being strongly determined by fixed calender times.

In the public debate, weather conditions have been considered as a major determinant of seasonal unemployment. In fact, adverse weather conditions are the prime justification for the peak in the unemployment rate during the winter period as shown in Figure 1 and the introduction of all-season employment promotion measures. Model B is therefore a first attempt to disentangle the impact of weather conditions, the business cycle and the legal setup by simultaneously controlling for all these factors.

The estimation results for model B suggest that adverse weather conditions significantly increase unemployment risks only if there have been more than two weeks of such conditions in the current winter season. Moreover, the odds of experiencing a transition to unemployment further increases with an extended period of four or more weeks of adverse weather conditions. Nevertheless, the impact of weather conditions appears minor compared to most calender times, a finding that is robust with respect to other model specifications which we do not present. However, this may partly reflect that the employment promotion during the statutory winter period has to some extent already made the construction sector weather-proof (e.g. stronger dismissal protection in

Figure 6: Estimated odds ratio of experiencing a transition to unemployment (Model A). Reference level is the summer period in 2001.



presence of bad weather). The impact of weather conditions might have been stronger in absence of employment promotion measures prior to our observation period. As an additional explanation, the impact of weather conditions may have been partly exaggerated and confused with other factors such as empty order books. In fact, unemployment risks strongly decline with increasing revenue levels in the construction sector (keeping the percentage change constant). Moreover, the partial effect of an annual percentage change in revenues is not significant during the summer (and has therefore not been included in the model) while it is significantly positive during the winter. In years of increasing revenues (given the same revenue level), firms thus seem to hire additional workers that do not belong to the core personnel and that are laid off in the subsequent winter period. Thus, we do find a strong and plausible impact of the business cycle on the inflow into unemployment.

In reference to the summer period, unemployment risks are significantly higher during the statutory winter period as captured by the three regimes of employment promotion in model B. Note that we do not observe a time period prior to the introduction of employment promotion regimes so that we can only compare the relative effectiveness of the four regimes in reducing individual layoffs. In particular, compared to SWG and WAG unemployment risks appear lower during winter periods in which a flexible working time approach has been implemented (OvWAG). Furthermore, differences between SWG and OvWAG are highly significant, indicating that OvWAG has been more effective in cushioning the impact of adverse work conditions during the winter period. This ranking of employment promotion regimes is in line with the hypothesis in section 2.

As a major limitation, model B does not yield any insights on the effect of the employment regimes depending on weather conditions. According to the discussion in section 2, the cushioning effect of certain regimes may wear off at a varying speed with accumulating adverse weather conditions during a winter season. In particular, the cushioning effect should wear off faster, the faster a firm's total cost of maintaining an employment relationship increase with accumulating shortfall hours due to adverse weather conditions. Model C thus extends the previous specification by interacting the four legal regimes with weather conditions in the current week and cumulative weather conditions in the present season. Findings for the other covariates are mainly unaffected by this extension so that we concentrate on the interpretation of these interaction effects. Table 4 eases this interpretation by not only showing the odds ratio of the SWG regime and its interactions with weather conditions, but by also displaying the corresponding differences to the two alternative regimes and their significance levels.

Table 4: Comparison of estimated odds ratios (OR) for the SWG regime with the two WAG regimes of employment promotion by weather conditions.

	OR of	OR of SWG minus OR of ...	
	SWG	WAG	OvWAG
Base effect of policy regime	1.60	−0.17	0.19***
Base effect ∧ WSW	1.76	0.59	0.02
Base effect ∧ WSW ∧ WSWw1	1.79	−0.18	0.14
Base effect ∧ WSW ∧ WSWw2	2.20	−0.05	0.38**
Base effect ∧ WSW ∧ WSWw3	2.21	0.22	0.52**
Base effect ∧ WSW ∧ WSWw4	2.58	0.07	0.34**

Note: Based on the results for model C in Table 3.

Significance levels: ***: 1% **: 5% *: 10%

First of all note that the odds of experiencing a transition to unemployment rises under the SWG regime from a base level of 1.6 to about 1.8 if bad weather conditions obstruct outside work in the current week and to about 2.6 if there have been at least four weeks of adverse weather conditions in the present season compared to a summer week with normal weather conditions. Thus, as hypothesised, the cushioning effect of employment promotion wears off with accumulating bad weather days.

