

REAL AND NOMINAL WAGE RIGIDITIES AND THE RATE OF INFLATION: EVIDENCE FROM WEST GERMAN MICRO DATA*

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This article examines real and nominal wage rigidities in West Germany. Using regionally disaggregated register data for 1975–2001, we estimate the extent of both types of wage rigidities from the observed distribution of individual wage changes, taking into account possible measurement error. The fraction of workers facing wage increases that are caused by nominal and particularly real wage rigidity is substantial. The extent of real rigidity rises with inflation and falls with regional unemployment, whereas the opposite holds for nominal rigidity. Overall, the incidence of wage rigidity, which accelerates unemployment growth, is most likely minimised in a moderate inflation environment.

This article presents evidence of real and nominal wage rigidity using individual level data for the period 1975 to 2001 from West Germany. The methodology, set out in the introduction to this Feature, allows us to estimate simultaneously what fractions of employees are affected by nominal and real wage rigidity, and by how much their wages are swept up by wage rigidity. Germany is an interesting case to study, because of its tradition of strong collective bargaining institutions. In contrast to the other two papers in this Feature, the German labour market changed in more gradual ways: since the 1980s, the coverage and influence of collective bargaining is believed to have been slowly declining. Moreover, the earlier work on wage rigidities in Germany has concentrated on nominal rigidities only (Beissinger and Knoppik, 2001, 2003).

The focus of this article lies in examining how the economic environment affects real and nominal wage rigidity prevalent in the distribution of wage changes. Using the regional variation in the data used for this study, obvious candidates for determinants of wage rigidity are contemporary regional unemployment rates and labour market conditions, but also the overall inflation environment. A second goal of this article is to investigate the consequences of wage rigidity. Does wage rigidity boost future unemployment, as is implied by theoretical considerations?

The results document the pervasiveness of wage rigidities of both types of rigidity, real and nominal. By several measures, the model is able to capture the actual distributions of wage changes over the observation period very accurately. Our results show a

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substantial influence of wage rigidities on the distribution of wage changes: in the late 1970s, about 20% of all wage changes are conducted in a fully flexible manner. In contrast, 20% of wage changes are affected by nominal wage rigidity and, more importantly, 60% are affected by real wage rigidity. This finding illustrates the importance of accounting for real wage rigidity in empirical studies of wage changes, in particular for Germany. In the early years of our sample, we find that approximately 5% of all workers face wage freezes instead of wage cuts. The impact of real wage rigidity is much stronger: the corresponding number of wage changes constrained by real wage rigidity amounts to between 35% and 40% of all wage changes in all years. As a consequence of these rigidities, wages in West Germany increased on average by about 2% more per year than in a flexible wage setting model. This points towards a substantial role of wage rigidity for macroeconomic performance.

Our results also show that the extent of overall and, in particular, real wage rigidity has declined substantially over the past 25 years. Both the fraction of workers affected by real wage rigidity and the incidence of wage changes being constrained by real wage rigidity have about halved from the mid 1970s to the late 1990s. The drop is even more pronounced when looking at the average wage sweep-up that is caused by real wage rigidity and that fell from around 2.5% to less than 1% per year. The opposite is true for nominal wage rigidity. Instead, the prevalence of nominal wage rigidity has become more important over time, nearly offsetting the decline in real wage rigidity. One main reason for this development may be the change of the inflation environment. Inflation fell over the observation period, leading to a decline in real wage rigidity. Indeed, our estimates show that a decrease in inflation by 1% reduces the fraction of individuals bound by real wage rigidity by about 1%, and increases the fraction of individuals bound by nominal wage rigidity by about the same amount. This, however, can only account for approximately half of the change over time.

Since there is substantial variation in the local labour market conditions in Germany, this allows us to examine how this affects wage setting. In general, we find that better local economic environments lead to stronger wage rigidity, in particular, real wage rigidity. A plausible interpretation is that trade unions, which bargain about wages with the respective employer associations at a local level, are less willing to take (real) wage cuts when the local labour market is in good shape.

When turning to the consequences of rigid wages, we find that the average wage sweep-up due to wage rigidity – in particular due to real wage rigidity – speeds up future unemployment growth, even when controlling for unemployment and economic conditions. This finding corroborates the findings of the other articles in this Feature as well as in other papers (Fehr and Goette, 2005), showing that there is a link between downward wage rigidity and adverse labour market outcomes

The remainder of the article proceeds as follows. The next Section gives a brief overview over the wage setting process in Germany. Section 2 describes the data used for the empirical analysis and the extracted sample. Section 3 discusses the incidence of downward wage rigidity on the basis of the obtained parameter estimates. Section 4 searches for possible causes for, as well as consequences of the measured wage rigidity on the macro level. Section 5 provides some concluding remarks.

1. Wage Setting Procedures in Germany: A Brief Overview

Wage setting in Germany is carried out on two different levels. First, collective agreements between unions and employer organisations are reached, usually centralised at the regional and industry level. These agreements typically specify the standard minimum wages for different tenure levels for a range of different job categories. While there is no minimum wage legislation in Germany, the wages listed in these collective agreements mostly provide the lower bound for the wages paid in an industry or sector. Second, pay relevant negotiations take place at the firm level, between works councils (which exist in practically all larger firms) and the individual employer. The collective agreements typically serve as the starting point of these negotiations. In the negotiations on the firm level, the parties bargain about payments above the tariff norm, either through a higher regular wage or through various alternative forms of compensation. As a consequence, actual wages often exceed the collective minimum wages by a substantial amount.

In the collective bargaining process, employers are represented by one of the numerous Employers' Associations (*Arbeitgeberverbände*), which are organised both on both industry and federal levels. The Federal Union of Employers' Associations (BDA) coordinates the activities of the different associations at the industry level, each of which represents up to 20 more specialised organisations. As the collective bargaining takes place at the regional level and by industry, the main task of the BDA is to issue a catalogue of general wage policy and negotiation guidelines. Membership in the employer associations is voluntary. In West Germany, around 80% of all firms are members of an employer organisation, whereas the proportion is substantially lower in the East German Länder.

Workers are represented by unified trade unions in the collective bargaining process. These cover both blue and white collar workers and are organised by industry rather than by occupation. As a result, a firm is normally covered by a single trade union only. The activities of the trade unions are loosely coordinated by the German Federation of Trade Unions (DGB). Actual wage negotiations are carried out by the individual trade unions, which decide on their wage policy independently. Since the 1970s, the organisation rate among West German employees declined to about 30%, with the degree of union membership varying substantially between industries. In East Germany, the fraction of union members is even lower.

The German constitution prescribes full independence for the parties bargaining over collective agreements. There is no official role for the state. In practice, however, the government can directly or indirectly influence the bargaining process, e.g., by informally announcing policy recommendations to the parties. Repeated attempts at directing wage policy through preparatory round table talks (*Konzertierte Aktion*, during the 1970s, *Bündnis für Arbeit*, during the late 1990s) were in general not successful. Since the state is one of the largest employers in Germany, the results of wage negotiations in the public sector often sets a benchmark for the collective bargaining outcomes in other branches.

There is no standard procedure according to which the parties' wage claims and wage offers are derived. Traditionally trade unions substantiate their wage policy referring to three elements:

- (a) the general or industry specific productivity gains in real terms,
- (b) consumer price inflation, and
- (c) an arbitrary redistribution factor.

In practice, the union departments preparing the negotiations typically consider the current forecasts of general economic development, unemployment, the predicted inflation rate (but also past inflation), and perhaps changes in the fiscal burden. Industry specific factors, like productivity growth, labour costs and competitiveness or the union's success in previous collective bargaining agreements also enter into the formation of the wage target.

