Dimensions and Consequences of Wage Rigidities in Germany

Ernst Fehr[*], Lorenz Götte[*] and Friedhelm Pfeiffer[**]

This version: February 2002, comments welcome

Abstract:

Evidence for nominal wage rigidities have been found in a number of recent studies for countries with decentralised wage determination. In this paper we examine wage rigidities in West Germany, where wages are determined in a mixed system of central wage bargaining between unions and employer associations or unions and firms and individual wage bargaining. Our estimates based on individual data from 1975 to 1995 confirm that the rigidity of nominal wages is a robust phenomenon also in Germany. Rigidities from central wage agreements, however, dominate. According to our estimates roughly 45 percent of employees who stay in the same plant for two consecutive years are protected against wage reductions below central wage agreements. Wage rigidities are more distinct for employees with more stable employment histories, longer tenure and for employees in larger firms. The strength of wage rigidities is measured with the amount of prohibited wage decreases in the absence of a wage rigidity, the wage sweep-up. The wage sweep-up varied between 4 and 8 percent. Without central wage bargaining and nominal wage rigidities wages the distribution of wage changes would have been less compressed. Wage rigidities have real consequences and the findings confirm the existence of bargaining power of employees in wage determination in Germany. On the individual level higher wage rigidities do not imply higher unemployment or future wage risks. On the aggregate level higher wage sweeps-ups are associated with lower sector employment growth rates.

JEL-Classification: J30, J41, J51

Key words: wage rigidities, bargaining power, efficiency wages, counterfactual distribution of wage changes.

[*] Institute for Empirical Research in Economics, University of Zurich, Bluemlisalpstr. 10, 8006 Zurich, Switzerland. Emails: *efehr@iew.unizh.ch*, *goette@iew.unizh.ch*.

[**] Centre for European Economic Research, P.O. Box 103443, D-68161 Mannheim, Germany, phone: +49/621-1235-150; email: *pfeiffer@zew.de*

Acknowledgement: We would like to thank Stefan Bender, Bernd Fitzenberger, Wolfgang Franz, Michael Feil, Winfried Pohlmeier and Josef Zweimüller for helpful remarks and Volker Ludwig for competent research assistance. Ernst Fehr and Lorenz Götte gratefully acknowledge financial support from the Swiss National Science Foundation grant no. 1214-051000.97. Lorenz Götte thanks the ZEW for its hospitality during his visit in Spring 2000. Friedhelm Pfeiffer gratefully acknowledges financial support from the German science foundation (Deutsche Forschungsgemeinschaft) under grants FR715/3-1/3-2.

1 Introduction

This paper investigates nominal and contractual (downward) wage rigidities in (West-)Germany from 1975 to 1995 based on a large employer-employee data set. Firms my be reluctant to cut nominal wages for several reasons. They may be constrained by efficient nominal wage contracts, by the evidence of nominal loss aversion or by nominal fairness standards.[1] With nominal wage rigidities money matters and (some) inflation might "grease the wheels of the labour market".[2] Recent studies have investigated the existence and extend of nominal wage rigidities for countries where wage determination takes place in a rather decentralised way or have ignored central wage bargaining for wage determination.[3]

In the German labour market, however, there is a mixed system of wage determination with elements of centralised and decentralised wage bargaining. In central wage bargaining rounds collective bargaining power determines wages. In Germany unions aim, as a rule, at real wage increases. Typical wage increases are considered as "fair" by unions, if they cover the real growth rate of labour productivity.[4] There are relatively strong unions in Germany and the labour law favours central wage bargaining ("Tarifautonomie"). Therefore the concentration on downward nominal wage rigidities might lack empirical relevance for the labour markets covered by central wage bargaining. Nevertheless roughly 1/3 of the employees in private firms are not covered by collective wage agreements, CWAs.[5] Therefore in a mixed system of wage determination two dimensions of wage rigidities

---

[1] See Fehr and Götte (2000). For recent surveys on theories and evidence on wage rigidities see also Bewley (1999) and Malcomson (1999).

[2] Card and Hyslop (1997), Tobin (1972). This argument has a long tradition in economics at least starting from J.M. Keynes.

[3] Nominal wage rigidities are investigated by Akerlof, Dickens and Perry (1996), Altonji and Deveroux (1999), Card and Hyslop (1997), Kahn (1997), McLaughlin (1994, 2000) for the United States of America, Christofides and Leung (2001), Christofides and Stengos (2001) for Canada, Fehr and Götte (2000) for Switzerland, Smith (2000) for the UK and Beissinger and Knoppik (2001), Knoppik and Beissinger (2001) for Germany. The results of these studies are somehow mixed. With respect to the existence of nominal wage rigidities there is evidence for Canada, Germany and Switzerland and the US, but not for Great Britain. There is some evidence for a positive relation between wage rigidities and unemployment in Switzerland, Germany and the USA. There is nearly no evidence for the relationship between individual wage rigidities and individual employment and wage prospects.

[4] Franz (1999). Determinants of CWAs in Germany have been investigates for example by Fitzenberger (1999) and Neumann et al. (1990). There is time series evidence that collective wage agreements do not react in a significant manner to unemployment rates in Germany.

[5] Franz et al. (2000). In the covered sector, effective wages can be higher than CWAs, so that elements of decentralised bargaining ("Privatautonomie") are also evident in the covered sector.

have to be taken into account and a concentration on nominal rigidities might lack empirical relevance.

In this paper a difference is made between downward nominal wage rigidities and wage rigidities stemming from CWAs. Wages are downward rigid in nominal terms when wages do not decline, although firms would prefer to reduce wages in the absence of efficient nominal wage contracts, nominal loss aversion and nominal fairness standards. This definition refers to workers, who are not covered by CWAs. The second dimension of wage rigidities refers to firms and workers who are covered by CWAs and is called a contractual wage rigidity. There exists a contractual wage rigidity when firms are reluctant to set wages below the CWA, although, in the absence of a CWA, they would prefer to do it.

The role of collective wage bargaining for wage levels, employment and unemployment has recently been investigated empirically in the framework of labour demand models or models of collective wage bargaining based on aggregate data.[6] Fitzenberger (1999) finds that unions take care of wage differentials between skill groups and Klotz et al. (1999) report evidence that the transmission of skill-biased technical change to employment in different skill groups is found to be influenced by central wage determination in Germany. That might help to explain the fairly stable wage structure in Germany compared to the US.[7] Büttner and Fitzenberger (2000) find that wages are flexible with respect to unemployment. Central wage bargaining, however, reduces wage flexibility for employees with low wages. Fitzenberger and Franz (2001) argue that it will be necessary to reduce wages for the less skilled by an order of magnitude between 14 and 37 percent and for the medium skilled by 10 to 34 percent to reduce unemployment by 50 percent in these groups.

These studies confirm the role of collective wage bargaining for wage determination in Germany. Employees seem to have some bargaining power, resulting in higher wages and a reduced wage flexibility. However some open questions remain. Attachment to central wage bargaining and CWAs is not unique and not enforced by law. Neither all firms in Germany are attached to CWA nor are all employees union members. Even covered firms are free to pay wages below CWAs to non union

---

[6] For theoretical investigations into the long run employment consequences of rigid wages above the market clearing level in an intertemporal general-equilibrium model with endogenous productivity growth see Hellwig and Irmen (2000). Among others the study indicates that in steady state equilibria employment contracts at a constant rate. Nominal rigidities in labour markets with collective wage bargaining at the firm level and hold-out of CWAs are investigated theoretically by Holden (1994, 2001). For surveys focussing on the empirical evidence on the relationship between unions, wages and employment see also Bertola (1999), Blau and Kahn (1999) and Nickell and Layard (1999).

[7] For the US compare for example Blau and Kahn (1999). Note in addition that de-unionisation has not taken place in Germany to the same degree than in the USA or UK, for Germany see Fitzenberger et al. (1999) and for the USA and UK see Acemoglu, Aghion and Violate (2001).

workers. Effective wages often are higher than CWAs even in covered firms, so that elements of decentral wage bargaining and individual bargaining power are also present in the covered sector. That should perhaps suffice for enhanced wage flexibility, given that wage reductions would be accompanied by employment gains. However, firms may be constrained by nominal efficient contracts, nominal loss aversions and nominal fairness standards. In addition, evidence on individual wage rigidities, the resulting wage sweep-up and its consequences for employees and employment is missing. These issues are addressed in the paper.

Firstly when there are wage rigidities, the counterfactual evidence on how high the wages would have been in the absence of wage rigidities can best be estimated on the basis of individual data.[8] The German mixed system of wage determination allows a quasi-experimental framework for the study of contractual and nominal wage rigidities. The model takes into account the German wage setting institutions in a detailed way and furthermore incorporates nominal wage rigidities. Although collective wage bargaining leads to uniform bargained wages in regions, occupations and sectors, not all firms and employers are legally bound to CWA and it is always possible for firms to pay higher wages. If firms already pay higher wages, they are allowed to set off against CWA. Therefore what really matters for the issue of wage rigidity in Germany is the question of whether individual wage would be lower in the absence of CWA or not and not attachment to CWAs per se. This can be regarded as central in gaining a better understanding of the determinants and dimensions of wage rigidity in Germany.

With respect to this first point we find evidence for contractual wage rigidities. Roughly 45 percent of the employees staying for two years in the same firm, show up wage rigidities. Nominal wage rigidities are also evident. However, wage rigidities from CWAs clearly are dominant. Wage rigidities are more distinct for employees with more stable employment histories, longer tenure, for employees in larger firms and for blue collar worker. Workers with these characteristics have a higher probability of being relatively more protected from wage competition. The strength of wage rigidities is measured with the amount of prohibited wage decreases in the absence of a wage rigidity, the wage sweep-up. The wage sweep-up varies on average between 4 and 8 percent points and on an individual level between 0 and 17 percent. There is also evidence from our analysis that individual unemployment periods leads to lower wages. However, these wage decreases are restricted to some labour markets and they do not result in further wage decreases due to wage rigidities. Therefore due to wage rigidities the law of one price in the labour market is

[8] If there are wage rigidities (for whatever reason) then there does not necessarily exist a labour demand curve for wages below the wage rigidity. Due to employee and employer heterogeneity presumably wage rigidities differ between firms. This heterogeneity can influence the results of aggregate labour demand analyses, which typically exploit wage differentials between sectors, regions, skill groups or other aggregates.

not valid and one can conclude that labour markets seem to resemble a collection of bilateral trading islands, rather than auction markets.[9]

Secondly our study provides evidence on real consequences from individual wage rigidities. While in an auction market environment wage rigidities might lead to a higher individual employment or income risk this may not be the case when employees have some monopoly power in the individual employer – employee relationship, for example, due to central wage bargaining, due to efficiency wages based on reciprocity or nominal efficient contracts. In these cases individual wage rigidity might have no negative effects on these individuals employment and income risks. Empirical evidence is rare and we examine that relationship in detail. It turns out that employees with a higher wage sweep-up have a lower unemployment risk and no higher wage risk in the future. Wage rigidities have, if they exist, real consequences for other employees or the unemployed. These consequences do depend on the dimensions and reasons of wage rigidities. Our analyses provides evidence that roughly 80 to 90 percent of the measured wage sweep-up could be attributed to efficiency wages and nominal efficient contracts. 10 to 20 percent are due to bargaining power of employees, which results in a negative relation between the wage sweep-up and employment growth in 63 sectors over a period of 20 years.

Thirdly, the paper contributes to the recent debate on the existence and robustness of nominal wage rigidities. It is shown that in the group of 1/3 of workers not covered by CWA nominal wage rigidities do exist.[10] Compared to findings for countries with decentralised wage setting, in Germany the estimated value of a is lower as is the share of employees protected by nominal wage rigidities. Again the main reason is the role of CWA in Germany.

The remainder of the paper is structured as follows: In the next section the mixed system of wage determination in Germany is introduced, including of some aggregate evidence. Section three introduces the individual data basis and displays the empirical distribution of income changes in Germany. The econometric model which allows a simultaneous examination of the determinants of wage changes and two dimensions of wage rigidities is elaborated in section four. The results are discussed in section five. Consequences of wage rigidities on the individual level with respect to future employment and wage prospects and on the sector level with respect to employment growth is examined in section six. Section seven concludes.

---

[9] Which confirms recent experimental evidence on the relation between incomplete contracts and wages, see Brown et al. (2001), Fehr et al. (1997) and Fehr and Falk (1999) and survey evidence by Agell and Lundberg (1994, 1999), Bewley (1999), Campbell and Kamlani (1997) and Franz and Pfeiffer (2002).

[10] Confirming Fehr and Götte (2000) for Switzerland, Knoppik and Beissinger (2001) for Germany and Altonji and Deveroux (1999) for the US.

2 Wage determination and wages in (West-)Germany from 1975 to 1995: an aggregate perspective

In Germany, wage determination takes place basically on two levels, with specific legal interrelationships.[11] Collective wage bargaining takes place between a union and an employer association in special regions and industries ("Flächentarifvertrag", for example: Bavarian chemical industry) or between a union and a firm ("Haustarif-vertrag").[12] The bargain is over wages, working hours and other labour conditions. The outcome of the wage bargain, CWA, is legally binding only for members of the union who are working in the bargaining firm or on the firm which is a member of the bargaining employers association. Pattern bargaining is common, where the bargain of a "leading" region is applied with slight modifications for the same industry in the other regions. CWAs constitute minimum conditions and it is possible to contract higher wages ("Günstigkeitsprinzip"). If a firm is not a member of a regional employer association or does not apply CWAs for other reasons wages are negotiated on an individual or firm specific basis.

Franz et al. (2000) find that 39 percent of the firms surveyed from five industries, which employed roughly 77 percent of the employees, did apply CWAs in 2000. Attachment to CWAs declines monotonously with firm size and with the share of high skilled labour. Since only around 30 percent of the workers are a member of a union (Fitzenberger et al., 1999) there must be reasons for employers to apply CWAs to nearly all of their employees. One reason is to avoid internal dispute in the case of differentiated wages and the other to deter employees entry to unions (Fitzenberger and Franz, 1999).

On a aggregate level, the (West) German economy (here as in the empirical analysis below we concentrate on the private part of the economy) is characterised by (relatively) high wage and productivity growth rates, low and declining inflation rates, modest employment growth and high and rising unemployment rates (*Figure 1*). In the period under investigation in this paper, 1975 to 1995, labour markets went through two serious recessions with declining employment and rising unemployment, lasting from 1979 to 1981 and from 1992 to 1994. Inflation rates (consumer price index) declined considerably. From 1985 to 1988 and in 1995 inflation rates were below 2 percent, from 1979 to 1982 above 4 percent. *Figure 1(b)* displays two

---

[11] For a more detailed discussion of wage determination in Germany see for example Fitzenberger and Franz (1999). Labour law constitutes a third level of wage determination, which is binding if it is applied. One case refers to the "Allgemeinverbindlicherklärung" of CWAs. In that case all firms in a region and industry have to apply CWAs, whether they are members of the negotiating employers associations or not. Furthermore in some parts of the economy there may exist minimum wages, for example in the construction sector.

[12] In 1998 there existed 2,720 CWAs from bargains between employers association and unions and 3,892 from bargains between firms and unions, Franz (1999, 237).

measures of aggregate wage changes, effective and contractual wage changes from CWAs. While these wage changes are not insensible to aggregate conditions, they seem to be linked tighter to employment changes than to unemployment rates, as the picture suggests.[13]

3 Income changes, changes in CWAs and wage drift 1975 to 1995: a microeconomic perspective

The microeconometric part of the paper is based on the IAB Employment Subsample 1975-1995 (IABS) for West Germany. The IABS contains information on daily income, age, gender, formal educational attainment, nationality, occupation, employment and unemployment spells, and the size and sector activity of the plant for each spell. Information on working time is restricted to three categories (*full time, part time* and *less than part time*) (*Table 3* Appendix). To study wage rigidities 21 samples from the IABS where drawn, dated to the key date June, 30th, of each year (see *Figure 2*) and separate for *stayers* and *movers*. *Stayers* are defined as workers, who stay in the same plant between two consecutive dates and *movers* who move to a different plant. Wage rigidities resulting from nominal efficient contracts, nominal fairness and efficiency wages are predominantly defined for existing employer-employee relationships and should become obsolete after separation. The German labour force is ageing, female participation is rising, the share of low skilled and blue collar workers is declining as is plant mobility. In 1995 36 percent of the employees who stayed in the same plant for two consecutive years have 10 years of tenure or more (see *Table 3*, Appendix).

Income changes (not wage changes) are defined based on the differences between two consecutive key dates. The time interval for a wage change is chosen to be one year, lasting from June, 30th in *t-1* to June 30th in *t*. Since collective wage bargaining rounds typically are replicated on a year to year basis this choice seems to be reasonable. Information on CWA is not available. It is not known, whether an individual employee is covered by CWA or a member of a union. Information on the yearly rise in CWAs for two types of workers (*Blue-collar worker*, "Arbeiter", and *White-collar worker*, "Angestellte") and industries has been merged to these individual income changes.[14]

For the following discussion it is necessary to keep in mind that we are talking about income, not wage changes in this section. *Figure 3*[15] displays the development of

---

[13] Which is confirmed by empirical studies on the determinants of CWAs, see Neumann et al. (1990) and the overview in Franz (1999).

[14] For more details on the data, on sample selection, the selection and construction of variables and the merging of CWAs see the appendix.

[15] Based on *Table 4* in the appendix.

mean income changes for *movers* and *stayers*. and in the lower part the wage drift. Mean nominal income growth is on average higher for *movers* compared to *stayers*. The differences range between 3 and 5 percent points. *Movers* on average seem to improve their income position. Note that the share of employees with negative income growth is higher in the group of *movers* which indicates a larger degree of heterogeneity in this group (*Table 4,* Appendix). The issue is examined more closely in the econometric part again. The wage drift is larger for *movers* compared to *stayers* and compared to the values calculated from aggregate data, which have been repeated for convenience in *Figure 3.* One reason for this finding is that the IABS-samples only contain workers who are employed in two consecutive years and who worked in the same working hours category.