When compared to the WAG regime that increases the financial burden for the employer, we do not find any systematic differences between the SWG and the WAG regime. As mentioned earlier WAG estimates may have a lack of reliability which precludes us from finding clearer results. However, in accordance with our hypotheses in section 2, the OvWAG regime reduces the risk of unemployment compared to the SWG regime. In particular, differences between OvWAG and SWG strongly increase with a prolonged period of adverse weather conditions. If adverse weather conditions prevail for at least two weeks in a present winter season, the odds ratio under the OvWAG regime is significantly lower by around 0.4. Our estimates have a causal interpretation if there are no relevant trends other than the business cycle which affect the probability of lay-off. For this reason, we have also estimated a model with a linear time trend to proxy for technological change. While this trend had a significantly positive effect, our main results remained unchanged. Although it is difficult to verify that trends are not correlated with the policy regime periods under investigation, we do not find evidence that our results are seriously biased.

Our estimation results therefore suggest that the flexibilization of working hours by means of overtime accumulation and the corresponding reduction of the fiscal burden a shortfall of work means to employers has been effective in reducing weather-induced seasonal layoffs compared to the long-standing SWG regime. In fact, our results indicate that seasonal unemployment has become less dependent on weather conditions under the most favorable regime OvWAG. Layoff probabilities less strongly increase with very prolonged periods of adverse weather conditions as suggested by the corresponding interaction effects in Table 3. The construction sector under the OvWAG regime has thus turned increasingly weather-proof. The peak in seasonal unemployment during the last observed years can thus not be attributed to a failure of the legal regime, but seems to be dominated by macro developments with regard to the declining business environment and a possible crowding out of domestic workers by mainly illegal foreign workers. Most of the increase in unemployment transitions thus seems captured by the year dummies for 2002 to 2004 that are much higher than in the previous years (see Figure 6).

Furthermore, note that even under the most effective regime OvWAG, the odds of experiencing a layoff during the winter period is significantly higher than during the summer period (base effect of 1.6). This suggests that a substantial share of seasonal layoffs is unrelated to either weather conditions or the business cycle. One explanation for this finding could be that employers prefer to permanently layoff workers (e.g. due to retirement) during the winter period as another adjustment mechanism to the seasonal character of construction work. This could also explain the mass points of layoffs at fixed calender times during the winter period and would indicate that a certain level of seasonal unemployment is unlikely to disappear even with the most effective employment promotion measure. We created a variable indicating a very hard winter by comparing cumulative bad weather days to the average number over the whole observation period. Surprisingly we found that unemployment risks are not systematically higher during extremely adverse winter periods. This is further evidence for a planned capacity reduction by firms. We also estimated a model where we interacted fixed calender times with the regimes. As several weather and regime related coefficients in this model loose significance, we concluded that such a specification is too flexible so that we do not report results here.

We finish this section by briefly summarising the main findings for the individual level variables from the pooled estimation (see Table 5, Appendix). Since all variables are dummy variables, it is possible to relate them directly. Having had a previous unemployment period strongly increases the incidence of unemployment. In addition, having already had a recall in the past weakens the effect in the summer while it strongly increases the effect during the winter. Interestingly, there is some evidence for discrimination against foreign nationals. Information on the citizenship is sometimes missing in the data even after imputing previous or future values from the individual employment biographies. For this reason we create a dummy for unknown citizenship. The coefficient on this variable is highly positive but more research on data quality is necessary to understand the composition of this group (German/non German). We observe a significant increase in unemployment risk for older employees with longer entitlement lengths for unemployment benefits after the late 1980s. We do not obtain evidence that the 1997 reform of the unemployment benefit system was able to offset these developments. Unemployment risk decreases if tenure is more than one year and strongly increases if the worker's wage is in the lowest quintile of the population wage distribution. The situation for low wage workers became even worse during the late 1990s. With the introduction of the Posted Worker Act, the German government has introduced minimum wages in several sub sectors of the construction sector such as electrical installation, roofing etc. Since the minimum wage regulations treat only parts of the workforce during specific periods of time, they can be analysed with a difference in differences setup (see also König and Möller, 2008). Unfortunately, we only have access to highly aggregated business sector level information and therefore cannot distinguish between the relevant business sub sector on firm level.

However, we interacted the sub sector minimum wage regulation periods by the profession of the workers (roofer, painter,...) to proxy for the specific business sub sectors. Our resulting difference in differences estimates are mainly insignificant. Therefore, similar to König and Möller (2008) we do not obtain empirical evidence for strong effects of the introduction of minimum wages on employment stability. The increase in unemployment risks for low paid workers therefore has to be explained by other reasons such as a shift of low paid employment subject to social security contributions towards other forms of employment. However, more detailed analysis using less aggregated data would be required to analyse this question in greater detail.