After the claims and offers have been presented, unions bargain with the employers' associations in a series of private meetings, until a collective agreement is signed by both parties. The negotiations take place on the industry level, but are carried out simultaneously and independently by the regional subdivisions of the relevant employer and employee organisations. Despite the decentralisation of the bargaining procedure, the final specification of the wage agreements is usually identical across regions. However, it does happen that the structure of the wage adjustment across different job or tenure categories varies across regions within an industry. Across different industries, the wage adjustment concluded in a given year might show substantial variation, which suggests that industry specific factors play an important role in the bargaining processes. It can and does happen that the agreed collective wage increases are lower than the nominal productivity gain, or even lower than consumer price inflation.

The duration of a collective agreement is typically 12 to 15 months. Occasionally, the partners find an agreement for a longer period, but rarely for more than two years. In general, negotiations can take place at any time throughout the year but the majority of the negotiations happens during the first 4 to 6 months of the year. During the negotiations but after the expiration of a prespecified period, the trade unions have the right to take short-term industrial action in order to reinforce their claims. An unlimited strike requires that the negotiations are declared a failure and must be approved by a strike ballot of the union members. Strikes have become successively less frequent to reach a collective agreement in Germany. More common is the appointment of an external mediator who concludes an unsettled bargaining process.

In principle, collective agreements are only binding for the members of the associations that constitute the bargaining parties. For them, the agreement has legal priority, in the sense that it cannot be overruled by other individual or firm level contracts. However, the collective agreement can include clauses that allow for deviations under specific circumstances. This option is increasingly used to render the collective agreements more flexible. Firms covered by collective bargaining have the right to employ individuals who are not union members on different terms from those specified by the collective agreements but this possibility has been of little practical relevance so far. In specific cases, collective agreements might be declared generally binding by the Federal Minister of Labour. In these cases, collective agreements also apply to firms who are not members of an employers' association. If a collective agreement is not generally binding and a firm is not a member of an employers' association, individual wage arrangements are allowed, even with union members.

Nevertheless, many of the non-organised employers adopt the collective agreements by signing analogous firm contracts with the responsible trade union. The share of the workers employed in firms which are not covered by collective agreements has increased substantially in the 1990s to about one quarter in West Germany, and about one third in East Germany. In addition, the number of employees who receive wages above the limit fixed by collective agreements is rapidly expanding.

Individual employers are allowed to offer voluntarily better compensation (or working conditions) than specified by the collective agreements. All that is required is a formal agreement with the works council. This arrangement leaves scope for wage bargaining at the firm level. Although firm level agreements are voluntary by definition, and cannot be enforced by industrial action, effective wages often exceed tariff wages.¹ Firm level arrangements have increasingly become a means of effectively decentralising the collective bargaining procedure. First, the gap between effective and tariff wages is now often used to buffer unwanted collective wage agreements, since it allows employers to counterbalance increasing tariff wages by cutting voluntary pay. In addition, employers rely more on forms of variable remuneration, like profit sharing. In an increasing number of cases, the collective wage agreement itself is corrected downward in subsequent firm level negotiations. Legally this is only possible if the collective agreement contains a proper exit clause. In practice, currently such agreements are concluded at the firm level even without a legal basis, particularly if the agreement is necessary to secure employment. In such a situation, the measures for adjusting wages range from postponing the collective pay increase, to longer working hours and to immediate wage cuts.²

2. Wage Change Data for Germany

2.1. *Data and Sample*

The empirical analysis uses data from the Regional File of the IAB Employment Subsample (IABS-R). The structure of the IABS-R is very similar to the more widely used standard IAB Employment Subsample but covers a longer time span ranging from 1975 to 2001.³ The IABS-R is based on a 2% random sample drawn from the German Social Security records, to which all employers are obliged to report at least once a year. The wage information available for employed individuals therefore covers all earnings subject to statutory Social Security contributions. The data are in the form of an event history, which enables compilation of the duration of workers' employment and unemployment spells on a daily basis. Wages are reported as gross earnings per day of an employment spell, rounded to the lower integer.

A major advantage of the IABS-R earnings data is its comprehensiveness and accuracy. There are legal sanctions for misreporting earnings and plausibility checks are performed by the Social Security authorities. Therefore the data are likely to be less

¹ Among the firm level agreements impacting on effective wages are: regrouping of employees into different job categories, allowances for atypical or heavy work, special bonuses such like vacancy pay, performance pay, and profit sharing.

² See also Fitzenberger and Franz (1999) for detailed descriptions of the wage setting process in Germany.

³ For an introductory description of the IABS, which for the most part also applies to the IABS-R, see Bender *et al* (2000).

affected by reporting or recording error than the survey data frequently used by empirical studies on nominal wage rigidity. Nevertheless problems of unobserved variability in wages arise which are not accounted for by our econometric model of measurement error. One problem is that only categorised information on working hours (full time, part time, less than part time) is available. If hours worked by an individual change within a given category, the corresponding earnings change is not the same as the *wage* change conceptualised by our model. Since fluctuations in working hours tend to be more frequent among employees working less than full time, we limit the sample to full time employees. However, this approach does not resolve issues related to overtime.⁴ Fringe benefits are another source of potential measurement error. One-time payments were not subject to Social Security contributions and therefore not systematically reported by employers prior to 1984. This causes a structural break in the wage change data at this date. More importantly, if one-time payments are more volatile than regular pay, it is possible that we overestimate wage rigidity at the beginning of the observation period.

Around 80% of the working population are subject to statutory Social Security contributions and therefore included in the population from which the sample is drawn. By construction, the sample misses groups not covered by the mandatory social security system, namely the self-employed, civil servants and workers engaged in minor employment contracts. If agents react to wage rigidities by moving in or out of these types of employment, our measurement of the incidence of wage rigidities may be biased. Exclusion of minor employment furthermore truncates the earnings distribution covered by the data at the bottom. Besides, reported earnings are censored at the top. A peculiarity of the German Social Security scheme is that earnings are subject to contributions only up to a unitary threshold. For earnings exceeding the threshold, the IABS-R only reports the threshold value so that actual earnings are unknown. Since we cannot compute wage changes for censored earnings, we eliminate individuals with earnings observations at, or slightly below, the threshold. While this approach is common practice, it is important to note that it changes the skill composition of the sample. High skilled workers are removed more than proportionally. This might cause another selection bias in our rigidity measures, if wage rigidity is correlated with the skill (or wage) level.⁵

Our empirical analysis relies on the distribution of individual wage changes over a given time period. We concentrate on wage growth from year to year, which we define as the difference in log wages as reported in the IABS-R, over a time interval lasting from July 1st to July 1st of two consecutive years. We will use the first period to label our annual observations, i.e. our yearly wage change observations begin with year 1975.

We limit the sample to full time prime age (25–55) workers not in apprenticeship training. Furthermore we concentrate on individuals employed in West Germany, since wage developments in East Germany are mostly driven by the transition crisis after

⁴ Overtime hours might be compensated by higher earnings or spare time. Accurate evaluation of wage changes requires information not only on overtime hours worked but also on the relevant compensation scheme. Neither is available in our data. Moreover, related work for Germany indicates that the incidence of overtime work seems to be fairly stable, see Bauer and Zimmermann (1999).

⁵ On average, less than 5% of all employees subject to mandatory social security contributions receive wages beyond the earnings threshold in West Germany, in East Germany the number is closer to 2%, see also Binder and Schwengler (2006).