Mean CWA changes seem to be fairly comparable to the corresponding aggregate values (*Table 4*). The lowest and highest values indicates the range of CWAs. These differences are, however, low compared to the distribution of observed income changes, which may hint at pattern bargaining in German collective wage negotiations. *Table 5* replicates the share of workers in four income regimes: negative income growth, zero, between zero and the change in CWAs and higher than the change in CWAs. These shares vary with the cycle and with inflation rates. The lower inflation rates are, the higher the number of employees with negative income growth. The share of employees with nominal income growth higher than CWAs changes varies between 48 percent in 1992/93 and 72 percent in 1989/90 in the sample of *stayers* and is higher in the sample of *movers*.[16]

Figure 4 displays the full distribution of observed income changes for *stayers* and *Figure 5* for *movers*. In these and other figures in this section, tails of the distribution are massed at the extremes, in order to allow a better view of the intermediate categories. At first glance and with respect to nominal wage rigidities the pictures seem to be in line with the international evidence. The distribution of income changes for *movers* is much wider than the one for *stayers* and the asymmetry around (positive) zero, which might hint at nominal rigidities, is evident for *stayers*. A second spike is visible in most samples at the right side of the distribution. This spike is located around the yearly changes in CWA. There is an asymmetry around this spike in the sense that more employees experienced higher than lower income growth.

Figure 6 shows the income changes net of CWA changes, this time for the group of *stayers* only. Zero income change now has the meaning of income change equal to a CWA change. For most samples, the spike is fairly exact around zero. It is confirmed that the mass of income changes is on the right side. At the left of zero

[16] The high values in 1983/84 are caused by a redefinition of income in 1984 and therefore not reliable. The share of *stayers* with zero income change varies between 4 and 7 percent. This value is lower than in Smith (2000) and Altonji and Devereux (1999). However, the numbers are not comparable since income in the IABS has been rounded and the true share of zero income changes is not known.

fast declines in the mass are common (see for example 1985, 1988). *Figure 7* displays income changes net of CWA changes for the pooled sample of *stayers* in eight plant size categories. In firms with 10 and more employees the distribution centres around CWA with more mass on the right side of zero. In comparison in small and very small firms income changes often falls short of CWA and the mass of the distribution seems to lie on the left side of zero. *Figure 8* displays income changes for the pooled sample of *stayers* in eight tenure categories. The longer the employment relationship between an employee and a firm lasts, the less variation is observed in income changes.

4 An econometric model of wage rigidities in a mixed system of wage determination

The upshot of the descriptive evidence suggest two potentially rigidities at work that affect the shape of the distribution of wage changes in important ways.

Firstly, a considerable share of workers seem to receive wage increases that correspond roughly to the increases in collective wage settlements, which is called the contractual wage in the following. The asymmetry around that point suggests, that wage increases for firms and workers covered by CWA might have been smaller in the absence of CWAs. We term this type of downward wage rigidity as *contractual rigidity*, which is the outcome of a bargaining process between agents that are concerned with real variables. Typical wage increases are considered as "fair" by union members, if they cover the real growth rate of labour productivity (Franz, 1999). Relative bargaining power determines the existence and extend of *contractual wage rigidity*.

Secondly, an asymmetry around zero nominal wage increases has been detected in almost every year. Small nominal wage cuts occur less often than one might expect from the otherwise continuous distributions. We refer to this feature as downward *nominal rigidity*, because the evidence suggests that forces such as efficient nominal wage contracts, nominal loss aversion or nominal fairness standards prevent firms from cutting nominal wages. The extent to which contractual or nominal wage rigidities are important seems to vary with characteristics of the employees and the plants where they are employed. For employees in larger plants or with higher tenure, for example, the pile up at contractual wage looked higher compared to employees in smaller plants or with lower tenure.

In the remainder of this section, we describe an empirical model that allows for both, contractual and nominal wage rigidities and considers the fact that the data used in the analysis are observed with measurement error. Such measurement error can arise, for instance, if income that is used to calculate wage changes also contain overtime payment and can give rise to a substantial number of false observed wage decreases. Since the *IABS* does not contain information on the levels of contractual and

effective wages the model has been formulated in first differences as in Altonji and Devereux (1999) and Fehr and Götte (2000).

Efficient nominal wage contracts, nominal loss aversion or efficiency wages based on reciprocity render wage cuts costly for the firm. Therefore firms are constrained in setting the desired or notional wage[17] in *t*, given the previous wage *t-1*. There is a difference between notional and actual wage changes between *t-1* and *t* for those employees with wage rigidities. This difference is not present for employees with no rigidities, whose wages rise or whose wage changes exceed the change of CWAs. In these cases, it is assumed that notional and observed wage changes are identical. For employees with wage rigidities notional wage changes are counterfactual. The task of the empirical model is to assess these counterfactual notional wage changes. Since they are observed in the group of employees without rigidities, it is straightforward to assess the counterfactual evidence for the group of employees with wage rigidities in the group of employees without wage rigidities.

A central assumption in the analysis is that the determinants of notional wage changes, which can be estimated in the group of employees without rigidities are identical to the group of employees with rigidities. It is assumed that in the absence of wage rigidities notional wage changes are realised, which result from market competition. If wage cuts and wage growth below the growth of CWAs is prevented than a rigidity exists. So reference situation of flexible wages is assumed to hold (ideally) in auction markets. If instead wage cuts or wage growth below the growth of CWAs are the result of firms bargaining power in Germany than the model would tend to overestimate wage rigidities.

Notional wage changes and wage rigidities

In the model workers are either covered by a CWA or not. The share of workers covered by CWAs is denoted by Ω and the individual probability of being covered by Ω_{it}. Wage setting for the two groups differs in an important aspect, namely in the extent to which their wages show downward rigidities (see *Figure 9* for illustration). Employees covered will typically not get pay below the increases in the negotiated wages. Wage changes, Δw_{it}, of workers that are covered by a CWA take the following form:

$$\Delta w_{it} = \begin{cases} x_{it} b_t + e_{it} & \text{if } x_{it} b_t + e_{it} \geq r_{it} \\ r_{it} & \text{if } x_{it} b_t + e_{it} < r_{it} \end{cases} \qquad (1)$$

[17] The term notional wage has been introduced by Altonji and Devereux (1999).

r_{it} denotes the increase in the contractual wage from central wage bargaining rounds that applies to individual i. $x_{it}\,b_t + e_{it}$ is the notional wage change, Δw_{it}^{*}, which is assumed to be identical to the realised wage change, Δw_{it}, in the absence of rigidities (the upper part of equation 1). x_{it} contains the individual's characteristics that are relevant for wage growth. These include tenure, age, education, gender, unemployment experience, and employer characteristics, among them plant size and sector affiliation.[18] e_{it} is an idiosyncratic unobservable component to wage growth. b_t and the standard deviation of e_{it} have to be estimated from the data. Note that the deterministic part of wage changes, the coefficient vector b_t, can vary over time in our specification. Previous studies on nominal wage rigidities usually assume the determinants of notional wage changes to be constant over time (Altonji and Devereux, 1999, Fehr and Götte, 2000, Knoppik and Beissinger, 2001).

One feature of the model is that it incorporates wage rigidity from CWA. Suppose that individual i has 'bad' characteristics (e.g. a worker in a large firm with long tenure) such that his wage increase would fall short of r_{it}. However, because the firm is covered by a CWA, it increases i's wage by r_{it}, as indicated in the second line of equation (1). Note that not all wages of employees covered by CWA automatically also are rigid, since some workers will experience even higher wage growth. The share of workers with contractual wage rigidities, which is termed $?$ in the following, has to be estimated from the data. So the model allows to differentiate between coverage and rigidities, which is essential from an economic point of view. For reasons of job creation or employment policies, for example, it is not coverage that matters, but rigidities due to coverage instead.

A second feature of this formulation is that $x_{it}b_t$ is informative about how wages would have grown in the absence of wage rigidity due to CWA. Consider the worker with the bad characteristics again. The model recognises that wage growth is truncated from below at r_{it} for these workers. Estimators which ignore this truncation, which is typically the case in wage level estimations, will produce an attenuated estimate of b_t. By comparing the OLS estimate of b_t to our models result, one can assess to what degree conventional estimators understate how much wages would have varied in the absence of downward wage rigidity.

---

[18] These and other variables have found to influence wage growth in a number of previous studies, see, e.g. Abowd et al. (1999) or Topel (1991). Note that wage level studies start from a different equation. Typically, the wage *level* is specified as $w_{it} = J_i + z_{it}\,b + e_{it}$, where z contains non-linear functions of experience and tenure, and interactions thereof with firm size or gender, for example. Taking first differences, one obtains $\Delta w_{it} = \Delta z_{it}\,b + \Delta e_{it}$. $x_{it} \equiv \Delta z_{it}$ and $e_{it} \equiv \Delta e_{it}$ would produce our formulation. Hence, our specification is equivalent to the one used in most studies, except that we cannot identify variables that enter the wage level linearly. Notice that by taking first differences, individual level heterogeneity is removed that acts on the wage level.

The share of employees not covered by CWA is defined by 1-Ω. Wage growth can fall short of r_{it}. However nominal wage rigidities has to be taken into account in for these labour markets. Wage growth can be in one of the following three regimes:

$$\Delta w_{it} = \begin{cases} x_{it} b_t + e_{it} & \text{if} \quad x_{it} b_t + e_{it} \geq 0 \\ 0 & \text{if} \quad 0 > x_{it} b_t + e_{it} \geq -a_{it} \\ x_{it} b_t + l_{it} + e_{it} & \text{if} \quad -a_{it} > x_{it} b_t + e_{it} \end{cases} \qquad (2)$$

The notation, except for a, l is the same as used previously. Notice first that nothing prevents wage changes from being lower than r_{it} for these workers. But our model allows us to test for potential downward rigidity in nominal wages. The idea here is that while these employers are not constrained by central wage bargaining institutions, they might nevertheless be reluctant to cut nominal wages due to efficient nominal wage contracts, nominal loss aversion or nominal fairness standards. These render nominal wage cuts costly for the firms. Therefore, firms will not implement all desired wage cuts and, as a consequence, there will be a difference between the desired or "notional" wage cuts and actually implemented wage cuts. However, the larger the notional wage cut the more likely it is that the benefits will outweigh the costs. Hence, there may exist a threshold value a above which the firm starts decreasing the nominal wage: If the notional cut is below a the firm will not implement the cut but if the notional cut is above a the pay reduction will be implemented. In that case it is possible that pay reduction is damped by a factor, l.[19]

Our main focus in this paper is to estimate the extent and determinants of wage rigidity and its consequences for individual wages and employment prospects as well as aggregate employment patterns over the period from 1975 to 1995 in West Germany. The parameters of interest are the fraction of individuals covered by CWAs, Ω, the extent to which nominal wages are downward rigid, a, l, and the determinants of notional wage changes, b. Ω, a, l will be estimated from the data. There are various reasons why coverage and nominal rigidities differ between workers with different characteristics. An interesting feature of our approach is that we can test the relevance of potential factors, among them tenure, plant size, gender, nationality, unemployment history and stability of employment spells.

Notice that the specification does not impose any form of wage rigidity a priori. An estimate of Ω close to 100 per cent zero implies that everybody is covered by CWAs and that the increases in contractual wages dictate the degree of rigidity. If O is close to 0 this would imply that nobody is covered by CWAs. Hence, increases in contractual wages are not directly relevant. For intermediate values of O, however,

[19] As is implied by efficient nominal contracts, Malcomson (1999).

wage competition might nevertheless affect wage changes in the non covered parts of the labour market. a close to zero implies that there is very little nominal wage rigidity, and that employees are not shielded from nominal wage cuts. Large a's and small l imply that nominal wages are in fact never cut. Our model also allows for any intermediate case and provides us with a framework to evaluate the quantitative importance and interaction of each type of rigidity, contractual and nominal.

Measurement Error

If wages can be measured accurately, estimation of the equation above would be straightforward. The IABS contains information on incomes, however not on working hours. Income changes are only equal to wage changes when the hours worked remains constant. This is presumably not the case. There may exist for example variations in overtime payments. That is one reason for data pollution with measurement error. There are two other reasons for potential measurement error in the IABS (see also the Appendix). The first is a redefinition of income for the social security accounts. Most prominent is the redefinition in 1984, when bonuses have been included. The second reason is due to rounding, which causes measurement errors in the income growth rates. Since in the IABS a substantial number of observations with incomes reductions is observed it remains to be examined how many of these are indeed result from measurement errors, for example hours reductions.

Measurement errors are added in the following form:

$$\Delta y_{it} = \Delta w_{it} + m_{it} \qquad (3)$$

where Δy_{it} are the observed changes in incomes, Δw_{it} the unobserved changes in wages and m_{it} is measurement error. *Figure 10* illustrates the complications that this might cause. The top panels display the distribution of notional wage changes without any rigidities, *(a)*, of wage changes with wage rigidities *(b)* as generated by our model (with $\Omega = 0.75$, $r = 0.03$, $a = .054$, $s_e = 0.10$). The two spikes at zero and $r = 0.03$ mark the two types of rigidities that the model embeds. From such a distribution it would be straightforward to assess the degree of wage rigidity in the data. But notice what happens when measurement error ($s_m = 0.03$) is added to the data. The result is displayed at the bottom left histogram *(c)*. The histogram still exhibits the characteristic shape that was discussed earlier and which has been replicated for reasons of comparison for the 1985/86 sample of *stayers* in *Figure 10 (d)*. Wage rigidities raises mean wage growth to 0.047 and reduces its standard deviation to 0.059, *Figure 10 (b)*. Measurement error in addition leave mean wage growth nearly unaffected. However its standard deviation now raises to 0.086, *Figure 10 (c)*.

The complete model

To estimate the system of five equations it is necessary to know the likelihood that an observation is in one of the five earnings regimes, taking into account psossible measurement errors. Pulling all elements together, the likelihood of Dy_{it} is

$$
\begin{aligned}
l_{it} = \quad & \Big[f_{e+m}\left(\Delta y_{it} - x_{it}b_t \mid x_{it}b_t + e_{it} \geq r_{it}\right) prob\left(\Delta w_{it}^{*} \geq r_{it}\right) \\
& + f_{m}\left(\Delta y_{it} - x_{it}b_t \mid x_{it}b_t + e_{it} < r_{it}\right) prob\left(\Delta w_{it}^{*} < r_{it}\right)\Big]\Omega_{it} \\
& + \Big[f_{e+m}\left(\Delta y_{it} - x_{it}b_t \mid x_{it}b_t + e_{it} \geq 0\right) prob\left(\Delta w_{it}^{*} \geq 0\right) \\
& + f_{m}\left(\Delta y_{it} - x_{it}b_t \mid -a_{it} \leq x_{it}b_t + e_{it} < 0\right) prob\left(-a_{it} \leq \Delta w_{it}^{*} < 0\right) \\
& + f_{e+m}\left(\Delta y_{it} - x_{it}b - l_{it} \mid x_{it}b_t + e_{it} < -a_{it}\right) prob\left(\Delta w_{it}^{*} < -a_{it}\right)\Big](1-\Omega_{it}),
\end{aligned}
\tag{4}
$$

where $f_{e+m}(\cdot)$ is the density of the sum of e and m. It is assume that e and m are independent identical draws from normal distribution $N(0, s_e)$ and $N(0, s_m)$ respectively. This allows us to derive an explicit expression for (4) and estimate all parameters by maximum likelihood. Essentially, it is a switching regime model where the regimes are unobservable and need to be estimated.[20] Ω_{it} denotes the individual probability of being covered by CWA and a_{it} the individual threshold value above which the firm starts decreasing the nominal wage. It will be tested, whether these values indeed differ between observed characteristics of individuals or firms.

In order to gain a better understanding of the model, the following intuitive account of what features in the data identify which parameter might help:

- Ω_{it} is identified through how quickly the density drops just to the left compared to the right of r_t. If the observed density drops very quickly just to the left of r_t, this implies the fraction of individuals covered by CWAs.
- a_{it} is sensitive to asymmetries around $Dy = 0$. The smaller the observed density to the left of $Dy = 0$, the larger will a_{it} be.
- s_m, the standard deviation of measurement error, is primarily identified through observations that are relatively close to r_t and zero. These observations are particularly likely to be located in the spikes of the true wage distribution and entirely consist of measurement error.

---

[20] The model is an extension of the model that has been developed by Altonji and Devereux (1999) and Fehr and Götte (2000). Their models consist of equation (2) above and neither of the two models allow for rigidities stemming from CWA (equation (1)). Since that is a special case of the full model developed here, it is possible to test whether rigidities from CWA are relevant in West Germany at all or whether all rigidities are of the nominal type.

- Finally, b is estimated by taking the potential truncation of the true wages at $Dy = 0$ and of $Dy = r$ into account. Though complicated through the presence of measurement error, it is essentially a truncated regression model that gives the ML estimate of b.

Wage Sweep - up

Given that consistent values of a, b, s_e and Ω can be obtained from the data, the approach outlined above allows an assessment of the amount of wage rigidities. First it is possible to calculate the deterministic notional wage change for each individual in each year, $x_{it}b_t$. From that information one can calculate prevented wage cuts for employees with nominal wage rigidities and for employees with rigidities stemming from CWA. That measure is called the wage sweep-up, *?*, in the following. It is defined by $q^{nom} = E\left(0 - \Delta w_{it} \mid -a < \Delta w_{it}^* < 0\right)$ for nominal rigidities and $q^{CWA} = E\left(r_{it} - \Delta w_{it}^* \mid \Delta w_{it}^* < r_{it}\right)$ for contractual rigidities. $?^{nom}$ is the assessment of the wage sweep-up in a world where there are only nominal wage rigidities and $?^{CWA}$, where there are exclusively wage rigidities stemming from CWAs. The individual expected wage sweep-up then is the weighted sum of these two terms, weighted with the probability of being covered or not:

$$?_{it} = \left[E\left(r_{it} - \Delta w_{it}^* \mid \Delta w_{it}^* < r_{it}\right)\right]\Omega + \left[E\left(0 - \Delta w_{it}^* \mid -a_{it} < \Delta w_{it}^* < 0\right)\right](1-\Omega) \qquad (5)$$

The mean of individual values is a consistent estimate of the aggregate value of *?*. Note that this aggregate value is based on the entire wage change distribution of the observations in the sample. This value can be interpreted as the increase in labour cost due to downward wage rigidities in Germany. If the interpretation is correct higher wage sweep-ups should have some real consequences, depending on the sources and composition of wage rigidities. This is discussed in *section 7* below. With *?* we denote the share of employees who are attached to CWA and whose notional wage changes are below *r*. The next section discusses the estimates that have been obtained for a, b, s_e, s_m, Ω, *?* and q.