6 Conclusion

Given the general lack of experience rating components in their unemployment insurance systems, a number of European countries have adopted different forms of employment subsidies to avoid temporary layoffs in the construction sector. However, to the best of our knowledge, there has been no attempt to assess the effectiveness of such measures in preventing seasonal layoffs so far. In Germany, recent years have seen several reforms that shifted the financial burden of a seasonal labor slack back and forth between employers, workers and the unemployment insurance fund. In particular, there has been a major shift from a system based on publicly funding a weather allowance to a system that promotes the additional use of overtime hours. For two of the main approaches of promoting all-season employment in the European construction sector, the regime shifts in Germany thus constitute a prime opportunity for comparing the effectiveness of such measures in preventing seasonal layoffs. Based on an extensive daily panel of individual employment histories, this paper examined the impact of the changing legal setup on individual layoff probabilities conditional on information concerning the regional business cycle as well as local weather conditions. Our analysis thus disentangled the main determinants of a seasonal layoff which, due to a lack of profound microeconometric research, have often been confused in the public debate.

Our results confirm the general belief that unemployment risks are lower in case of a favorable business environment. However, layoff risks are higher during winters that follow a boom year, thus indicating the previous hiring of additional workers that do not belong to the core personnel. Our results also suggest, that the impact of weather conditions is significant, but less strong than usually thought as layoffs mainly take place at fixed calendar times. Our results therefore suggest that seasonal unemployment is systematically linked to planned capacity reduction during less productive time periods.

As expected, the higher the subsidies to a firm's employment costs in case of a weather-induced shortfall of work, the higher is the layoff probability. In particular, the longstanding bad weather allowance (SWG) is associated with more layoffs compared to the winter allowance with flexible working hours accounts (OvWAG). Moreover, OvWAG appears to make the construction sector largely weather-proof. At the same time, the fiscal burden on the part of the Federal Employment Agency of promoting all-season employment has been considerably lower under the OvWAG than under the SWG regime as annual real expenses fell from about EUR 500m to about EUR 250m. The combination of compensating initial shortfall hours by overtime hours with a weather allowance that is paid only after the shortfall of working hours exceeds some threshold thus results in more stable employment relationships at lower public expenditures.

However, since workers are financially worse off when compensating shortfall hours by overtime accumulation, high ability workers may not be willing to accept these cutbacks in exchange for stable employment and may thus leave the construction sector permanently. This concern was among the reasons why OvWAG was abolished in 2006 and replaced by the *Saisonkurzarbeitergeld*, a legal setup that is more generous in publicly compensating for shortfall hours than the long-standing weather allowance, but that tries to promote the use of flexible working hours by additional economic incentives. Since we do not have access to post 2006 data, we are not able to evaluate the most recent reform. This is left to future research as well as an attempt to evaluate the cost efficiency of public employment subsidies. For this purpose, it would be necessary to observe a winter period without any employment subsidy. While our findings indicate that employment subsidies affect layoff probabilities and may thus partially explain why seasonal unemployment in Germany is no more pronounced than in the US despite having no system of experience rating, the available data in Germany do not allow to tell to what extent employment subsidies prevent layoffs relative to a winter without any such subsidy. Given this open question, it would be interesting to perform a similar analysis for countries with equivalent policy schemes if there are periods or regions in absence of any employment promotion.

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Appendix

Table 5: Effect of individual level variables on unemployment risks in the west German construction sector. Symbolic results derived from pooled logistic regression with 7,089,948 observations.

variable name	effect	variable name	effect
female	-	aged <26	+
aged 51-55	0	aged >55	-
aged 51-55 & >24 months employment	-	aged >55 & >24 months employment	-
ext UIB entitlements for aged 51-55 in 1987-1997	0	ext UIB entitlements for aged >55 in 1987-1997	+
ext UIB entitlements for aged 51-55 after 1997	+	ext UIB entitlements for aged >55 after 1997	+
previous unemployment	++	previous unemployment and winter	0
same employer before previous unemployment	–	same employer before previous unemployment and winter	++
foreign citizen	+	unknown citizenship	++
blue collar	+	blue collar and winter	+
previous employment 6-12 months	0	previous employment >12 months	–
low wage	++	low wage after 1997	+
construction worker after 1997	+	roofer after 1997	0
electrician after 1997	-	painter after 2003	+
min wage construction	0	min wage roofer	0
min wage electrician	0	min wage painter	-

Legend: ++ strong positive effect, + positive effect, 0 negligible effect, - negative effect, −− strong negative effect