German unification (Hunt, 2001). Finally, the analysis is limited to job *stayers*. We define job stayers as workers who are continuously employed with the same employer and in the same occupation at the 3-digit level, during the full length of a given year. Integration of job movers would require introducing individual heterogeneity in regime propensities conditional on the reason of the job move. On the one hand, movers who voluntarily quit are more likely to be under the flexible regime. On the other hand, if adjustment of employment is a correcting mechanism for wage rigidity, involuntary movers due to dismissals are less likely to be under the fully flexible regime. We refrain from analysing job movers, since the reason for a job change, quit or dismissal, cannot be retrieved from our data.

2.2. Descriptive Evidence on Wage Changes

The data restrictions leave 26 years of observations containing between 134,245 and 177,304 individual wage changes in the private sector in each year for the period 1975 to 2001. Figure 1 plots the mean of the wage change distribution for each year of the observation period. The ups and downs of mean wage growth closely follow the business cycles of the West German economy. In the second half of the 1970s, Germany recovered from the oil crisis, and experienced relatively high GDP growth rates (4–6%), not depicted in the Figure. This period of high growth was succeeded by a severe recession (real GDP contracted in 1982), followed by a moderate economic upswing during the mid 1980s. The mean of individual wage changes clearly followed the growth pattern also when the moderate economic downswing of the later 1980s was overturned by the reunification boom, which led growth and wage rates to rise substantially. After the reunification boom, both economic and mean wage growth steadily declined.

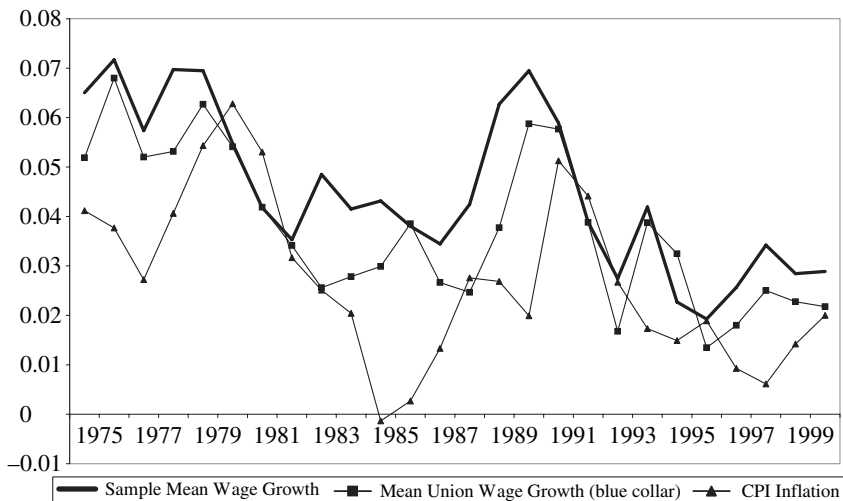


Fig. 1. *Sample Mean Wage Changes, Standard Wage Growth and Inflation*

Notes. Union wage growth refers to the mean change of standard wages written into collective bargaining agreements for blue collar workers. The union wage growth and CPI time series are obtained from Federal Statistical Office.

Figure 1 also draws time series of variables that are likely to have an impact on nominal wage growth. Mean wage growth seems to be almost always larger than price inflation as measured by the CPI, unless the economy is close to recession, as it was, for example in the early 1980s.⁶ It seems that a wide majority of job stayers benefits from real wage growth over time. Mean wage growth in our sample is highly correlated ($\rho = 0.88$) with average growth of hourly wages in the total labour force, as agreed on by trade unions. In most years, union wage growth exceeds price inflation, which illustrates that unions appropriate some of the gains from real productivity growth but is smaller than mean wage growth. This suggests that wage drift is a relevant phenomenon. Many workers receive higher wage increases than are designated by collective agreements. With wage drift, actual wages are not necessarily downward rigid even if unions set an effective floor for wage growth. In other words, one cannot conclude *a priori* from aggregate data that collective bargaining outcomes limit wage flexibility.

Figure 2 displays the full distribution of individual wage changes. To conserve space, we only display the graph for every fifth year in the data. The central bar of each histogram measures the frequency of wage changes of exactly zero, whereas the adjacent bars cover small wage cuts (increases) of less than (more than) 0.01 log points. The sequence of histograms exhibits some striking regularities. First, in almost every year there is a prominent spike at exactly zero. In addition there is an asymmetry around the spike: negative wage changes close to zero are less frequent than positive wage changes close to zero, leading to the impression of skewness to the right. Skewness also seems to be prominent around the mode of the distribution, illustrated by fewer observations of positive wage changes below the mode than above. In accordance with the rigidity concept built into our empirical model, these observations might indicate the presence of nominal *and* real downward wage rigidity in the data. Secondly, compared with the number of observations at exactly zero, the number of observations in the neighbouring bins in general is small. This suggests that the data measure individual wage changes fairly accurately. Measurement error would inflate the frequency of very small wage changes at the expense of exactly zero wage changes.

Taken together, the descriptive evidence suggests that both nominal and real rigidity shape the observed wage distribution. In addition, the fact that we use administrative data as well as specific characteristics of the observed wage change distribution suggests that measurement error is rare, and hence that we measure the actual wage change distribution fairly accurately.

3. The Extent of Real and Nominal Wage Rigidities

For each cross-section of individual wage changes, we obtain a set of parameter estimates determining the population share of the various wage setting regimes. This Section discusses the variation in the incidence of nominal and real wage rigidity over time. The benchmark for judging the wage effects of downward wage rigidity is the notional wage change distribution estimated for those individuals who are in the fully flexible

⁶ The same is true for the GDP deflator. The GDP deflator has the advantage that it measures price inflation covering a wider basket of commodities. We use CPI in most of the analysis as it is the benchmark for wage bargaining. Sensitivity checks of our empirical results at the macro level show little differences between the two measures, however.