5 Empirical findings

Overview

The proposed model has been estimated based on the 20 samples drawn from the IABS. Based on the Maximum likelihood estimates for *movers* and *stayers* separately the share of employees with nominal and standard wage rigidities and the wage sweep-up (equation (5)) has been calculated. First some general economic and econometric findings are summarised. Next the wage sweep-up, the determinants of

notional wage changes and the extent and determinants of nominal and contractual wage rigidities are discussed in detail.

In the period from 1975 to 1995 there existed massive wage rigidities in West Germany. These can be regarded to be a robust phenomenon. The result of the log-likelihood ratio tests with respect to the relevance of rigidities from CWA is unequivocal: the model which consists only of nominal wage rigidities is clearly rejected for all samples of *stayers* and *movers*.[21] Contractual wage rigidities are evident for around 45 percent of the employees which implies that these in fact dominate nominal rigidities. Estimated CWAs coverage varies between 52 and 83 percent (*Table 7*). Nominal wage rigidities in the group of non covered employees are not absent. However they are not as important as in countries with decentralised wage determination. Surprisingly, roughly 50 percent of the employees show not rigidities. Therefore despite high coverage rates of CWAs, the wages in Germany are not that inflexible. The average wage sweep-up in the private parts of the economy varied over time between 4 and 8 percent (*Table 7*) and individually between zero and 17 percent. There are different reasons behind the wage sweep and in the absence of CWA the measured wage sweep would vary in the aggregate between 0,4 and 5,3 percent.

With respect to l it turned out that in the preferred estimate l equals a. So in fact wage reductions below the threshold value of a start with zero.[22] The models which hypothesise the same Ω or the same a for all employees[23] are rejected. There are differences between *stayers* and *movers*, which are consisted with economic reasoning. *Movers* have a lower probability of being covered by CWAs and wage rigidities are nearly absent, which confirms previous findings by Fehr and Götte (2000). Efficient nominal contracts and nominal fairness standards are constraint to the boundaries of firms.

The ML coefficient estimate of $ß$ varies substantially to the ones from simple OLS models of wage changes without taking wage rigidities into account. To document this, *Table 8* compares these two estimates for two out of the twenty samples. The results for the other samples confirm these differences. OLS estimates, which do not take rigidities into account, are biased.

Some determinants of notional wage changes (the estimated $ß$`s) vary over time, others show a higher degree of constancy (see *Table 9*). Plant characteristics such as *plant size* and *sector* vary to a larger degree than socio-demographic characteristics such as *age*, *gender* or *nationality*. The *Tenure* coefficients also seem to be relatively stable over time. Previous *periods of unemployment* matter, especially for

---

[21] Compare L (opt) restricted 3 and L (opt), *Table 6*.

[22] Compare L (opt) restricted 1 and L (opt), *Table 6*.

[23] Compare L (opt) restricted 2 and L (opt), *Table 6*.

movers. Wage competition from unemployment and the unemployed therefore exists. However, despite rising unemployment rates the degree of wage competition has not changed that much in Germany.[24] Wage competition could not unfold its potential for larger effective wage reductions due to the existing wage rigidities. The law of one price for labour is absent in the labour market. Due to wage rigidities the exchange of labour services takes place in bilateral trading islands rather than in auction markets.

CWAs do not only have direct impacts on wage rigidities for covered employees. There is also evidence on negative indirect influences on non covered employees and on nominal wage rigidities. In the non-covered sector the share of workers with true wage reductions (*Table 7*) is higher compared to countries with decentral wage determination like Switzerland.

Measurement error is relevant. Its standard deviation varies between 0.02 and 0.03 for *stayers* and 0.02 and 0.06 for *movers* (*Table 6*). The estimated standard deviation of notional wage changes varies between 0.09 and 0.12 for *stayers* and 0.13 and 0.16 for *movers* (*Table 6*).

Further estimates have been performed for sensitivity reasons. Among others separate estimates have been performed for blue and white collar worker, for men and woman, for full time German employees with full employment spells in *t-1* and *t*, and in the samples of workers with information on CWA changes. There is no evidence that the reported central findings are affected by the choice of samples.

Wage rigidities and the wage sweep-up: aggregate evidence

Table 7 summarises the findings with respect to q, a, Ω, $?$, q^{nom}, q^{CWA} and the estimated share of employees with nominal rigidities and wage reductions. To illustrate *Figure 11* displays the average values of a, Ω, $?$ and q for the twenty periods in the samples of *stayers*. The share of covered workers varies between 52 and 83 percent, with an average around 70. The figure suggests a greater variability of that share after 1984 compared to the time period before and a slight reduction in Ω over time (*Figure 11(a)*). This finding confirms the relevance of CWA in Germany and is in line with survey evidence.[25] More important for the issue of wage rigidities is $?$, the share of employees whose wages are prohibited from a decrease below CWA. These shares vary around 45 percent and with the exception of the lowest value in 1993, 37 percent, there seems to be no negative trend between 1975 and 1995, despite declining union membership.

The second part of *Figure 11(b)*, displays the average wage sweep-up and in addition aggregate employment growth rates in the private sector of the economy.

---

[24] A similar result has been reported by Agell and Lundstrom (1999) for Sweden.

[25] See Franz et al. (2000). Although union membership has declined in Germany, coverage has remained on a high level according to our estimates.

The wage sweep-up varies between 4 and 8 percent and years with a rising wage sweep-up often are years with falling growth rates in employment. For example, during the recession 1980 to 1981 the wage sweep-up rose from 5.4 to 7.3 percent. The rise of the wage sweep up in 1991 and 1992 was followed by negative employment growth rates after 1992.[26]

The average value of *a* is displayed in the lower part of *Figure 11(c),* together with the inflation rate. *a* varies between 1 and 13 percent hinting at varying degrees of nominal rigidities over the cycle. By and large the estimated *a* seems to be higher in low inflation times, a result which confirms Fehr and Götte (2000). However there are exemptions, for example the very low value in 1990, with growing inflation rates high employment growth resulting from the demand boost during German unification. Note that nominal rigidities can occur only for around 30 percent of the employees. On average roughly one quarter of these employees are protected against wage reductions by nominal wage rigidities.[27]

The share of workers with true wage reduction varies between five (in 1990) and 14 (in 1994) percent (*Table 7*). Firstly this findings suggests that nominal wages reduction takes place in Germany. Quite surprisingly it is more common than in Switzerland, where only two to four percent of workers experience true wage cuts, Fehr and Götte (2000). Secondly it shows that most observed income reductions in fact are the result of changes in working hours.

Figure 12 displays a, b, Ω, $?$ and q for *movers*. In general *movers* show less wage rigidities than *stayers* which is in line with theoretical considerations. Nominal wage rigidities are absent, which confirms previous findings by Fehr and Götte (2000). Efficient nominal contracts and nominal fairness standards are constraint to the boundaries of firms. Wage rigidities stemming from CWA for *movers* are less evident compared to *stayers*, although they do not fully vanish. The share of *movers* who are protected against wage reductions due to CWA varies between 14 and 23 percent. Moving between two different plants might not automatically imply leaving the boundaries of a firm. If there are periods of unemployment between the move rigidities are absent. In that case the probability of leaving the boundaries of a firm is evident.

---

[26] In *section 7* the relationship between the wage sweep–up and employment dynamics is investigated in greater detail taking into account sector variations.

[27] According to Knoppik and Beissinger (2001) 80 to 90 percent of workers are protected by nominal wage rigidities in Germany. From the viewpoint of the current analysis these numbers seem rather high. Since these authors do not incorporate contractual wage rigidities in their analysis, part of the measured nominal wage rigidities in their analysis might in fact be due to contractual rigidities.

Determinants of notional wage changes

The estimated *ß*-coefficients of notional wage changes are summarised in *Table 9*. Bold numbers indicate significant positive values, normal ones significant negative values.[28] Most of the factors contained in *x* have a non zero impact on wage change which differs between *movers* and *stayers*.

Age and *tenure* show a stable influence in all samples for *stayers* and age in the *mover* samples as well. Compared to the reference group (employees *aged 55 and more*) dynamic wage changes occur in the group of employees *aged 16 – 20*. The differentials decline with rising age. In the group of employees *aged 41 – 47* wage growth is around three percent higher compared to the reference group. Wage differentials from *tenure* amount to nearly 3 to 5 percent for *one to two years of tenure* compared to *more than ten years*.[29]

Vocational degrees matter for wage change and higher degrees lead to higher wage growth, which are significant nearly in all samples. Compared to workers without any formal vocational degree, the wages of workers with *Apprenticeship* and *Abitur* rise fastest. Furthermore wage growth of workers with *Abitur* without *apprenticeship* in some samples is higher than that of workers with *Apprenticeship* indicating the significance of analytical and cognitive skills in the age of computers.[30] *Upskilling* between *t+1* and *t* leads to a significant positive wage differential in 9 from 20 samples.

Plant size effects are evident for *stayers*. In most samples wage growth is higher for employees in small compared to large firms. However, in five samples the reverse is the case and in another five samples most coefficients are not different from zero.[31] In 10 samples a rise in the size of the plant between two consecutive years results roughly in a 1 percent wage growth differential.

Blue collar worker realised higher notional wage growth than *white collar workers* until 1986. Afterwards the sign reversed or the effect loose significance. Positive

---

[28] Coefficient which are not different from zero at the one percent level are left aside for reasons of clarity.

[29] That findings is in line with Dustmann and Meghir (1999) who also find (small) tenure effects, based on a sample of young workers aged less than 30 years from the IABS.

[30] Fitzenberger (1999) distinguishes between low, medium and high skilled labour. One finding is that wage growth for low and high skilled labour was higher than for medium skilled for men. Our finding based on six instead of three skill groups show that this result might have been partly an aggregation effect.

[31] The literature often reports on persistent wage level differentials between firms of different sizes with higher wages in larger firms. The work of Abowd et al. (1999) suggests that large part of these differences are in fact due to unobserved individual heterogeneity.

effects are sometimes evident for *part time workers*, for *females* compared to males and for *foreigners* compared to Germans.

For *movers* there are some further results. Moving in a larger firm results in higher differential wage growth. Furthermore changing the industry, and moving from East to West Germany (only available for 92/93, 93/94, 94/95) leads to positive wage growth differentials. Educational mobility, *upskilling*, results in higher wage growth differentials for *movers* compared to *stayers*.

From a labour market view the impact of individual unemployment experience and the contemporary unemployment probability on wage changes is important, as has been discussed in the literature on the wage curve.[32] Unemployment may enhance wage competition and lower wages may enhance employment. In a dynamic view such a self-correcting mechanism may, if it exists, ultimately restore full-employment. For *stayers* we measure negative impacts of unemployment experience. The coefficients are significant in the periods from 1983 to 1990 and loose significance thereafter. The estimated unemployment probability is negatively significant only in one sample. In the group of *movers* an unemployment period between leaving one plant in *t-1* and entering the other plant in *t* has negative influences on wage growth rates. 100 days of unemployment reduces wage growth between two and four percent. Depending on the cycle between ten and 28 percent of *movers* are hit by unemployment periods and the amount of *unemployment days* varied between 70 and 104. Therefore, wage competition from unemployment and the unemployed exists, which confirms previous findings from Büttner and Fitzenberger (2000), who find a negative relationship between unemployment and wage levels. Wage competition which results in notional wage changes can however not unfold its potential for larger effective wage reductions due to wage rigidities in large parts of the labour market. In addition, we find that the significance of notional wage reductions did not rise, despite rising unemployment rates. To the contrary the strength of the relationship has been weakened.

Wage rigidities and the wage sweep-up: observed heterogeneity

Attachment to CWA and nominal wage rigidities are influenced by individual and plant characteristics. In the empirical specification it was tested, whether working time, occupation, gender, nationality, education, tenure, unemployed experience, employment stability, plant size and the growth rate of CWAs influenced the probability of being attached to CWA. For nominal rigidities working time, employment stability, gender, nationality and the mean growth rate of CWAs has

[32] Blanchflower and Oswald (1994). For recent, somewhat modified studies on wage curves for Germany see also Büttner and Fitzenberger (2000) and Puhani (2001).

been incorporated in the sample of *stayers*.[33] The estimates of the marginal effects are displayed in *Table 10*.

Tenure and *plant size* significantly influences the probability of being attached to CWA. The probability of being attached to CWA is about 10 percent higher for employees who stayed 10 years or longer in a plant compared to new entrants or employees who stayed less than five years in the plant. The magnitude of the effect varies and the relationship is not monotonously raising over the samples. In small compared to large plants attachment is about 70 percent lower in some samples, which is in line with survey evidence. The magnitude of the effect varies over the samples and is monotonously declining with plant size. Furthermore it turns out that *white-collar* employees, *Germans*, employees with full employment spells in *t-1* and *t* (*spell type 1*) have robust higher marginal probabilities compared to their complements in all samples. Employees without *no formal vocational degree* have a lower probability of being attached to CWA than the employees with a formal vocational degree in most samples.[34] In most samples *female* have a higher probability of being covered by CWAs, which however is quantitatively not that large. Employees, who *never have been unemployed*, have a slightly lower probability of being covered by CWA.

a is higher for *full-time employees* and for employees with full employment spells in *t-1* and *t* (*spell type 1*). It is lower for *females* and *foreigners* confirming previous results by Fehr and Götte (2000) for Switzerland. This finding is in line with wage theories based on fairness and theories of efficient nominal contracts in repeated employer employee relationships. The wages of employees with a higher and lasting attached to a firm should be reduced less often.

Germans, *full-time employed*, *white-collar* workers, employees with full employment spells in *t-1* and *t* (*spell type 1*), employees whose *tenure* is five years and longer and employees who are working in *larger plants* have a higher probability of belonging to the group of employees with wage rigidities of both types. *White-collar* worker, *plant size*, *tenure*, nationality, employed full-time, and full employment spells (*spell type 1*) are amongst the more important single factors from a quantitative point of

---

[33] Since the share of employees for whom nominal wage rigidities are relevant varies only around 30 percent, the number of potential factors is lower here. Additional variables like the firm size as a determinant of a caused technical problems in the Maximum Likelihood procedure in a number of samples. In most samples of *movers* a is not different from zero and the inclusion of further characteristics does not change this result.

[34] Based on the GSOEP Fitzenberger et al. (1999) report a negative relationship between union membership and vocational skills and white-collar employees. CWA coverage and union membership are of course two different concepts. They are related nevertheless. Our findings suggest that blue-collar employees without any formal vocational degree have a lower probability of being a union member. This finding would be plausible, given that the low skilled are affected most by unemployment (Fitzenberger and Franz, 2001) and might be helpful in explaining wage strategies of unions.

view in most of the samples. Being an "insider" in wage determination depends simultaneously on a multitude of factors, whose influence may change over time. Therefore it is not correct to say that white-collar employees with full employment spells and high tenure working in large plants are the insiders. Nevertheless employees with these characteristics have a higher probability of belonging to the group of insiders and of being protected against wage reductions compared to blue-collar employees with low tenure rates in small firms.

Figure 13 displays the whole distribution of the wage sweep-ups in the 20 samples of estimation *(a)* and for reasons of comparison notional wage changes in addition *(b)*. There is a whole distribution of wage sweep-ups which vary over time and seems to depend on the business cycle. Compare the even distribution of the wage sweep-up in 1991 and 1992, a time with rising employment with the compressed one in 1994 and 1995, a time with falling employment. In 1994 the average wage sweep up amounted to four percent points, while inflation was 2.75 percent points, in 1992 to 8 percent points, with inflation rates of 3.92 percent points. Bargaining power of insiders unfold its influence on wages over time in a rather relative and incremental way, not in a radical way. *Figure 14* and *Figure 15* confirm the role of *plant size* and *tenure* for the pooled samples. For employees in small firms (*Figure 14*) and with low tenure (*Figure 15*) the distribution of the wage sweep-up is much more concentrated at zero, implying on average lower wage rigidities and lower wage sweep-ups in these groups over the whole observation period.

Direct and indirect effects of CWAs on wage rigidities

Do CWAs directly influence contractual wage rigidities and indirectly also nominal wage rigidities? Higher nominal growth rates of CWAs in one sector compared to another may indicate higher wage bargaining power of employees as a result of a higher unionisation, for example. It also may be the result of a growth in labour demand as a consequence of sector-specific positive demand shocks. Furthermore CWA might exert indirect impacts into the non covered sector of the labour market due to wage competition.

The empirical results with respect to the marginal influence of CWA growth rates are contained in *Table 10*. The table illustrates the marginal impact of a 1 percent higher standard wage on Ω and a. Surprisingly, the impact of CWA growth rates on coverage is negative in most samples, which at demand effects in the wage determination process instead of bargaining power. The indirect influence is with the exception of one sample always positive. Nominal wage rigidities rise with higher contractual wages. This finding hints at spillover effects of CWA to non covered labour markets. Higher CWAs make non-covered firms also more reluctant to cut their wages. The gains from nominal wage reductions declines with higher growth rates of CWAs.

The net effect on CWA on overall wage rigidities may be negative or positive depending on the magnitude of the direct and indirect impacts.

6 Consequences of wage rigidities

A framework for analysing the consequences wage rigidities

Real consequences of wage rigidities, if there are any, can differ between individuals, firms, sectors and time and between the reasons of rigidities. They will depend on the degree of bargaining power of employees, on the existence of efficiency wages and efficient nominal contracts and on employment protection laws. The consequences of CWA on the individual level depends on whether the bargain is over wages only ("right to manage") or over wages and employment ("efficient bargaining"). If it is over wages only and the firm has the right to manage than the higher the individual wage sweep-up the higher the probability of a job loss should be. If it is over wages and employment than the individual wage sweep-up might not be as important. "Insiders" with a high wage sweep-up might effectively protect themselves against job losses and they may in fact have no interest in efficient bargaining.[35] On the other hand wage sweep ups are the result of efficient nominal contracts and efficiency wages depending on nominal fairness considerations. The consequences of higher wage sweep-ups therefore depend on its sources. Bargaining power of employees and efficiency wages cause equilibrium unemployment. However the consequences for aggregate employment should be negative in the case of bargaining power and neutral or positive in the case of efficiency wages or efficient nominal contracts. At the individual level, higher wage sweep ups should indicate a stronger attachment to a firm (higher investment in specific human capital and trust) and less unemployment risks.

To assess the consequences of the wage sweep – up, q, it is assumed that q has an specific impact on individual employment and wage change and on sector employment growth. To uncover the consequences at the individual level models of the following kind in the sample of job *stayers* have been estimated:

$$y_{i;t+t;k} = d_{t;k} q_t + g'_{t,k} x'_{i,t} + e_{i,t,k} \qquad (6)$$

where y denotes an outcome variable and d the parameters of interest. k is an index for different outcomes to be explained below and t for the time in the future when y is measured. t will be one or four. x is a set of explanatory variables that shall control for other factors determining the outcome variable. To assess the differential

[35] This is a well known idea in economics, see Bewley (1999, 401ff) and Shister (1943).

consequences of the wage sweep–up x contains all explanatory variables from the deterministic part of notional wage changes as explained in section 3. The outcomes measure employment and income risk and are specified as follows:[36]

(1) any unemployment spell between t and t;

(2) still in the same plant at the key date $t+t$;

(3) any reduction in plant size in t compared to t;

(4) wage changes between $t+1$ and t.

With the exception of wage changes (4) these outcomes are qualitative in nature and equation 6 has been estimated using binary probit models. For wage changes our empirical model of wage rigidities explained in section 4 is re-estimated, now in the samples t, $t+1$. As an additional variable the value of the wage sweep-up, q_t , calculated from the estimates in the samples $t-1$, t is contained.[37]

The second examination of potential consequences takes place at the sector level. In the estimation samples from the IABS 63 sectors can be identified. To get an idea whether the wage sweep –up is related to aggregate employment dynamics, the average sector wage – sweep up, q_t^{agg}, has been calculated based on the twenty samples as the mean from the individual values for each sector. For reasons of comparison the average standard wage r_t^{agg} and the average income change Δy_t^{agg} for the 63 sectors has also been calculated. Employment levels for the 63 sectors, L_t, have been estimated for the 21 cross-sections from the IABS.[38] Sector employment growth rates between $t+t$ and t, t = 1, 2, 3, 4, ΔL_{t+t}, are defined as log differences of the number of employees. Based on these sector panel data, weighted ordinary least square regressions have been performed with sector- and time specific fixed effects:

$$\Delta L_{t+t,h} = m_h + m_t + k q_{t,h}^{agg} + n_{t,h} \qquad (7)$$

---

[36] Different outcomes investigated have been *upskilling* and leaving the social security account (for the four year period). Results are available upon request.

[37] Since q_t is missing for some observations in the samples t, $t+1$, the number of observations is lower than in the samples without q_t.

[38] Part– time employees with a working time below the half of the full working time were weighted with 0,4, part – time employees with a working time above the half of the full working time were weighted with 0,8, full – time workers received the weight one.

where ? is the parameter of interest. h = 1, ..., 63 is the sector index, t = 77, ..., 95[39] the time index and t indicates the lag length of employment considered. t is one to four. The same type of equation has been estimated with r_t^{agg} and Δw_t^{agg} instead of the wage sweep-up and in addition with the hypothetical wage sweep-up stemming solely from nominal wage rigidities, q^{nom}. $L_{t-1,h}$ is the weight used to account for size differences.[40]

Econometric findings

The econometric results with respect to the consequences of the wage sweep-up on individual unemployment and income risks is summarised in *Table 11* for the one year period ahead and in *Table 12* for the four year period. Note that these results are based on the samples of *stayers*. The tables contain the marginal probability effects only and the share of employees affected. Remember that this is a differential impact, given the other influences summarised in x, which capture education, age, gender, tenure a.s.o.. The wage sweep-up does not enhance the individual unemployment risk, neither in the near nor in the further future. Instead nearly all estimates show a significant negative coefficient, so that in fact higher wage sweep-ups and lower unemployment risks go hand in hand.[41]

The relationship between the wage sweep-up and plant mobility is not that uniform and depends on t and t. For the nearer future ($t=1$, *Table 11*) the coefficients are negative and significant with the exception for the period 1980 to 1984. In 1979 a severe recession started in Germany. In that period higher wage sweep-ups implied a higher probability of leaving the plant. The impact of the wage sweep-up on the four year probability of leaving the plant is less obvious. Although the marginal effect is negative for almost all samples, the coefficients are, as a rule, only purely defined. So other factors than the wage-sweep up dominate in the explanation of plant mobility in the four year period.

The third outcome variable investigated is plant size. The wage sweep-up raises significantly the probability of a decline in plant size in the nearer future. This finding hints at real indirect consequences of the individual wage sweep-up. Since the individual probability of leaving the plant is negatively affected by the rigidity (with

---

[39] In the 1976 cross section the sector distribution of employment differs a great deal compared to 1975 and 1977, which results in very high employment growth rates in some sectors. Therefore 1975 and 1976 are left aside for the aggregate impact analysis.

[40] The differences between weighted and ordinary least squares are not that large and we report only the former.

[41] We are not aware of a comparable result from the empirical insider-outsider literature which is according to Lindbeck and Snower (2001, 184) “still in its infancy”.

the exception 1980 to 1984) and plant sizes declined in the period of investigation employees with lower rigidities might have had a higher probability of leaving a plant as a consequence of wage rigidities. The plant size effect is not that obvious in the four year period (*Table 12*). In a four year period the employment adjustment consequences resulting from higher wage sweep-ups might have fully taken place and other factors determining plant size dominate.

The last finding for the individual level is that wage rigidities from the period *t-1, t* do not have a negative measurable impact on wage growth between *t* and *t+1* (*Table 11*). So higher wage sweep-ups in one period do not influence future wage changes. This may be due to bargaining power, efficiency wages or efficient nominal wage contracts as well.

Is there a relationship between the wage sweep-up and sector employment dynamics? *Table 13* contains average employment change, average change of CWA and of income change, and the wage sweep-up in the pooled sample for the 63 sectors.[42] The numbers hint at persistent wage growth and wage sweep-up differentials between sectors. The lowest average wage sweep-up occurred in service sectors (72, 74, 77, 86) with values between 4 and 4.8 percent, the highest values of 7 percent and more in industrial sectors (10, 57) and also in the health care sector (78). CWAs varied between 3.6 and 4.4 percent. The majority of CWAs do not differ that much. That is compatible with pattern wage bargaining in Germany. On the other hand a one percent difference in contractual wage changes in a period of 18 years reflects considerable and lasting wage level differences between the sectors. Observed effective income changes even vary between 4.6 and 7.1.

The results of the weighted fixed effects estimates in the panel of 63 sectors from 1977 to 1995 are documented in *Table 14*. The upper part of *Table 14* contains the estimated coefficients for the various lag length of (annualised) employment growth. The first column reports the coefficient for the wage sweep-up q^{agg}, the second for the wage sweep-up resulting only from nominal rigidities q^{nom}, the third for CWAs and the last for $Dy_{t, t-1}$.

The wage sweep-up exerts a negative significant influence on employment growth which is highest for the three year lag and declining thereafter. This finding hints at the importance of the wage sweep-up for sector employment dynamics. Since the correlation between wage rigidities and employment growth rates is negative, part of the wage sweep up is the result of bargaining power of employees. It is not CWA or wage growth per se that matters for employment, but the wage sweep up. If wage rigidities in Germany would have solely occurred as a result of nominal rigidities then there also would have been a negative correlation with employment change of almost

---

[42] Furthermore, the table contains the number of employees in 1995, calculated from the 1995 IABS cross section.

the same magnitude.[43] The correlation between actual and standard wage changes and employment dynamics is either not different from zero or positive, never negative. Part 2 of *Table 14* contains the partial correlation between CWA and the wage sweep-ups, q, q^{nom}, and on actual income changes. Higher CWA exerted a positive influence on the wage sweep-up and on actual income changes.

The reported coefficients suggest the following relationship between wage rigidities, employment growth and CWA changes. Between 1977 and 1995 the number of employees in the 63 sectors rose from 15.8 to 19.8 million. Average one year employment growth was 0.52 percent and the wage sweep-up amounted on average to 5.9 percent (*Table 14*, bottom). If during the whole period the average wage sweep-up would have been 5.4 percent instead, average employment growth would have been roughly 0.77 percent instead of 0.52 (0.52+(0.49*0.5)). In that case, in 1995 the average wage level would have been lower by a magnitude of 9.4 percent ($(1.005^{18} -1)*100$) and employment would have been higher by 4.6 percent points (or 0.89 million). One way to achieve that goal would have been moderate CWA. From part 2 of *Table 14* one can calculate that average annual CWA growth rates of roughly 2.9 instead of 3.9 percent would have been sufficient. So wage level in the covered sector would have been lower by 19,6 percent. These numbers are not so far away from recent estimates based on econometric models of labour demand equations by Fitzenberger and Franz (2001) for the low and medium skilled. A similar effect would have been achieved with more constant inflation rates over the whole observation period, but only if the nominal values of CWAs would have stayed the same (which in practice is not plausible).

Our empirical model of wage rigidities highlights one reason why moderate CWA did not occur in the past. Firstly, those individuals who gained most from higher CWA did neither suffer individually from employment nor from wage risks. Secondly, more moderate CWA do not imply a uniform wage reduction for all. According to our estimates (*section 5*) only about 45 percent of the employees would suffer from wage losses. These are the employees, who are protected by CWA against wage reductions. So the wage losses would have been concentrated on roughly 9 million employees. For the other employees, there would have been no (direct) wage losses, since their wages show no rigidities. In a dynamic view the relationship between individual wage losses, aggregate employment dynamics and wage rigidities becomes much more complex. However, in the light of these simple calculations unions wage strategies (no moderation in CWAs) do not seem to be that irrational. It resulted in nearly 20 percent higher wages for 10 million employees without higher individual unemployment risks. That has to be compared to the alternative of 20 percent lower wages, unknown impacts on the individual unemployment risk (perhaps even higher)

---

[43] This confirms findings of Fehr and Götte (2000) who report real negative consequences of nominal wage rigidities.

and 0.89 million additional employees whose wages perhaps also would have been 20 percent lower.

7 Concluding remarks

The paper investigates the existence and extent of wage rigidities in Germany, as well as its impacts on individual employment histories and plant and sector employment dynamics. To achieve that goal the paper extends the model of Fehr and Götte (2000) to take care of institutional aspect of wage determination in Germany. Wage determination is dominated by collective wage bargaining between unions and employer associations or unions and firms. Wages from collective wage bargaining may show up with specific wage rigidities and this possible dimension of wage rigidities has been added to the models of nominal wage rigidities. Central wage agreements typically are oriented at some measure of real wages, for example the rise in real labour productivity. As a methodical novelty the models allow a direct measure of the amount of wage rigidities from wage changes.

Our main findings, which are based on a large sample of employees working in 63 sectors of the private part of the West German economy from 1975 to 1995, are that indeed wage rigidities stemming from CWA dominate in Germany, and that the wages of roughly 45 percent of the employees staying in the same plant in two consecutive years, *stayers*, are protected against wage reductions below the CWAs. In addition, one quarter of the group of employees who are not covered by CWAs, are protected against nominal wage reductions. The overall wage sweep-up resulting from these two dimensions of rigidities in Germany varied between 4 and 8 percent in the period of observation. Wage rigidities are the reason that outside forces, especially unemployment, loose influence on wages.

Wage rigidities and wage sweep-ups are not distributed uniformly over the population of employees. There is evidence that *stayers* show up with higher wage rigidities than *movers*. The same is true for employees with more stable employment histories, for employees working in large firms and for employees with longer tenure rates, among others. Employees with these characteristics have a higher probability of belonging to the “insiders”, the employees whose wages are protected against wage reductions. It is furthermore shown that CWA exerts a positive spillover effect on the extent of nominal wage rigidities.

A framework is developed for the analysis of employment and wage impacts of rigidities on the individual, plant and sector level. The econometric findings hints at bargaining power from employees, efficiency wages and efficient nominal contracts in wage determination in Germany. Employees with higher individual wage sweep-ups do not have higher unemployment or wage risks within the imaginable future. However, on the sector level, a higher average wage sweep-up and lower employment growth rates go hand in hand. It is not as much the level of wage growth, but rather the wage sweep-up, that matters for employment dynamics. The analysis uncovered

the heterogeneity of labour markets and the degree of "monopoly power of each worker" (Gordon, 1981: 526), which, as our empirical results confirm, can work through market forces such as nominal fairness standards or institutional arrangements such as collective wage bargaining, or both.

Although the findings are (by and large) in line with the literature on European labour markets based on more aggregate data as reviewed recently in Bertola (1999) and Layard and Nickell (1999) and the German studies based on labour demand approaches (Fitzenberger and Franz, 2001) or structural models of central wage bargaining (Fitzenberger, 1999, Klotz et al., 1999) and seems to confirm recent theoretical explanations of wage rigidities, from our point of view it is preliminary in nature. Reflections on some of the reasons for the preliminary nature of the results may be helpful for future research. Firstly, there is a data problem, because there is no direct information on coverage and contractual wage levels. Information on contractual and effective wage levels would be helpful for improved estimations. Secondly the selection of employees into the covered and non-covered sector might in fact be endogenous, rising further questions of unobserved heterogeneity. Thirdly other input and goods markets are missing. These markets may also be characterised by rigidities. A deeper knowledge of imperfect competition in these markets may well lead to refined conclusions.

8 Bibliography

Abowd, J.M., F. Kramarz and D.N. Margolis (1999), High wage worker and high wage firms. *Econometrica* 67, 251-333.

Acemoglu, D., P. Aghion and G.L. Violate (2001), *Deunionization, Technical Change and Inequality.* Havard University Cambridge, Working Paper prepared for the Carnegie-Rochester Conference Series of Public Policy.

Agell, J. and P. Lundstrom (1999), *Survey evidence on wage rigidity and unemployment: Sweden in the 1990s*. Uppsala University, Working Paper Series 1999-12.

Akerlof, G.A., W.T. Dickens und G.L. Perry (1996), The Macroeconomics of Low Inflation. *Brooking Papers on Economic Activity* 1, 1–76.

Altonji, J.G. and P.J. Devereux (1999), *The extend and consequences of downward nominal wage rigidity.* NBER Working paper No. 7236.

Ashenfelter, O. and D. Card (Hrsg.) (1999), *Handbook of Labor Economics* (Vol. 3A – 3C), Amsterdam, Elsevier.

Beissinger, T. und C. Knoppik (2001), Downward Nominal Rigidity in West-German Earnings. *German Economic Review* 2 (4), 385–417.

Bender, S., A. Haas and C. Klose (2000), *IAB Employment Subsample 1975-1995. Opportunities for Analysis Provided by the Anonymised Subsample.* Bonn, IZA Discussion Paper No. 117.

Bertola, G. (1999), Microeconomic Perspectives on Aggregate Labor Markets. In: O. Ashenfelter and D. Card (Eds.), 2985 - 3028.

Bewley, T.F. (1999), *Why wages don't fall during a recession.* Cambrigde Ma., Harvard University Press.

Blau, F.D. and L.M. Kahn (1999), Institutions and Laws in the Labor Market. In: O. Ashenfelter and D. Card, (Eds.), 1399-1461.

Brown, M., A. Falk and E. Fehr (2001), *Contractual Incompleteness and the Nature of Market Interactions*. University of Zurich, Manuscript.

Büttner, T. and Fitzenberger, B. (2000), *Central Wage Bargaining and Local Wage Flexibility: Evidence from the Entire Wage Distribution*. University of Mannheim, Manuscript.

Campbell III, C.M. and K.S. Kamlani (1997), The Reasons for Wage Rigidity: Evidence from a Survey of Firms. *Quarterly Journal of Economics* 3, 759 - 789.

Card, D. and D. Hyslop (1997), Does Inflation "Grease the Wheels of the Labor Market"? In: C.D. Romer and D.H. Romer (Hrsg.), *Reducing Inflation*. Chicago, The University of Chicago Press.

Christofides, L.N. and T. Stengos (2001), A non-parametric test of the symmetry of PSID wage-change distributions. *Economic Letters* 71, 363–368.

Dustmann, C. and C. Meghir (1999), *Wages, experience and seniority.* London, The Institute for Fiscal Studies WP 99/1.

Fehr, E. and A. Falk (1999), Wage rigidity in a competitive incomplete contract market. *Journal of Political Economy* 107, 106–134.

Fehr, E., S. Gächter and G. Kirchsteiger (1997), Reciprocity as a Contract Enforcement Device: Experimental Evidence. *Econometrica* 65 (4), 833–860.

Fehr, E. and L. Götte (2000), *Robustness and Real Consequences of Nominal Wage Rigidity.* University of Zurich, Working Paper # 44.

Fitzenberger, B. (1999), *Wages and Employment Across Skill Groups. An Analysis for West Germany*. Heidelberg, Physica.