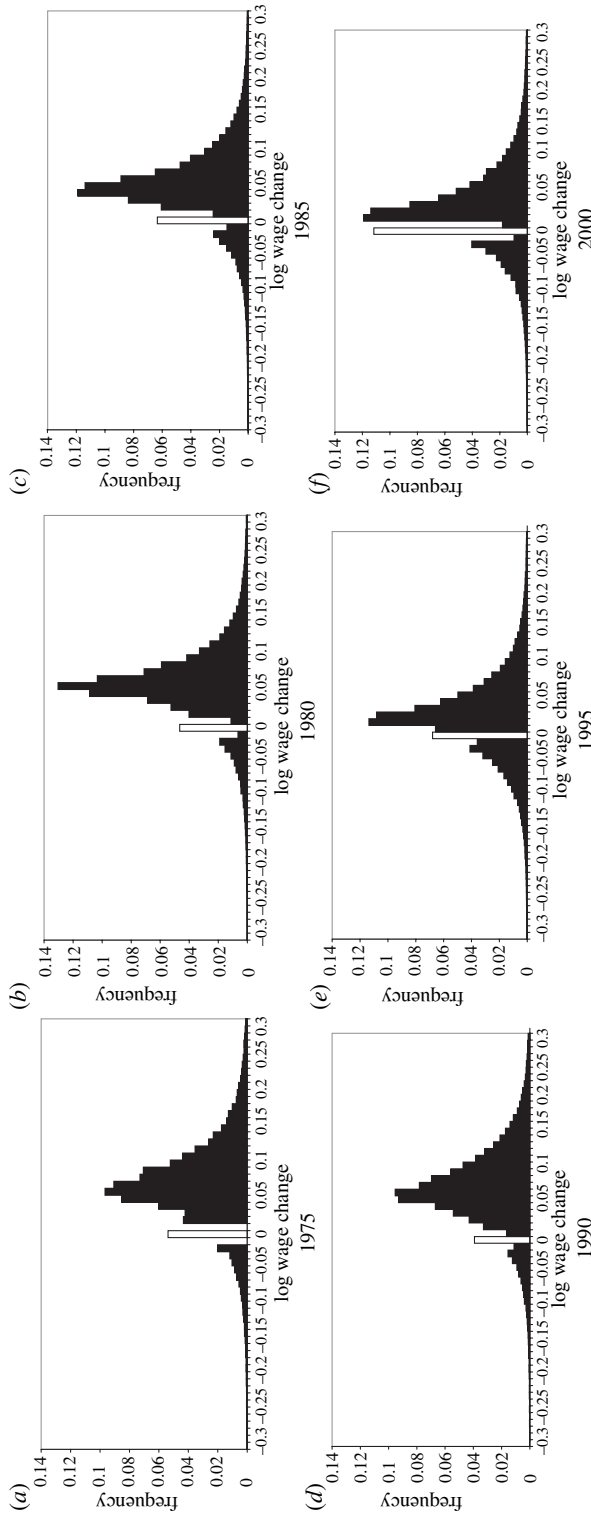


Fig. 2. Histograms of Distribution of Individual Wage Changes for Selected Years

Table 1
Sample and Predicted Moments of Wage Change Distribution

Year	Mean		Median		Standard Deviation	
	Sample	Predicted	Sample	Predicted	Sample	Predicted
1975	0.065	0.065	0.063	0.062	0.076	0.076
1976	0.072	0.072	0.072	0.072	0.072	0.072
1977	0.057	0.057	0.056	0.056	0.071	0.071
1978	0.070	0.069	0.063	0.063	0.073	0.073
1979	0.069	0.069	0.065	0.066	0.069	0.069
1980	0.055	0.055	0.055	0.055	0.067	0.067
1981	0.042	0.042	0.043	0.042	0.065	0.065
1982	0.035	0.035	0.036	0.035	0.063	0.063
1983	0.048	0.048	0.044	0.042	0.069	0.070
1984	0.042	0.040	0.037	0.037	0.068	0.067
1985	0.043	0.042	0.041	0.041	0.066	0.066
1986	0.038	0.037	0.036	0.036	0.065	0.065
1987	0.034	0.032	0.029	0.028	0.066	0.066
1988	0.042	0.041	0.036	0.035	0.067	0.067
1989	0.063	0.061	0.057	0.056	0.071	0.071
1990	0.069	0.068	0.066	0.066	0.073	0.072
1991	0.059	0.058	0.057	0.057	0.072	0.071
1992	0.039	0.038	0.038	0.038	0.070	0.070
1993	0.027	0.026	0.023	0.022	0.069	0.069
1994	0.042	0.040	0.038	0.038	0.069	0.069
1995	0.023	0.022	0.020	0.020	0.069	0.069
1996	0.019	0.018	0.016	0.016	0.068	0.067
1997	0.026	0.024	0.021	0.020	0.067	0.067
1998	0.034	0.032	0.031	0.031	0.071	0.071
1999	0.028	0.026	0.023	0.022	0.072	0.072
2000	0.029	0.027	0.024	0.024	0.072	0.073

Notes. Prediction based on parameter estimates obtained with the following officially reported individual characteristics as explanatory variables of notional wage changes: age (cubed), gender, occupational position, school qualification (3 groups), occupation dummies (130 groups), industry dummy (16 groups).

regime. We first present results obtained from a parsimonious specification of notional wage changes that only accounts for officially recorded worker characteristics. To be specific, our baseline specification includes age, age squared, gender and occupational status (blue vs. white collar), dummies for 132 occupational groups and dummies for 16 industries, as well as a constant, as explanatory variables in (1) of the model in the Introduction to this Feature.⁷

Table 1 compares key moments of the wage change distribution as simulated on the basis of the maximum likelihood parameter estimates for the baseline to the moments of the wage change distribution of our sample of workers employed in the private sector. The results indicate that the empirical model replicates the data very well. In particular, both the simulated means and medians of the wage change distributions are consistently very close or identical to the observed counterparts in the data. In general, deviations are less than one tenth of a percentage point.

⁷ For robustness checks, we also used several richer specifications including occupational and other individual characteristics. The main results concerning the incidence and extent of wage rigidities were virtually identical, detailed results are available upon request.

Table 2
Baseline Model Parameter Estimates

Year	$X_{\mathcal{Z}}$	σ_w	r	σ_r	p^m	σ_m
1975	0.038	0.069	0.053	0.021	0.064	0.152
1976	0.045	0.064	0.064	0.022	0.070	0.144
1977	0.032	0.065	0.049	0.019	0.058	0.152
1978	0.041	0.070	0.052	0.019	0.060	0.148
1979	0.047	0.062	0.055	0.018	0.068	0.139
1980	0.031	0.060	0.050	0.017	0.056	0.147
1981	0.020	0.056	0.039	0.015	0.053	0.148
1982	0.016	0.052	0.033	0.012	0.058	0.140
1983	0.036	0.055	0.031	0.013	0.066	0.135
1984	0.024	0.057	0.030	0.012	0.059	0.141
1985	0.027	0.052	0.035	0.013	0.072	0.132
1986	0.020	0.052	0.032	0.012	0.067	0.133
1987	0.019	0.053	0.023	0.009	0.060	0.141
1988	0.027	0.054	0.026	0.011	0.067	0.135
1989	0.047	0.057	0.041	0.017	0.078	0.132
1990	0.054	0.057	0.053	0.019	0.084	0.129
1991	0.041	0.059	0.049	0.017	0.064	0.143
1992	0.023	0.053	0.034	0.014	0.076	0.133
1993	0.016	0.048	0.016	0.008	0.098	0.122
1994	0.027	0.053	0.032	0.012	0.083	0.129
1995	0.012	0.049	0.018	0.008	0.092	0.125
1996	0.008	0.046	0.014	0.006	0.093	0.125
1997	0.014	0.048	0.016	0.006	0.086	0.126
1998	0.016	0.056	0.029	0.011	0.068	0.143
1999	0.012	0.055	0.019	0.007	0.077	0.139
2000	0.012	0.058	0.021	0.008	0.065	0.148

Notes. $X_{\mathcal{Z}}$ refers to the estimated mean of the notional wage change, while σ_w is the corresponding standard deviation of the unobserved heterogeneity component. Values in column r refer to the estimated mean of the lower bound of wage changes for constrained individuals under the real rigidity regime, σ_r is the estimated standard deviation of the individual variation around this mean. Finally, p_m refers to the estimated probability of measurement error in wages, whereas σ_m is the estimated standard deviation of one-period measurement error in wages. Sample of workers employed in private sector.

In Table 2 we summarise the estimates for the notional wage change, real rigidity bound and measurement error parameters of the model. The estimated fraction of mismeasured wages (P^m) is less than 10% for all years. This confirms that reporting error is not a serious issue, as one would expect of wage data from social security registers. Measurement error, if it occurs, is rather large as is indicated by the estimated values for the standard deviation (σ_m). This parameter, however, should be interpreted with caution, since it most likely reflects outliers in the tail of the observed wage change distribution, which are difficult to explain by the notional wage change distribution. The estimated size of the standard deviation of the unobserved heterogeneity component impacting notional wage changes (σ_w) appears more reasonable. A range of 0.046 to 0.069 log points is in line with the variation of individual wage changes in the data. The mean of the estimated notional wage change distribution is considerably smaller than that of the observed wage change distribution (also see Figure 1).