Fitzenberger, B. and W. Franz (1999), Industry-Level Wage Bargaining: A Partial Rehabilitation – The German Experience. *Scottish Journal of Political Economy* 46, 419-436.

Fitzenberger, B. and W. Franz (2001), *Jobs. Jobs? Jobs! Orientierungshilfen für den Weg zu mehr Beschäftigung*. In: W. Franz, H. Hesse, H.J. Ramser and M. Stadler (Eds.), *Wirtschaftspolitische Herausforderungen an der Jahrhundertwende*. Tübingen, Mohr Siebeck, 3–42.

Fitzenberger, B., I. Haggeney and M. Ernst (1999), Wer ist noch Mitglied in Gewerkschaften? *Zeitschrift für Wirtschafts- und Sozialwissenschaften* 119 (2), 223-263.

Franz, W. (1999), *Arbeitsmarktökonomik*. Berlin, Springer (4. ed.).

Franz, W., M. Gutzeit, J. Lessner, W.A. Oechsler, F. Pfeiffer, L. Reichmann, V. Rieble and J. Roll (2000), *Flexibilisierung der Arbeitsentgelte und Beschäftigungseffekte. Ergebnisse einer Unternehmensbefragung.* Mannheim, ZEW-Dokumentation 00-09.

Franz, W. and F. Pfeiffer (2002), Zur ökonomischen Rationalität von Lohnrigiditäten aus der Sicht von Unternehmen. *Jahrbücher für Nationalökonomie und Statistik* (in preparation).

Gordon, R. J. (1981), Output Fluctuations and Gradual Price Adjustment. *Journal of Economic Literature* 19, 493-530.

Hellwig, M. and Irmen, A. (2000), *Wage Growth, Productivity Growth, and the Evolution of Employment*. University of Mannheim, Manuscript.

Holden, S. (1994), Wage Bargaining and Nominal Rigidities, *European Economic Review* 38, 1021-1039.

Kaiser U. and F. Pfeiffer (2001), Collective wage agreement and firms‘ employment policies. *Labour* 15 (2), 319-341.

Kahn, S. (1997), Evidence of Nominal Wage Stickiness from Microdata. *The Economic Review* 87 (5), 993 – 1008.

Klotz, S., F. Pfeiffer and W. Pohlmeier (1999), Wirkung des technischen Fortschritts auf die Qualifikationsstruktur der Beschäftigung und die Entlohnung. *Jahrbücher für Nationalökonomie und Statistik* 219 (1+2), 90-108.

Lindbeck, A. and D.J. Snower (2001), Insider versus Outsider. *The Journal of Economic Perspectives* 15 (1), 165- 188.

Malcomson, J.M. (1999), Individual Employment Contracts. In: O. Ashenfelter und D. Card (Eds.) Vol. 3B, 2291–2372.

McLaughlin, K.J. (1994), Rigid Wages? *Journal of Monetary Economics* 34, 383 – 414.

McLaughin, K.J. (2000), *Asymmetric Wage Changes and Downward Nominal Wage Rigidity*. City University of New York, Working Paper.

Neumann, M.J.M., R. Schmidt and E. Schulte (1990), Determinants of contract wages in Germany. *European Economic Review* 34, 1233–1245.

Nickell, S. and R. Layard (1999), Labor Market Institutions and Economic Performance. In: O. Ashenfelter und D. Card (Eds.), Vol. 3C, 3029 – 3084.

Puhani, P.A. (2001), *Wage rigidities in Western Germany? Microeconometric evidence from the 1990s*. Mannheim, ZEW Discussion Paper 01–36.

Shister J. (1943), The Theory of Union Wage Rigidity. *Quarterly Journal of Economics 57*, 533 - 542.

Smith, J. S. (2000), Nominal Wage Rigidity in the United Kingdom. *The Economic Journal 110* (March), 176 – 195.

Tobin, J. (1972), Inflation and Unemployment. *American Economic Review* 62 (1), 1-18.

Topel, R. (1991), Specific Capital, Mobility, and Wages : Wages Rise with Job Seniority. *Journal of Political Economy* 99 (1), 145 – 176.

8 Appendices

8.1 The IAB Employment Subsample 1975-1995

The microeconometric part of the paper is based on the IAB Employment Subsample 1975-1995 (IABS) for West Germany.[44] The IABS is a 1 percent random sample drawn from the German social security accounts, enriched with information on benefits recipients from the unemployment insurance system and by characteristics of the plants where the workers is employed, including size, sector activities and an individual plant identification number.[45] The information results from employer reports for its employees who are covered by the system of social security.[46] Civil servants, self-employed workers and workers whose earnings are below a minimum wage threshold are not included.[47] The public use file of the IABS is organised in the from of spells which covers the periods from 1975 to 1995. It contains 6,711,153 spells from 483,327 West Germans.

The advantage of the data is the official status of the information around wage work, including income. However, the original information has been changed somewhat for the public use file, the IABS, and precise information on working hours is missing. Available is the average value of (gross) income, calculated on a daily base and rounded to the lower integer value. The starting and endpoint of the corresponding employment spell is also available. The value of daily income can be censored from above or truncated from below. If the income lies above the upper social security threshold,[48] the threshold is reported instead. Furthermore it is indicated if the wage is below the lower social security threshold, and the employee is already part of the IABS. The correct value of that income is not reported. Three categories of working hours are available: full time, part time and less than part time. Since we are interested in wage changes and not in income changes the econometric procedure will take account of potential errors due to unobserved changes in working hours.[49]

---

[44] The IABS employed in our study covers the period from 1975 to 1995, for a description see Bender, Haas and Klose (2000).

[45] A firm usually is defined as a legal entity, a plant as an economic entity. Plants can be placed at various stations or can consists of different factories. For example a plant of the automotive industry can have five factories.

[46] In 1993, approximately 78 percent of the employed were covered by the system of social security, Statistical yearbook for the Federal Republic of Germany (1995: 110, 114), own calculations.

[47] 'Geringfügigkeitsgrenze'. In 1995 the threshold value was DEM 580 a month, or around 19 DEM a day. In 1975 the monthly value was DEM 350.

[48] 'Beitragsbemessungsgrenze'. The nominal value of the Beitragsbemessungsgrenze amounted to DEM 260 a day in 1995 or DEM 7.800 a month. In 1975 the monthly value was DEM 2.800.

[49] Furthermore it has to be taken into account that the definition of income in the social security accounts has been extended somewhat during the observation period. Especially since 1984 one-time payments to the employee have been included.

The samples constructed from the IABS

To study wage rigidities we draw 21 samples from the IABS, dated to the key date June, 30th, of each year (see *Figure 2*). Income changes are defined based on the differences between two consecutive key dates. The time interval for a wage change therefore is chosen to be one year, lasting from June, 30th in *t-1* to June 30th in *t*. Since collective wage bargaining rounds typically are replicated on a year to year basis in Germany the choice of one year seems to be reasonable. The number of observations with an available employment or unemployment spell at the key date for West Germans vary between 193,685 in 1975 and 221,790 in 1995 (*Table 2*). The estimates on wage rigidities have been performed on samples of blue and white collar workers who are employed on both key days and for whom daily earnings is available for the key dates at *t-1* and *t*. An estimation sample with t = 1995 therefore in fact is a two period panel with information from 1994 and 1995. 20 samples have been constructed.

The samples are furthermore restricted to workers from the private economy[50] and to workers who did not change the working hours category in the two consecutive years. The remaining number of observations is 132,682 for 1976 and 151,975 for 1995. The information on educational attainment, which has been identified as an important dimension of wages and employment in numerous studies, is unfortunately missing for a significant fraction of workers in the IABS. Furthermore the values of daily incomes up to DEM 5 below the upper threshold seem to be not reliable and have been excluded as well as small incomes which do not exceed the lower threshold by DEM 10.[51] In addition, observations with observed income changes below the 1 and above the 99 percentile are disregarded. The number of observations for the estimation therefore reduces to 100,472 in 1975 and to 112,581 in 1995. The further analysis is based on these samples.

Merging collective wage agreements to the IABS

The information of CWA for an individual employee is not contained in the IABS. It is neither known, whether an individual employee is covered by CWA or a member of a union. In Germany payment traditionally has been differentiated between *Blue-collar worker* ("Arbeiter") and *White-collar worker* ("Angestellte") and there are two systems of social security accounts, one for each category. Information on the yearly rise in CWAs for the two types of workers has been calculated from official sources.[52] The IABS uses a two digit classification scheme of economic sectors, the Federal Statistical Office a different five digit classification scheme. By and large it was possible to find adequate categories. For the sectors

---

[50] Employees in agriculture and private services and in the public sector in t are excluded. In agriculture self-employment and unpaid family workers are more common than in other sectors, which might lead to special wage setting mechanism. Wages in the public sector are bargained between politicians and unions and not between firms and unions.

[51] In each cross section, there is a significant rise in the fraction of workers with values of daily incomes around DEM 2,3,4 and 5 below the upper threshold, which presumably results from a wrong codification. These values should be 300 in the code of the IABS instead. All estimates have been performed in addition in samples without these restrictions (sample type 1 in *Table 2*). Wage rigidities based on these samples are even more evident. The results are available upon request.

[52] Taken from STATIS - Statistical time series on CD-ROM, 1999, published by the Federal Statistical Office, Wiesbaden, 1999 (Statistisches Bundesamt, Fachserie 16, Index der Tariflöhne und –gehälter).

with missing CWA information[53] average CWA changes were imputed instead. Descriptive statistics of CWAs and nominal income changes are presented in section 3.5 below.

Employee and Employer Characteristics in the IABS

The IABS contains information on age, gender, formal educational attainment, nationality, occupation, the employment spell, and the size and sector activity of the plant for each spell.[54] Further information on the employment histories of employees, including tenure and unemployment duration has been calculated from the entire panel information of each person. Furthermore, the individual probability of unemployment has been imputed from the cross section information. Individual characteristics such as age, gender or vocational qualification determine general human capital. Characteristics of the plant are important determinants of the attachment to CWAs. Tenure indicates plant specific human capital and/or seniority payment. Periods of unemployment as well as the imputed individual probability of unemployment shall be helpful in modelling the relation between unemployment and wage changes on the individual level.

A worker is defined to be a *stayer*, if he/she has the same plant identification number at the two consecutive key dates of one sample.[55] If the plant identification number differs, the worker is defined as a *mover* instead. All estimations are performed in either the samples of *stayer* or those of *mover*. One reason is that we do not know whether *movers* between plants stay in the same firm or leave the boundaries of a firm. Leaving the firm or moving between two plants of one firm are obviously two different things with respect to wage rigidities. Leaving the firm might enhance the likelihood of changing the relevant CWA, while changing the plant not. Furthermore, leaving the firm might be involuntary because of bankruptcy for example. We will rest our main emphasis on the sample of *stayer*. Nevertheless evidence for *movers* seems to be important since wage flexibility in Germany might be enhanced through mobility between firms, if wage rigidities are not as important for *movers* compared to *stayers*, which is an empirical question.

From the information contained in the IABS we constructed eight *age* groups and six *vocational education* groups. *University* and *Technical university* typically imply 18 or 16 years of overall schooling, 5 respectively 4 at a university or a technical university. *Apprenticeship* means a vocational education in one of 372 occupations of the dual vocational training system, which on average last three years and a prior of 9 years of general schooling. Persons with *Abitur* have successfully finished 13 years of schooling at a grammar school.[56] *Upskilling* takes the value 1 for all those observations, whose vocational degree in $t+1$ is higher than in t and the value 0 otherwise. *Table 3* summarises the definition of all variables constructed for estimations.

---

[53] 17 percent in 1976 and 28 percent in 1995. These are mainly (growing) service sectors, where coverage is lower compared to manufacturing, Kaiser and Pfeiffer (2001).

[54] Information on family background (married, number of children) is unfortunately often missing and seems to be not very reliable. Therefore it has been excluded.

[55] Studies based on the PSID typically are based on workers who stayed at the same job in two consecutive years (for example Altonji and Deveroux, 1999). The concept used in our study presumably includes a larger share of workers.

[56] In the German educational system *Abitur* is a prerequisite to enter a university or technical university. There are two categories of persons with *Abitur*, who did not enter a university: those with an additional apprenticeship degree and those without. Persons without any formal vocational degree constitute the reference category.

Working time is divided into *Full time, Part time* and *Less than part time* hours. Information from employment and unemployment spells is used to construct further information on individual employment histories. Nine categories of employment *spells* have been constructed to control for heterogeneity stemming from different length and types of the spells. From the ISCO-code of occupations we defined three broad categories of activities belonging to *Primary*, *Secondary* or *Tertiary* occupations. *Foreigners* are workers who have no German nationality. *Plant size* is available in eight size categories and two variables indicate changes in the plant size between two consecutive years. *Sizeup* equals one if in *t* the plant size category is higher than in *t-1*, *Sizedown* equals one if in *t* the plant size category is lower than in *t-1*, and *Samesize* equals one if plant size does not change.[57]

For every key date the cumulated individual *number of days in unemployment* has been calculated and transformed into five categories (*Never unemployed, Up to three (months), Three to six, Six to twelve and Twelve months and more*). Furthermore for every key date the cumulated number of days in the same plant (*Tenure*) has been calculated and transformed in up to 8 tenure categories.[58] The individual probability of being unemployed stems from logit estimates (1 unemployed, 0 employed) based on the cross section data for the period with explanatory variables *age*, *age* square, *female*, *foreigner* and *vocational education*.[59]

Descriptive statistics for the five selected sample 1976, 1981, 1986, 1991, 1995 and differentiated according to *stayer* and *mover* are contained in *Table 3*. The evolutionary pattern of the German labour force becomes quite obvious from comparing the means over time: The restructuring of the economy from industries to services in conjunction with a continuous process of ageing, a decline of the low skilled and a decline of the share of large plants (with 1,000 and more workers) is visible. Participation of woman is rising, the number of workers who never have been unemployed declined steadily to 66 percent in 1995. The individual year to year probability of being unemployed has risen to 7.7 percent in 1995 and seems to be moderately higher for *stayers*. Job *movers* are more often younger, female, better educated, employed full-time than *stayers* and furthermore, they more often worked in smaller firms before the job change. The share of persons whose formal educational attainment has been improved amounts to 9 percent for *movers* and 1 percent for *stayers* with a declining tendency especially in the group of *stayers*.

---

[57] In addition all estimates contain a full set of the two digit code of sector activities. Some sectors have been aggregated so that categories contain 200 or more observations.

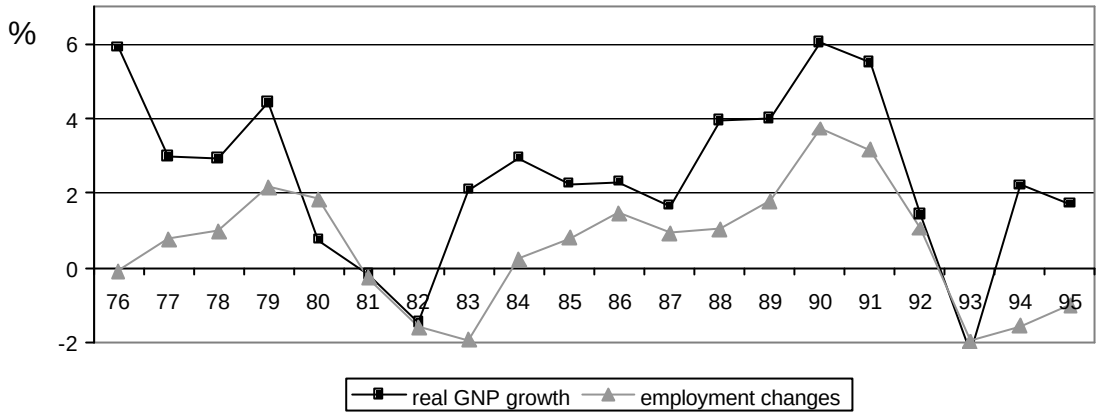
[58] Unfortunately, it is not possible to construct exact tenure information before 1975. Therefore, starting with 1976 with every consecutive sample the number of tenure categories is rising (*Table 3*). For unemployment duration the same argument holds. Since the number of officially registered unemployed persons rose from 149,000 in 1970 to 582,000 in 1974 and to 1,074,000 in 1975, the cumulated numbers of days of unemployment are perhaps underestimated.

[59] For *movers* there are three extra variables: *Change of industry* indicates whether a change in the sector has taken place simultaneously with the job change, *Change of region* indicates whether the employee always has been in West Germany or has experience in East Germany (only for the samples 1993, 1994, 1995), *unemployment spell t, t-1* indicates whether the employee has been unemployed between the job change. *Unemployment days t, t-1* refers to the number of days in unemployment.

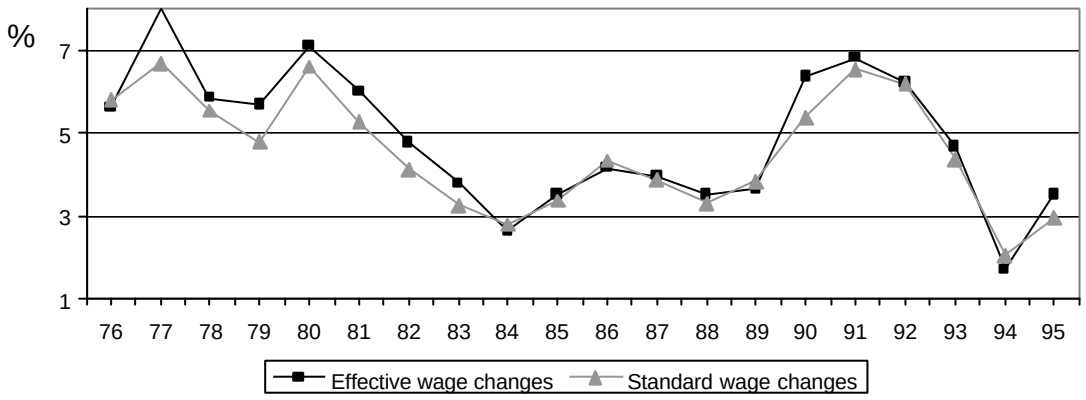
8.2 Figures and Tables

***Figure 1*:** Wage changes and economic indicators from aggregate data

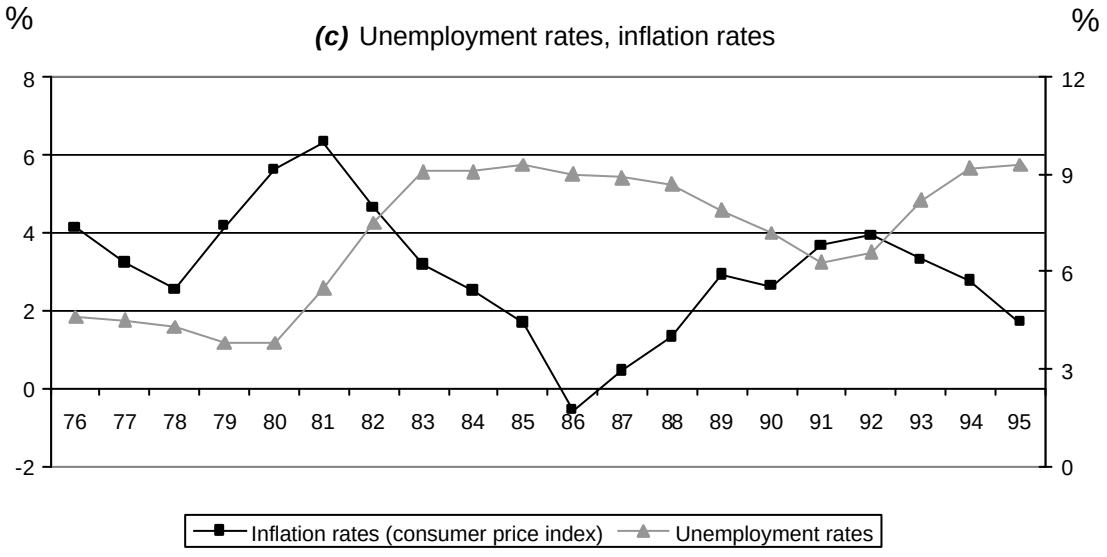
(a) Real GNP growth, employment change



(b) Effective and standard wage changes in nominal terms



(c) Unemployment rates, inflation rates



Source: DIW Vierteljährliche Gesamtrechung; employment is restricted to the private sector of the economy; all variables are calculated as log differences (see *Table 1* for more information).

Figure 2: Outlining the genesis of 20 two year samples from the IABS

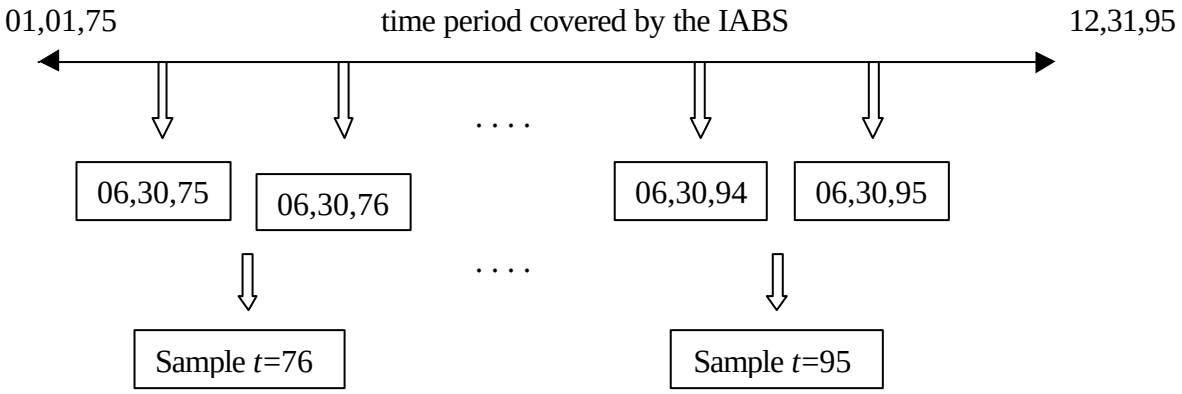
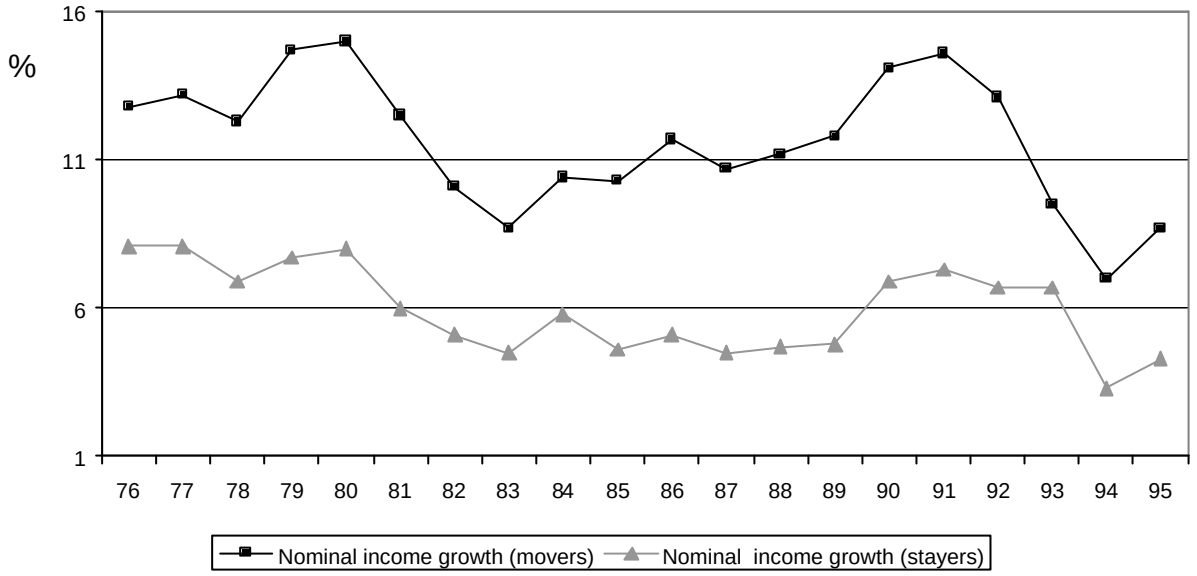
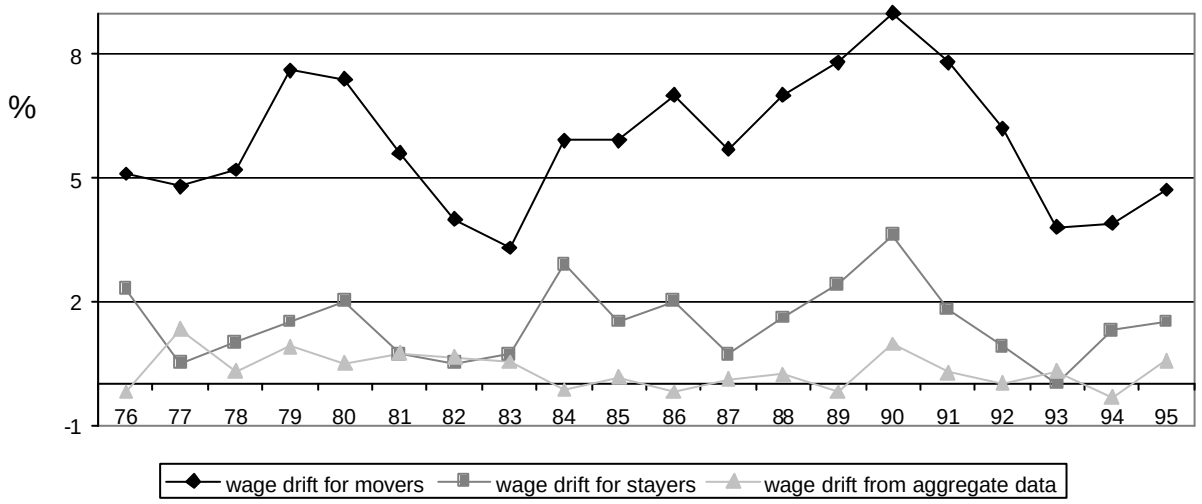


Figure 3 **:** Average nominal income growth and wage drift

(a) Average nominal income growth for *stayers* and *movers*

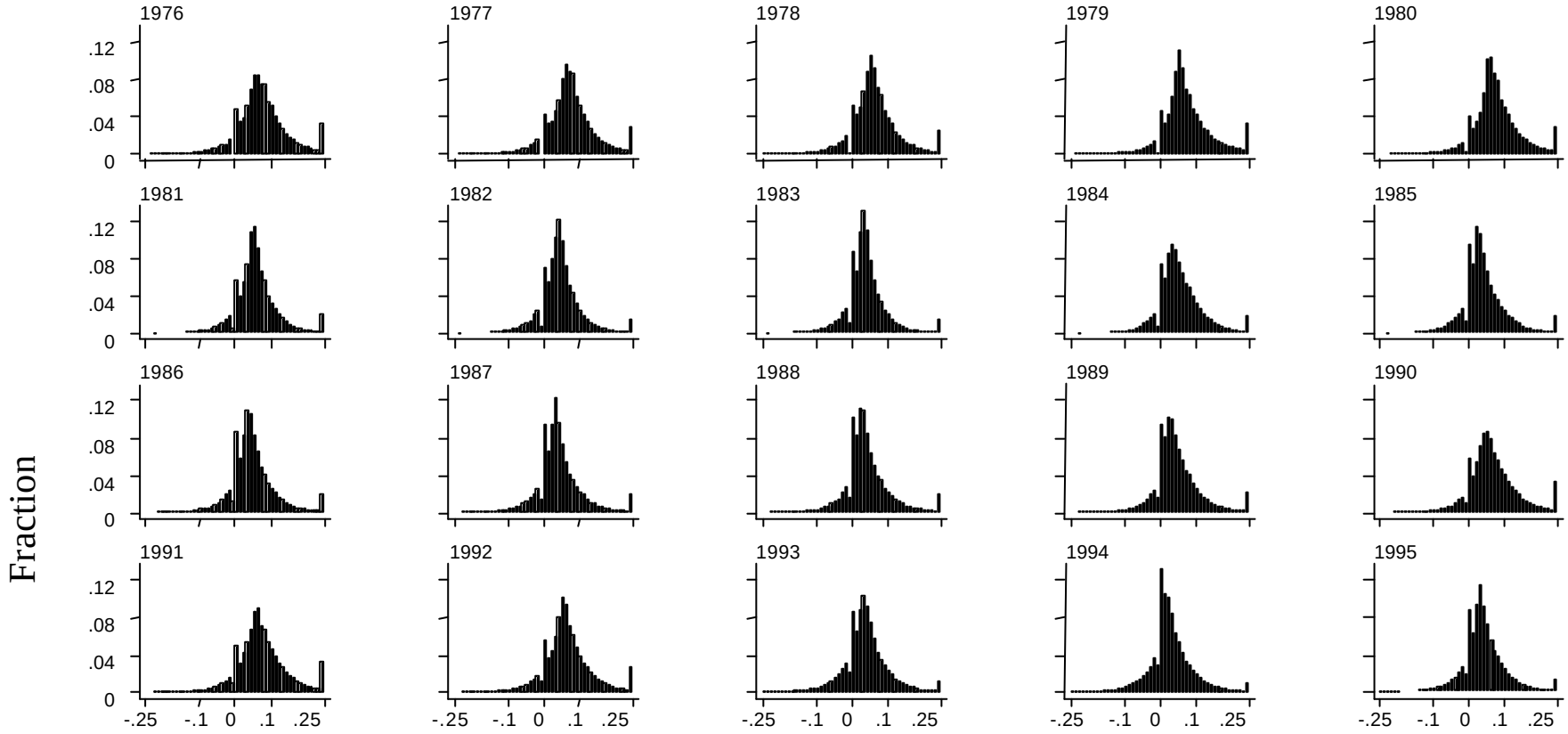


(b) Wage drift for movers, stayers, from aggregate data



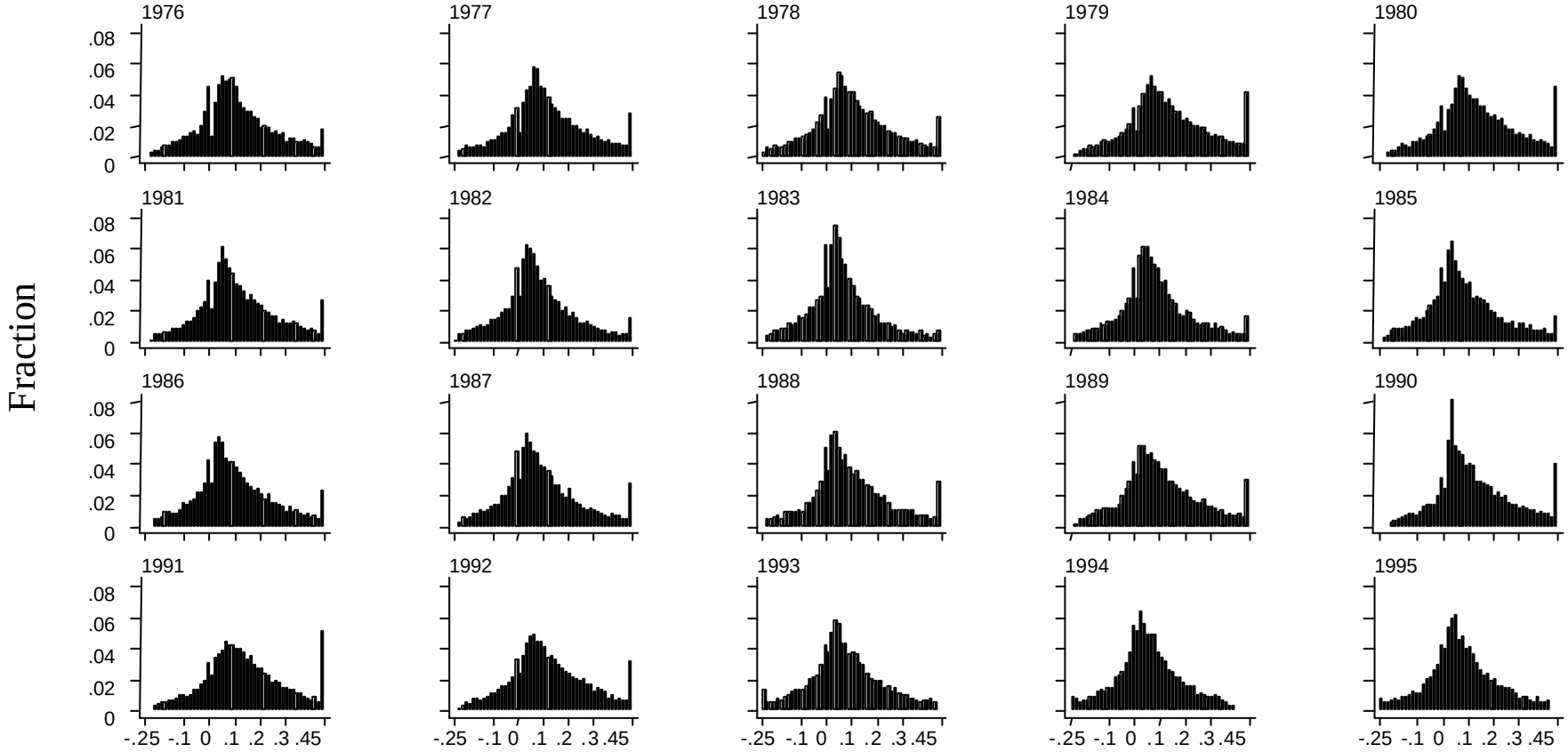
Source: based on *Table 4.*

***Figure 4*:** Distribution of nominal income changes for *stayers*, 1976 - 1995



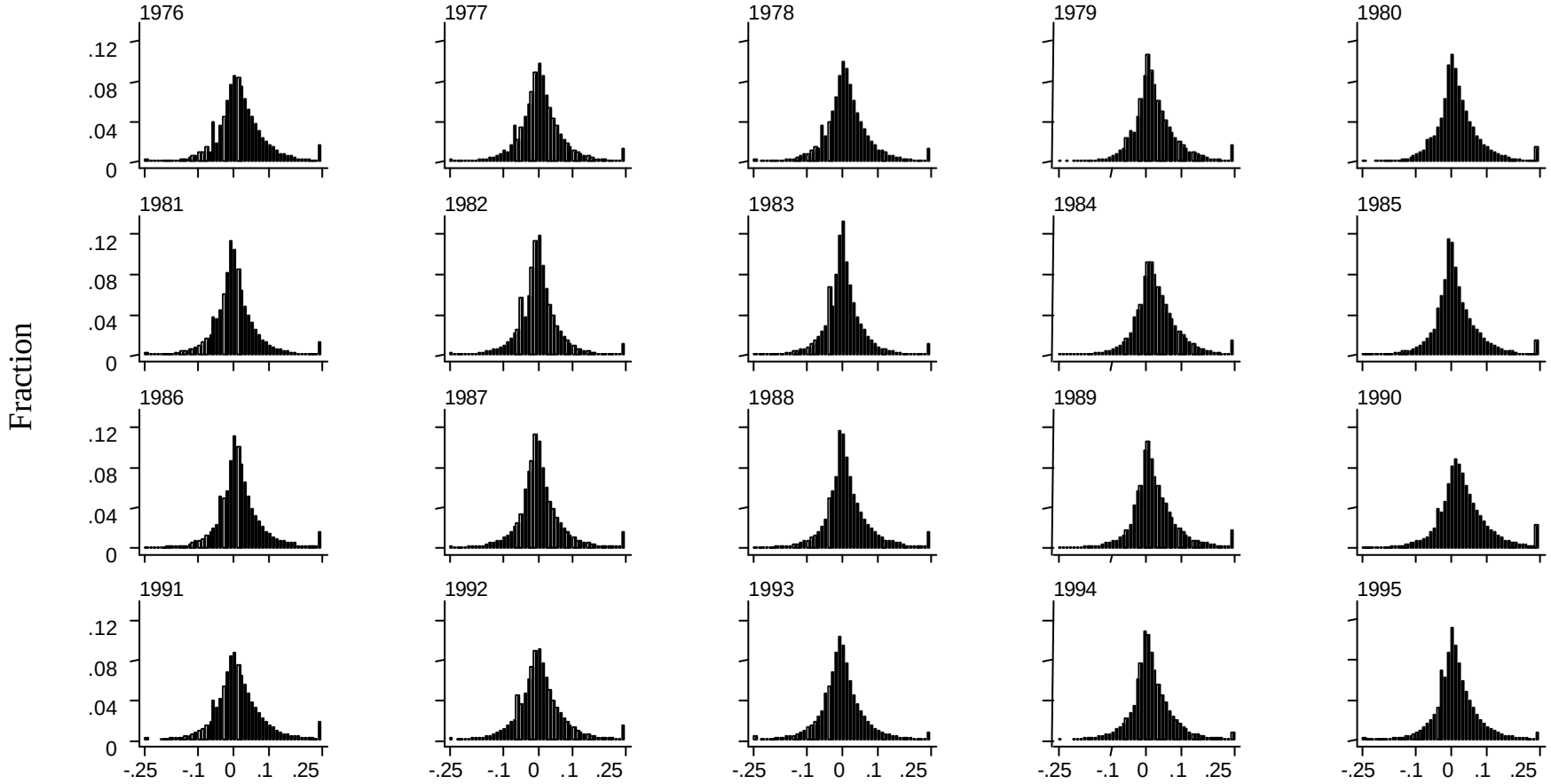
($\hat{m}$; $\hat{s}$): (0.077; 0.077 / 0.077; 0.075 / 0.065; 0.074 / 0.076; 0.076 / 0.080; 0.074 / 0.060; 0.071 / 0.048; 0.068 / 0.041; 0.066 / 0.056; 0.072 / 0.044; 0.072 / 0.050; 0.071 / 0.045; 0.073 / 0.044; 0.073 / 0.049; 0.074 / 0.071; 0.079 / 0.077; 0.080 / 0.068; 0.077 / 0.039; 0.070 / 0.030; 0.067 / 0.043; 0.068)