The mean threshold for real wage rigidity r is estimated to be around 5 log points at the beginning of the observation window and falls to around 2 log points or even less during the 1990s. There is a high correlation between r and average union wage growth of blue or white collar occupations measured by the the Federal Office of Statistics

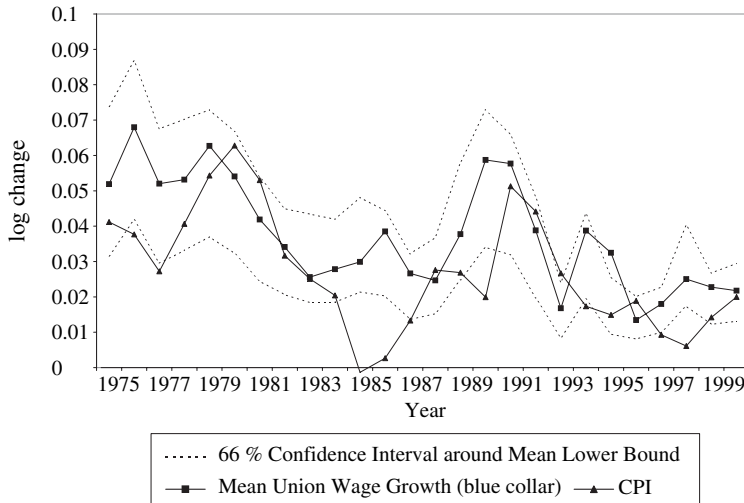


Fig. 3. *Location of the Lower Bound for Wage Changes in the Real Rigidity Regime*

Notes. Width of the confidence interval is plus/minus one standard deviation around the real rigidity bound, based on the estimated value of the model variance σ_r^2 . Sample of workers employed in private sector, union wage growth and CPI series as in Figure 1.

($\rho = 0.95$ and $\rho = 0.94$, respectively, $p < 0.01$ in both cases), the GDP deflator ($\rho = 0.85$, $p < 0.01$) or the CPI inflation ($\rho = 0.60$, $p < 0.01$). Thus, these results are consistent with r being influenced mainly by union wage growth, negotiated at the industry level, or by inflation. In Figure 3, we plot a confidence interval of \pm one estimated standard deviation around the mean of r , as well as union wage growth and the CPI inflation. Union wage growth and the CPI inflation do not coincide. However, the confidence band generated by our estimates envelopes both up until the late 1990s when inflation drops considerably, and rigidity seems to be clearly driven by centralised bargaining outcomes. The estimated standard deviation of r thus appears to be driven mostly by the difference between union wage growth and inflation. The estimated standard deviation is generally estimated to be small: it is well below 2% in most years. Our interpretation of this finding is that there is substantial heterogeneity in the onset of real wage rigidity. For some individuals, union wage growth may be relevant, for others, inflation may be more focal. This also points to the importance of allowing for this kind of heterogeneity in estimating wage rigidity.

Table 3 presents the incidence of the fully flexible as well as the real and nominal wage rigidity regimes in the private sector as estimated by our model. Note that the incidence of the three regimes add up to 100%, since each represents an exclusive state. The real rigidity regime clearly dominates the nominal rigidity regime. The share of employees subject to the nominal rigidity regime fluctuates between 15% and 30% throughout the observation period, with a slight upward trend in the 1990s. In contrast, 30% to 70% of wages are set under the real rigidity regime, where the fraction was between 60% and 70% during the late 1970s, around 50% during the 1980s, and around 30% to 40% during the early 1990s. The decline of the real rigidity regime takes place during a period of declining GDP growth, inflation, and union power. According to Schnabel and Wagner (2003), union density fell from roughly one third to roughly

Table 3
Estimated Extent of Wage Rigidity in the Private Sector

Year	Incidence (in%)						Wage Sweep-up from (in log points)	
	of Regimes (Overall)			of Constrained		Real Rigidity	Nominal Rigidity	
	Fully Flexible	Real Rigidity	Nominal Rigidity	Real Regime	Nominal Regime			
1975	0.187	0.624	0.189	0.359	0.057	0.024	0.003	
1976	0.162	0.656	0.183	0.400	0.046	0.026	0.002	
1977	0.206	0.622	0.173	0.368	0.055	0.023	0.002	
1978	0.128	0.715	0.156	0.400	0.046	0.026	0.002	
1979	0.155	0.670	0.176	0.368	0.042	0.021	0.002	
1980	0.234	0.605	0.160	0.372	0.050	0.022	0.002	
1981	0.277	0.557	0.166	0.349	0.061	0.019	0.002	
1982	0.295	0.520	0.185	0.322	0.071	0.016	0.003	
1983	0.329	0.433	0.237	0.204	0.066	0.010	0.002	
1984	0.309	0.496	0.194	0.270	0.068	0.014	0.003	
1985	0.294	0.484	0.221	0.270	0.070	0.013	0.003	
1986	0.313	0.478	0.209	0.280	0.075	0.014	0.003	
1987	0.360	0.434	0.207	0.229	0.076	0.011	0.003	
1988	0.297	0.492	0.211	0.241	0.066	0.011	0.002	
1989	0.243	0.539	0.218	0.251	0.048	0.012	0.002	
1990	0.269	0.495	0.236	0.245	0.044	0.012	0.001	
1991	0.324	0.512	0.164	0.282	0.042	0.015	0.002	
1992	0.405	0.431	0.164	0.246	0.056	0.013	0.002	
1993	0.451	0.319	0.229	0.159	0.086	0.006	0.003	
1994	0.353	0.445	0.202	0.237	0.064	0.011	0.002	
1995	0.500	0.303	0.196	0.166	0.081	0.007	0.003	
1996	0.494	0.300	0.206	0.164	0.089	0.007	0.003	
1997	0.449	0.307	0.244	0.160	0.096	0.007	0.003	
1998	0.352	0.355	0.293	0.207	0.115	0.011	0.005	
1999	0.381	0.305	0.313	0.168	0.131	0.008	0.006	
2000	0.381	0.335	0.284	0.188	0.120	0.010	0.005	

Notes. Baseline specification (see also Introduction to this Feature). The wage sweep-up is derived by aggregating the prevented individual wage cuts for constrained workers within a regime. It is an average value based on the wage change distribution including all sample observations. Sample of workers employed in private sector.

one quarter during the observation period. Therefore, if centralised wage bargaining was the dominant source of downward real wage rigidity, collective wage agreements would have to cover a substantial amount of workers that are not union members. Indeed, union coverage in Germany is more widespread than union membership as indicated by evidence from survey data gathered by Fehr *et al.* (2002). Time series variation in the share of workers under fully flexible wage setting mirrors the development of the other two regimes. The incidence of the flexible wage setting regime increases from around 20% in the late 1970s to between 20% and 30% during the 1980s, and up to around 40% in the 1990s.

Our model also allows us to assess the extent to which the two forms of wage rigidity were constraining wage setting. Since the real rigidity bound is positive, it truncates a larger part of the notional wage change distribution than the nominal rigidity bound at zero. Therefore constrained wage setting is necessarily more frequent under the real rigidity than under the nominal rigidity regime. The estimated model parameters

indicate that more than 30% of workers under the real rigidity regime receive a larger wage increase than they would do in a flexible environment during the first half of the observation period. This number falls to below 20% at the end of the observation window. In contrast, this happens to less than 10% of workers under the nominal rigidity regime before the mid 1990s. Only during the late 1990s are more than 10% of the wage changes under the nominal rigidity regime constrained by nominal wage rigidity. This means that, taken together, around 60% of workers at the beginning of the observation period in the 1970s, and 70% of workers at the end of the observation period during the 1990s, indeed received their notional wage change, that is, were not constrained by any rigidities in their wage setting.

Stable probabilities for constrained wage setting imply that the pattern of the shares of workers who are constrained in the real and nominal rigidity regimes basically follows the pattern revealed by the overall shares of the real and nominal rigidity regimes. The estimated proportion of wage changes generated by the constrained real rigidity regime declines from 36% in 1975 to 19% in 2000. At the same time, the share of workers protected against nominal wage cuts ranges between 6% and 12%, without a clear time trend for most of the observation window. Hence downward wage rigidity seems to be less widespread than indicated by previous studies, which exclusively analyse nominal wage rigidity, such as that by Beissinger and Knoppik (2001) using similar German data. The discrepancy reveals why inclusion of the real rigidity regime is important for describing the observed distribution of wage changes. Without the possibility of real wage rigidity, workers whose wages actually cannot fall because of real rigidity constraints are likely to be assigned to the nominal rigidity regime. Thereby the incidence of downward nominal wage rigidity is overestimated.

To summarise, it seems that in Germany wage rigidity, though apparently in decline, is fairly important. Even at the end of our observation period, close to one quarter of individual wage adjustments were larger than intended – two thirds of them as a consequence of downward real wage rigidity. The raw number of workers affected by downward wage rigidity, however, is not necessarily informative with regard to its economic consequences. We therefore express the extent of wage rigidity in terms of the extent of the corresponding pay rise beyond the notional (intended) wage change. This requires comparison of the actual wage growth of a constrained individual, i.e. the rigidity bound, to the counterfactual wage change in a flexible wage setting environment i.e. the notional wage change.

The last two columns of Table 3 present the average wage growth that directly results from downwardly rigid wages computed with regard to the entire sample. The shift to the right of the mean of the observed wage change distribution due to the fact that a certain fraction of wage changes cannot be smaller than a threshold value reveals that in the absence of downward real wage rigidity, wages would have grown by around 2.5% less per year on average during the 1970s. Wage sweep-ups decreased to about 1.5% during the 1980s, and to about 1% during the 1990s. In comparison, the aggregate sweep-up caused by nominal rigidity, ranging between 0.20 and 0.6 log points, is persistently much smaller.

These numbers might seem moderate but one has to keep in mind that they represent sample averages. In other words, they are the product of the sample share of

the constrained rigidity regimes, discussed above, and the average wage sweep-up conditional on being constrained under a regime. The magnitude of the latter suggests that wage rigidities may indeed have substantial consequences for affected firms and workers. For constrained individuals under the nominal rigidity regime, the conditional wage sweep-up is around 3.5% to 4.5% throughout the observation period. For constrained workers under the real rigidity regime, the wage sweep-up is naturally larger. The conditional wage sweep-up due to downward real wage rigidity amounts to around 6.5% during the 1970s, and somewhat less than 5% during most of the 1980s and 1990s. The decline of the conditional wage sweep-up is steeper than that of the sweep-up due to rigid nominal wages mainly because of the downward shift of the real rigidity bound. Still, the downward movement of the average wage sweep-up is dominated by the declining sample share of constrained individuals.

For a robustness check of the previous results, we also estimated the model for different, more parsimonious specifications of notional wage changes. The results, which are available upon request, deliver almost identical results for downward wage rigidities, particularly concerning the estimated incidence of the real and nominal rigidity regimes, or the incidence of the fully flexible regime, across different specifications of notional wage changes. This also indicates that no mixture of the explanatory variables in the notional wage growth relationship is able to create the multiple modalities and asymmetries in the observed wage change distribution, which the empirical model exploits to identify downward wage rigidity. The fact that the estimated location of the real rigidity bound varies very little across the models also supports this interpretation.

The chosen specification of the notional wage growth relationship is likely to have a stronger impact on the estimated aggregate wage sweep-up due to downward rigid nominal and real wages, as it shifts the counterfactual distribution used for the benchmark. The average distance between notional wage changes and fixed rigidity bounds then shifts accordingly. The effect on the estimated aggregate wage sweep-up, however, does not turn out to be very systematic. If anything, including occupation and industry dummies reduces the predicted adverse wage effects.

The previous results suggest that it is important to model real wage rigidity in order to understand wage changes in Germany. Previous studies such as Beissinger and Knoppik (2001) have only allowed for nominal wage rigidity. When we re-estimate our model but constrain the real rigidity regime to zero we obtain different results. The estimator overstates the extent of downward nominal wage rigidity by a factor of 4 in the early years and by a factor of 2 in the later years of our sample (the results are available on request). These results are very different from what we find in the unrestricted model. This means that restricting the analysis to nominal wage rigidities only, as is done in the previous literature, leads to substantially biased estimates of (nominal) wage rigidity.

Because of the generally poorer fit of this restricted model, the estimator picks significantly higher levels of measurement error to obtain a closer fit to the data. The frequency of measurement error is estimated to be between 15% and 25%, whereas we estimate it to be between 5% and 9% in the unrestricted model. In sum, these results suggest that leaving out real wage rigidity from the econometric model can produce severely misleading results.

4. Sources and Consequences of Wage Rigidity

This Section explores the sources and consequences of wage rigidity using variation in the estimated model parameters over time and across regions. Differences in the extent of nominal and real wage rigidity across regions are informative from several perspectives. First, while unions typically bargain on the industry level rather than on the occupational level, bargaining agreements usually have regional components and take regional differences in labour market conditions, like GDP growth or unemployment rates, into account.

Our strategy for identifying causes and consequences is to use the timing of the events. It is plausible to assume that current economic conditions affect the unions' and firms' behaviour in negotiating wages. Given the German labour market institutions, it is almost impossible that current wage negotiations translate into, e.g., dismissals in the current period (Franz, 1999). Thus, we interpret contemporaneous correlations between wage rigidity and economic outcomes as causes of rigidity. On the other hand, firms have more ways to adjust to high wages in the long run. Therefore, our strategy to identify the consequences of wage rigidity is to see how wage rigidity in region i in year t affects outcomes in that region in years $t + 1$ and $t + 2$.

4.1. Causes of Wage Rigidity

In search of the potential sources of wage rigidities on the macro level, we exploit the fact that there is variation in wage rigidity and unemployment across regions. We use the panel of rigidity measures estimated for 22 years of observations and 10 regions (states) in West Germany to investigate the causes and consequences of wage rigidity.⁸ Unemployment rates, GDP, employment, and investment by region are obtained from official statistics. Inflation measured by CPI, however, is only available on the national level. Hence, the estimated impact of inflation of wage rigidities is only identified by variation over time rather than variation over time and across regions. We determine significance levels for the within group estimates on the basis of efficient standard errors taking into account that many of the regressors do not vary across sectors.