***Figure 5*:** Distribution of nominal income changes for *movers*, 1976-1995



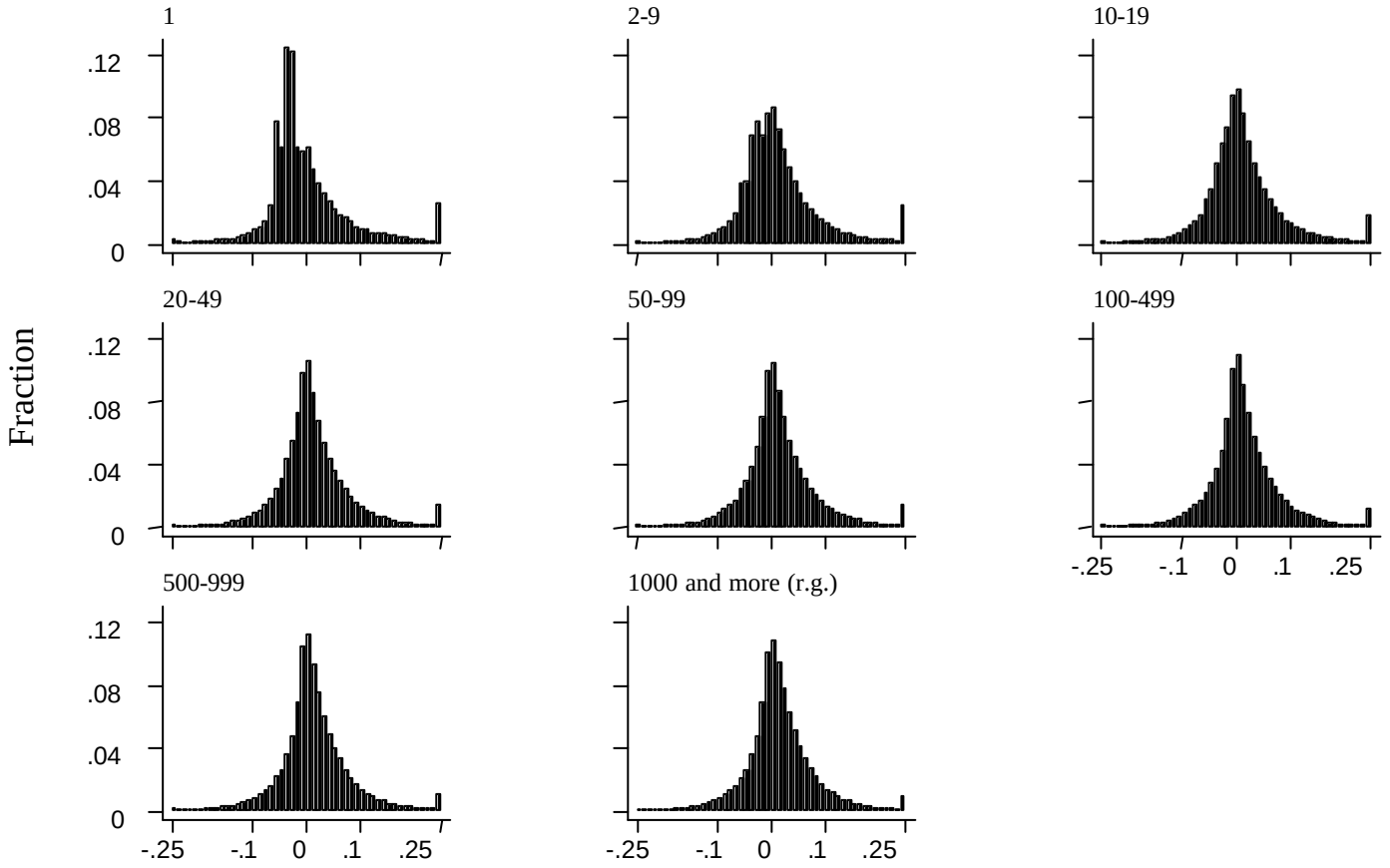
($\hat{m}$; $\hat{s}$): (0.106; 0.146 / 0.115; 0.149 / 0.105; 0.151 / 0.129; 0.156 / 0.135; 0.155 / 0.110; 0.147 / 0.083; 0.140 / 0.067; 0.129 / 0.087; 0.140 / 0.087; 0.143 / 0.099; 0.146 / 0.093; 0.146 / 0.098; 0.148 / 0.105; 0.150 / 0.125; 0.149 / 0.137; 0.157 / 0.120; 0.151 / 0.077; 0.142 / 0.057; 0.129 / 0.075; 0.134)

***Figure 6*:** Distribution of nominal income changes net of CWA, *stayers*



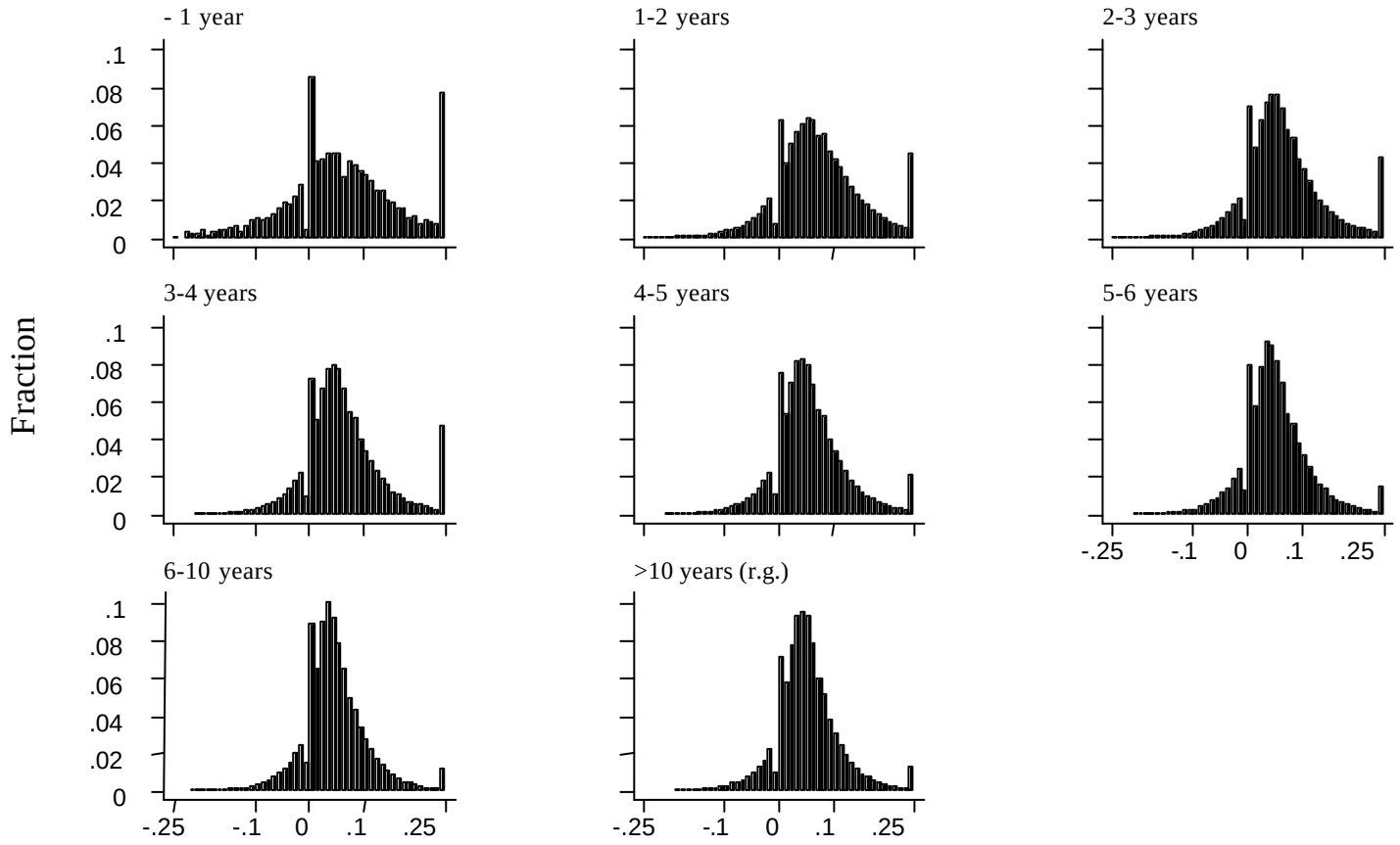
$(\hat{m}; \hat{s})$: (0.022; 0.078 / 0.009; 0.075 / 0.016; 0.074 / 0.025; 0.075 / 0.020; 0.074 / 0.006; 0.072 / 0.005; 0.068 / 0.007; 0.066 / 0.029; 0.072 / 0.015; 0.071 / 0.020; 0.072 / 0.008; 0.074 / 0.017; 0.073 / 0.024; 0.074 / 0.036; 0.080 / 0.018; 0.081 / 0.008; 0.078 / 0; 0.070 / 0.013; 0.067 / 0.016; 0.068)

***Figure 7*: Distribution of income changes net of CWAs in 8 plant size groups, pooled sample**



$(\hat{m}; \hat{s})$: (0.004; 0.086 / 0.015; 0.083 / 0.014; 0.077 / 0.015; 0.075 / 0.016; 0.074 / 0.016; 0.072 / 0.016; 0.069 / 0.017; 0.067)

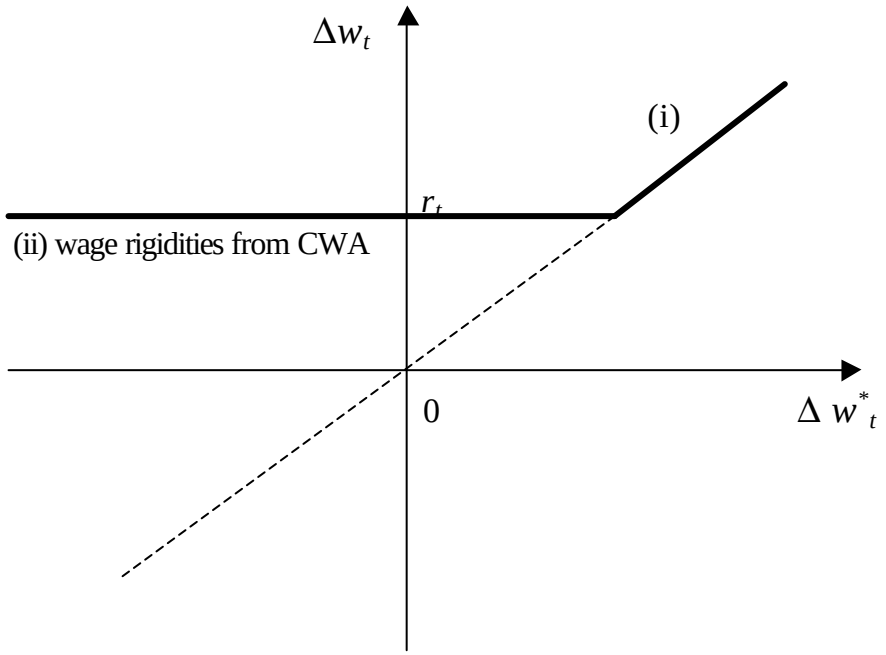
***Figure 8*:** Distribution of income changes in 8 tenure groups, pooled sample



$(\hat{m}; \hat{s})$: (0.066; 0.117 / 0.075 0.090 / 0.067; 0.090 / 0.067; 0.093 / 0.057; 0.075 / 0.051; 0.069 / 0.046; 0.066 / 0.052; 0.066)

Figure 9: Actual and notional wage changes in the mixed system of wage determination

(a) labor markets covered by CWA



(b) non covered labor markets

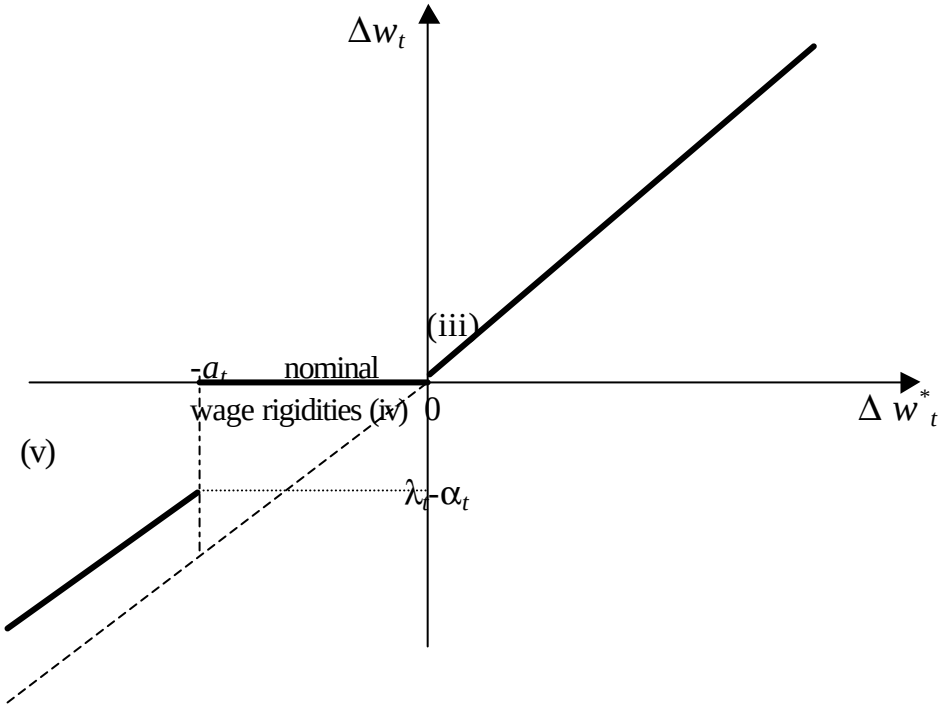
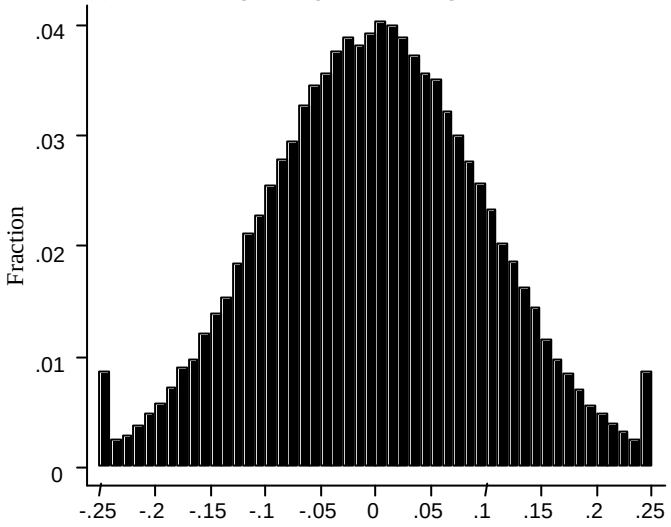


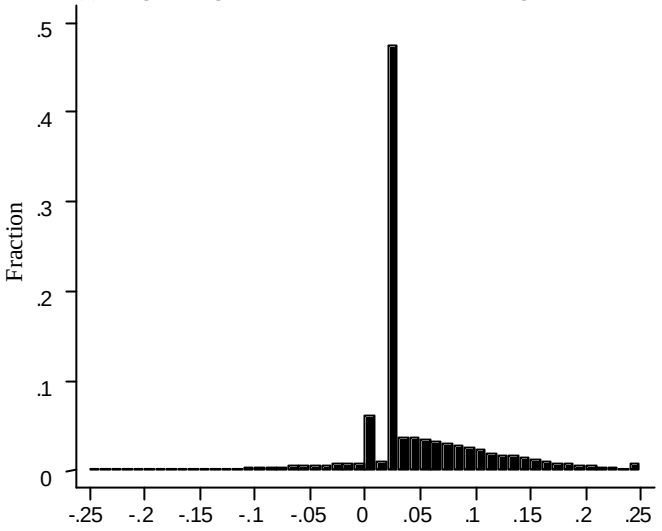
Figure 10: Simulated wage changes with measurement error and income changes