We focus on the role of labour market conditions in determining wage rigidity. Unemployment reflects both the bargaining position of unions and the severity of the punishment arising from misbehaviour and dismissal. Figure 4 illustrates the role of regional unemployment rates as a determinant of both the share of workers affected by the real rigidity regime in that region (left panel) and by the nominal rigidity regime in that region (right panel). The plots indicate that higher regional unemployment is associated with lower incidence of the real wage rigidity regime in that particular region. A similar picture arises when plotting the percentage of workers actually constrained by real or nominal wage rigidity, respectively, on unemployed, or by plotting the average wage sweep-up due to real or nominal wages. Intuitively, this is exactly what one should expect: higher unemployment indicates worse regional economic conditions, necessitating more real wage cuts in that region. At the same time, high unemployment implies a stronger bargaining position for employers, facilitating bargaining outcomes that imply declines in the real wage. On the contrary, higher regional unemployment is associated

⁸ For reasons of comparability before and after reunification, we exclude East German Länder and Berlin.

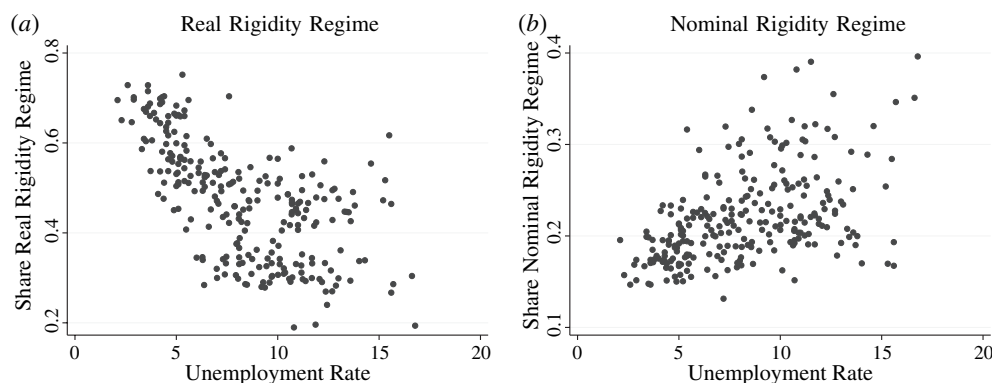


Fig. 4. *Unemployment as Determinant of Wage Rigidity*

with a higher incidence of nominal wage rigidity. This relationship is more difficult to rationalise. Workers who are under the real rigidity regime in good times could move into the nominal rigidity regime in bad times. Another reason for the positive outcome is that conditional on being under the nominal wage setting regime the probability of being constrained increases when unemployment goes up, since the notional wage change distribution shifts downward when the economic environment is unfavourable. Moreover, the psychologically damaging effects of cutting nominal wages could induce firms either to avoid nominal wage cuts, or dismiss workers if downward adjustment of labour costs is necessary, leading to even higher unemployment.

In order to investigate the potential causes more systematically, we run within a group estimation of different measures of real and nominal wage rigidities on different macroeconomic indicators, including the regional unemployment rate, regional GDP, employment and investment growth, and inflation. Table 4 presents a representative selection of results for the relationship between the extent of nominal and real downward wage rigidity in terms of the incidence of the real and nominal regimes. The regressions allow for region fixed effects and a linear time trend.

The following broad picture emerges: the linear time trend is always negative for the real rigidity regime, both for the incidence and the share of constraint wage changes. In contrast, the trend is significant and positive for the nominal rigidity regime, which would not be immediately evident from the raw figures (see Table 3). This outcome indicates that wage setting in Germany has indeed shifted gradually from real wage rigidity to nominal wage rigidity over the observation period.

When controlling for time trend and inflation, unemployment only appears to have an effect on real wage rigidity. As indicated by the Figure 4, higher unemployment reduces the incidence of real wage rigidity. In contrast, unemployment does not affect the incidence and extent of nominal wage rigidity considerably. This is consistent with previous empirical results confirming that in Germany collective agreements are moderated when unemployment pressure is high.⁹

⁹ Evidence for the determinants of collective bargaining outcomes suggests that German unions are prepared to moderate wage claims in periods of weak economic growth (or high unemployment) but not to accept wage agreements that do not cover expected inflation.

Table 4
Macroeconomic Causes of Wage Rigidities

		Dependent Variable:							
		% of Workers in							
		Real Regime				Nominal Regime			
Linear		-0.116***	-0.106***	-0.114***	-0.113***	0.026***	0.033***	0.027***	0.026***
Trend (10^{-1})		[0.007]	[0.007]	[0.006]	[0.007]	[0.004]	[0.004]	[0.004]	[0.004]
Unemployment		-0.009***	-0.009***	-0.008***	-0.010***	-0.002	-0.002	-0.001	-0.002
Rate		[0.003]	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
CPI _{t-1}		0.663*	1.100***	1.333***	0.934***	-1.191***	-0.878***	-0.969***	-1.161***
		[0.362]	[0.360]	[0.323]	[0.349]	[0.232]	[0.229]	[0.232]	[0.235]
GDP Growth			0.894***				0.636***		
			[0.195]				[0.122]		
Employment				2.570***				0.813***	
Growth				[0.289]				[0.206]	
Investment					0.276***				0.03
Growth					[0.055]				[0.036]
Intercept		0.687***	0.646***	0.643***	0.674***	0.230***	0.200***	0.215***	0.228***
		[0.028]	[0.028]	[0.025]	[0.027]	[0.018]	[0.018]	[0.018]	[0.018]
Observations	254	254	254	254	256	256	256	256	256
R ²		0.79	0.81	0.84	0.81	0.42	0.47	0.45	0.42

		Average Wage Sweep-Up due to							
		Real Rigidity				Nominal Rigidity			
Linear		-0.004***	-0.004***	-0.004***	-0.004***	0.001***	0.001***	0.001***	0.001***
Trend (10^{-1})		[0.0003]	[0.0004]	[0.0003]	[0.0003]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Unemployment		-0.001***	-0.001***	-0.001***	-0.001***	-0.0001	-0.0001	-0.0001*	-0.0001
Rate		[0.000]	[0.000]	[0.000]	[0.0001]	[0.0004]	[0.0004]	[0.0004]	[0.0004]
CPI _{t-1}		0.018	0.017	0.026	0.025	-0.022***	-0.024***	-0.024***	-0.023***
		[0.018]	[0.018]	[0.018]	[0.018]	[0.005]	[0.005]	[0.005]	[0.005]
GDP Growth			-0.002				-0.002		
			[0.010]				[0.003]		
Employment				0.032*				-0.007	
Growth				[0.016]				[0.004]	
Investment					0.007**				0.0004
Growth					[0.003]				[0.001]
Intercept		0.025***	0.025***	0.024***	0.025***	0.003***	0.003***	0.003***	0.003***
		[0.001]	[0.001]	[0.001]	[0.001]	[0.0004]	[0.0004]	[0.0004]	[0.0004]
Observations	254	254	254	254	256	256	256	256	256
R ²		0.76	0.76	0.76	0.77	0.42	0.43	0.43	0.43

Notes. Estimates are Within-Group estimates. Hausman-tests reveal that the null that differences between random and fixed effects coefficients are not systematic cannot be rejected at any level of significance. Standard errors in brackets. ***, **, * are used to indicate that a parameter value is significant at the one, five or ten percent level, respectively.

Interestingly, inflation tends to increase real wage rigidity. The higher the inflation rate on the national level, the larger the fraction of wage changes in the different regions that are affected or constrained by real wage rigidity. The effect is weaker for the fraction of wage changes actually constrained by real wage rigidity, however. On the other hand, the incidence of nominal wage rigidity declines with the rate of inflation. This effect is strong and significant both for the incidence of the nominal rigidity regime, and the fraction of actually constrained wage changes. This finding supports the hypothesis that

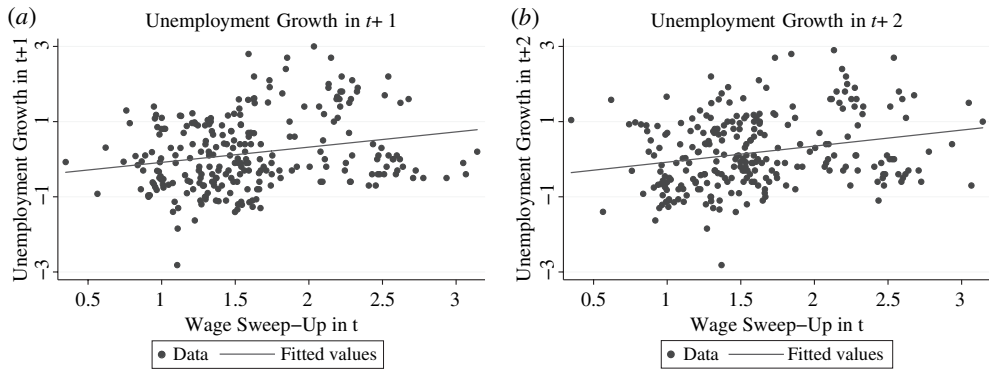


Fig. 5. *Unemployment as Consequence of Wage Rigidity (Total Wage Sweep-Up)*

inflation expectations are relevant for the formation of downward wage rigidity. Hence we conclude that real wage rigidity becomes more relevant when expected inflation is high, while the opposite holds for nominal wage rigidity. This can have important implications for monetary policy, a point to which we return in the conclusions.

Good economic conditions in the respective regions have a positive effect on the incidence of real and nominal wage rigidity, regardless of whether economic conditions are measured by regional GDP growth, regional employment growth or regional investment growth. The most plausible interpretation is that unions bargain more aggressively when outside options are good.

Regressions using the wage sweep-ups caused by downward nominal and real rigidity as the dependent variable are presented in the second part of Table 4 and reveal basically the same picture. Both the time trend and the regional unemployment exhibit similar effects compared to using the share of constrained wage changes as dependent variable. Inflation has no impact on the sweep-up caused by real wage rigidity but tends to decrease the sweep-up from nominal wage rigidity. The effects of labour market conditions become weaker and mostly insignificant. There is only weak evidence that better economic conditions tend to increase the sweep-up from real wage rigidity. This outcome is consistent with the hypothesis that collective bargaining is the dominant source of downward real wage rigidity.

4.2. *Macroeconomic Consequences of Wage Rigidity*

We next turn to the potential consequences of wage rigidity. If firms cannot implement notional wages for some workers, the involuntary wage sweep-up might lead firms to adjust at the external margin and reduce employment. We thus examine how excess wage growth in period t affects economic outcomes in later periods. In this sense, we estimate a wage curve (Blanchflower and Oswald, 1995) in differenced form. We aggregate the wage sweep-ups to the regional level.¹⁰ Figure 5 illustrates the main findings graphically. The larger extent of wage rigidity, in the form of a total sweep-up

¹⁰ See Fehr *et al.* (2002), but also the two studies for Italy (Devicienti *et al.*, 2007) and the UK (Barwell and Schweitzer, 2007) for studies of the relationship between wage rigidity and employment probabilities on the individual level.

Table 5
Unemployment Consequences of Wage Rigidities

	Dependent Variable:			
	Δ Unemployment Rate _{t+1}		Δ Unemployment Rate _{t+2}	
Real Wage Sweep-Up _t	0.480*** [0.103]	0.290** [0.112]	0.232*** [0.060]	0.517*** [0.101]
Nominal Wage Sweep-Up _t	-2.401*** [0.630]	-2.057*** [0.355]	-0.269*** [0.023]	-1.032 [0.634]
Total Wage Sweep-Up _t		0.437*** [0.111]	0.326*** [0.064]	0.516*** [0.109]
GDP Growth _t		-0.107*** [0.023]	-0.064*** [0.024]	-0.088*** [0.025]
GDP Growth _{t+1}		-0.262*** [0.017]	-0.266*** [0.019]	-0.272*** [0.019]
GDP Growth _{t+2}				-0.266*** [0.019]
Δ Unemployment Rate _t		0.269*** [0.046]	0.377*** [0.047]	
Δ Unemployment Rate _{t+1}				0.274*** [0.052]
Constant	-0.471*** [0.151]	0.452 [0.283]	1.101*** [0.168]	-0.497*** [0.148]
Observations	256	256	256	256
R ²	0.08	0.13	0.75	0.1
				0.11
				0.08
				0.72
				0.71

Notes: Estimates are Within-Group estimates. Standard errors in brackets. **, * are used to indicate that a parameter value is significant at the 1% or 5% level, respectively.

in wages caused by wage rigidities, leads unemployment to grow faster. To substantiate this finding by conditioning on other potential covariates, we regress changes in the unemployment rate on variables covering the contemporary economic environment and lagged values of the estimated wage sweep-up due to downward wage rigidity. Table 5 shows the main results.

A first glance at the results indicates that wage sweep-up, in particular caused by real wage rigidity, indeed increases unemployment growth. These findings are robust to controlling for current and lagged growth in regional GDP and lagged growth of regional unemployment. As expected, instantaneous and lagged GDP growth has a strongly significant negative impact on the change in regional unemployment.

Our results need to be interpreted with caution. For instance, we also find that the larger the wage sweep-up caused by nominal wage rigidity, the slower unemployment grows in a particular region. An explanation for this seemingly contradictory finding is that most of the variation in the nominal wage sweep-up seems to come from the shift from real to nominal wage rigidity. Hence, a higher nominal sweep-up is correlated with less real rigidity, which has positive effects on the labour market. In order to identify adverse effects of nominal wage rigidity, one would need variation in the inflation rate in years where a constant fraction of workers are affected by nominal wage rigidities. Unfortunately, there are no such episodes in our sample period.¹¹

5. Conclusion

This article estimates the extent of nominal and real downward wage rigidity in the West German labour market since the mid 1970s. The results of our empirical analysis, which are based on individual wage change data, indicate that wage rigidity is a robust phenomenon. Although the incidence of wage rigidity has significantly decreased over time, at the end of the observation window 30% of workers are still shielded from real wage cuts and an additional 30% are shielded from nominal wage cuts.

There is substantial variation in the pattern of rigidity across sectors and over time. Our results show that bad labour market conditions tend to make wages more flexible: In years and industries with high unemployment rates, wages tend to be less rigid. We also find a shifting pattern of rigidity with lower inflation: the pervasiveness of real wage rigidity is declining, while at the same time, nominal wage rigidity is increasing. This shift is consistent with Akerlof *et al.* (2000). They propose a model in which individuals start to ignore inflation once it becomes low enough. Thus, our results suggest that monetary policy can have an important impact on the labour market by affecting the types of rigidity. Given that the wage sweep-ups from nominal wage rigidity are clearly larger than those from real wage rigidity, monetary policy may thus affect the labour market directly.

¹¹ Fehr and Goette (2005) examine such an episode in Switzerland and find strong effects of nominal wage rigidity on unemployment.

Indeed, our evidence also suggests that wage sweep-ups tend to increase future unemployment, as suggested, e.g., by the wage curve (Blanchflower and Oswald, 1995). Consequently, it seems that prudent monetary policy might help to reduce the adverse labour market effects of downward wage rigidity. This suggests that an environment of moderate inflation and moderate bargaining outcomes might be most favourable in order to minimise the adverse labour market effects of downward rigid wages.

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