(a) Notional wage changes without rigidities



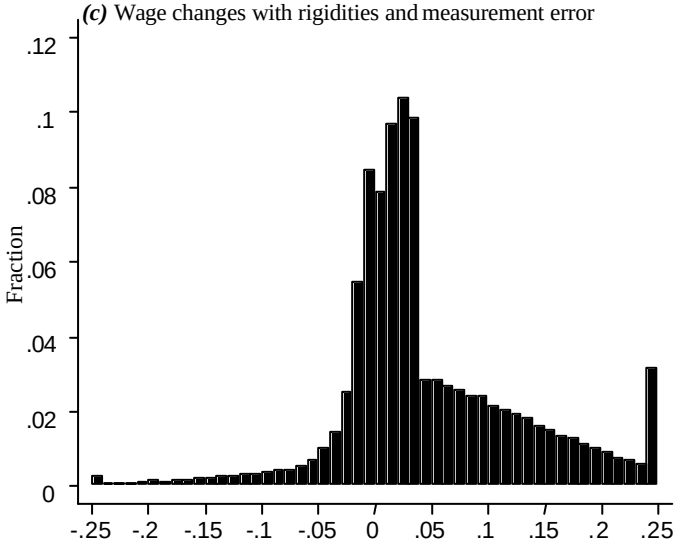
$\Delta w^{*} \sim N(0;0.10)$

(b) Wage changes with nominal and standard rigidities



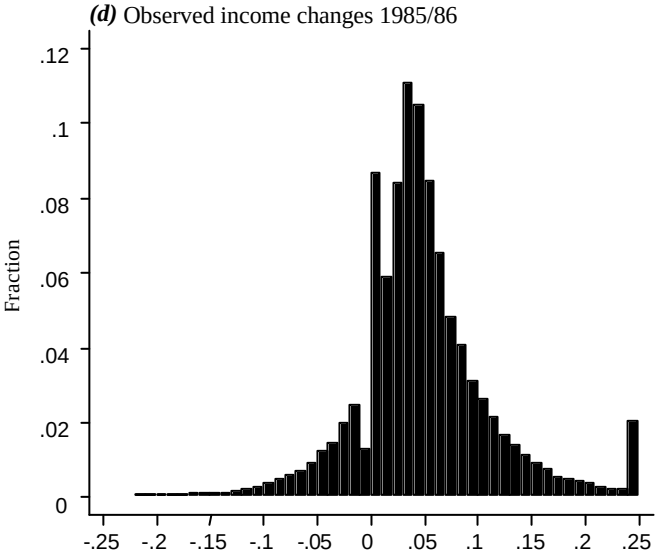
$Dw(a = 0.054;\ W = 0.75;\ r = 0.03)$; mean=0.047; std.-dev=0.059

(c) Wage changes with rigidities and measurement error



Δw+m ($N(0;0.03)$); mean=0.048; std.-dev.=0.086

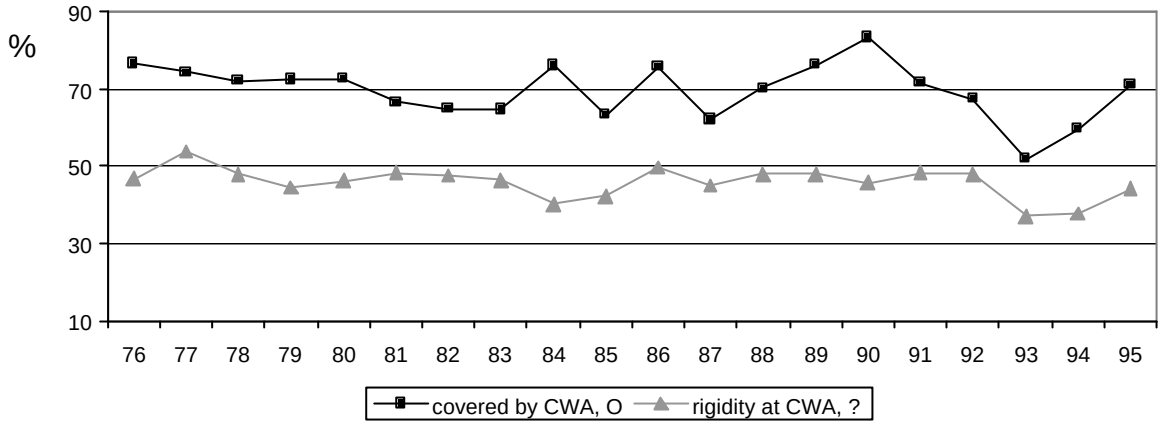
(d) Observed income changes 1985/86



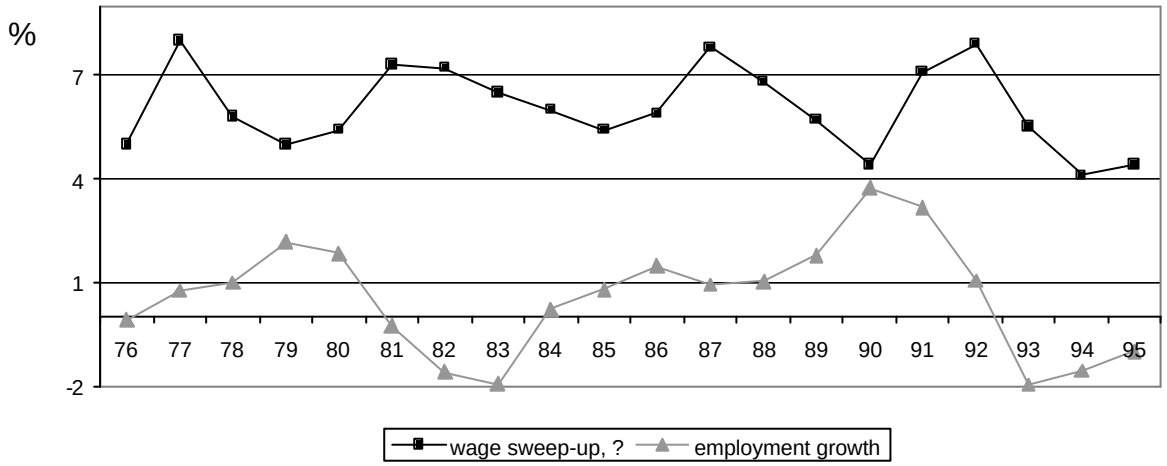
mean=0.050; std.dev.=0.071

Figure 11 **:** Wage rigidity and wage sweep-up for *stayers*

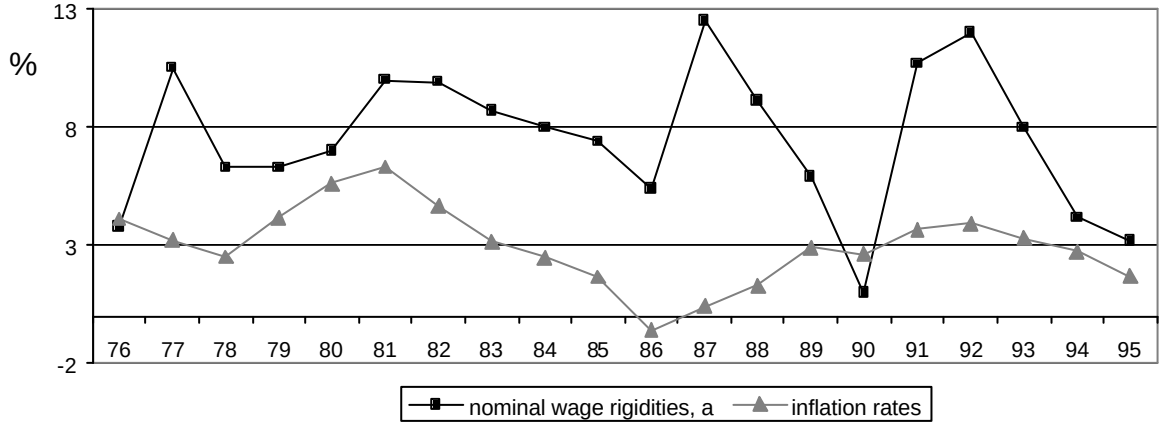
(a) Individual Probability of being covered by CWA and of rigidities due to CWA



(b) Wage sweep-up, employment growth



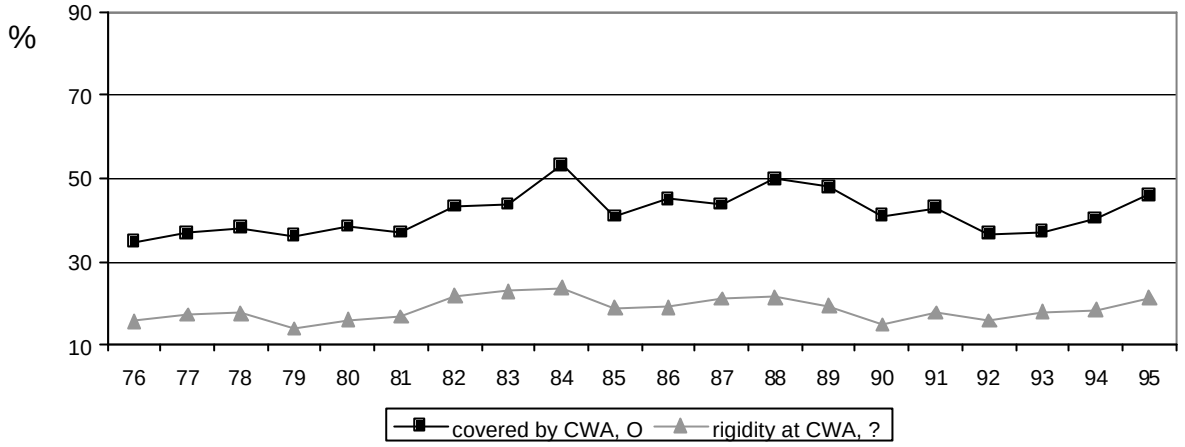
(c) Nominal wage rigidities, inflation rates



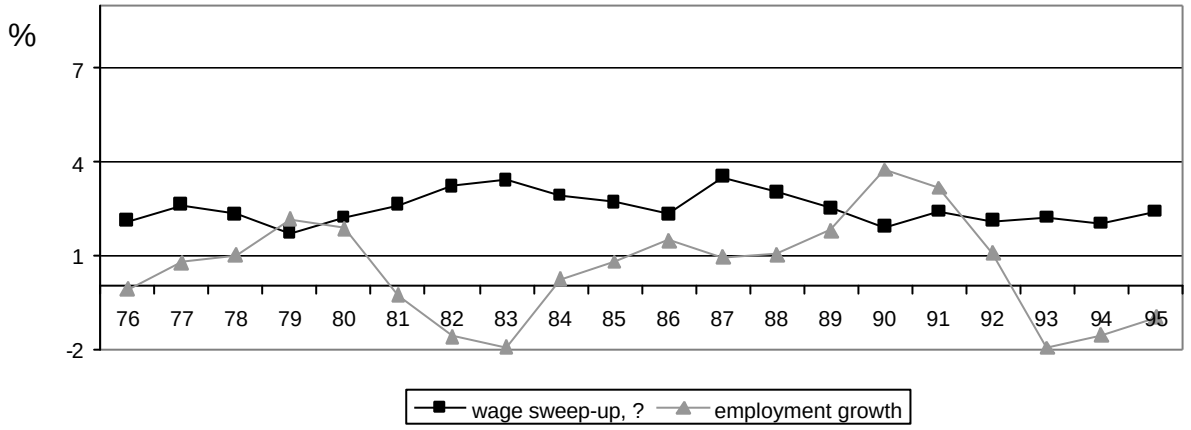
Source: based on *Table 1* and *Table 7*.

Figure 12: Wage rigidity and prohibited wage reduction for *movers*

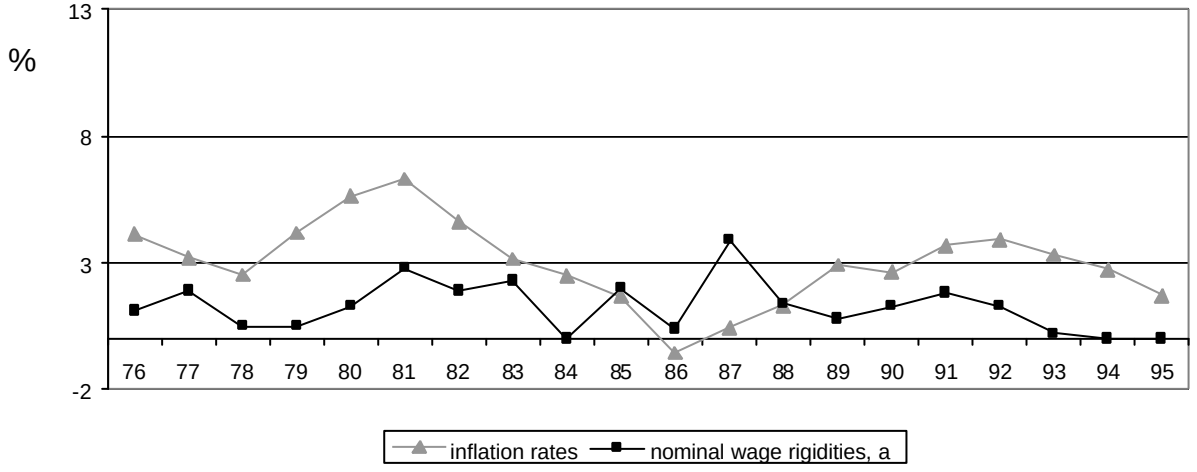
(a) Individual Probability of being covered by CWA and of rigidities due to CWA



(b) Wage sweep-up, employment growth



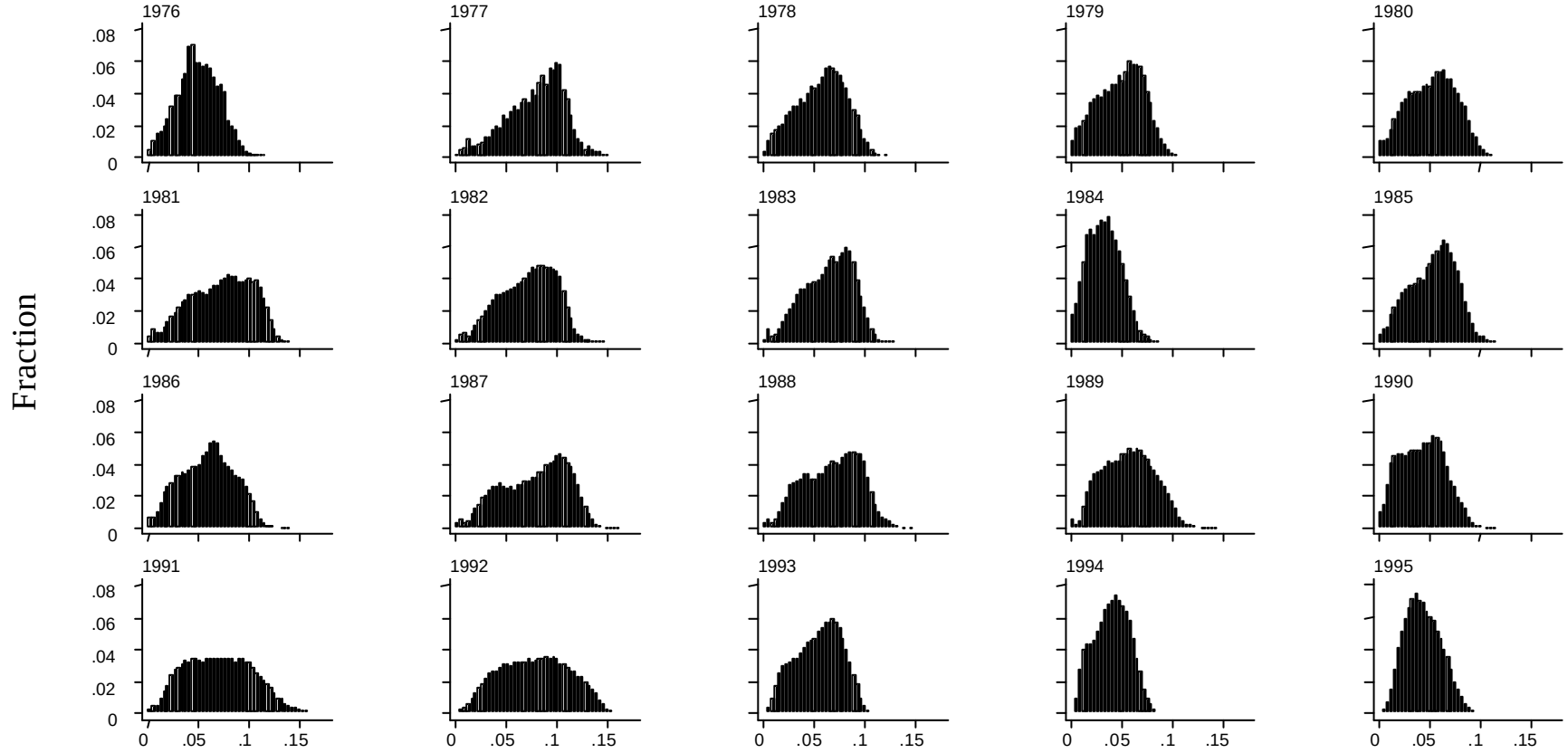
(c) Nominal wage rigidities, inflation rates



Source: based on *Table 1* and *Table 7*.

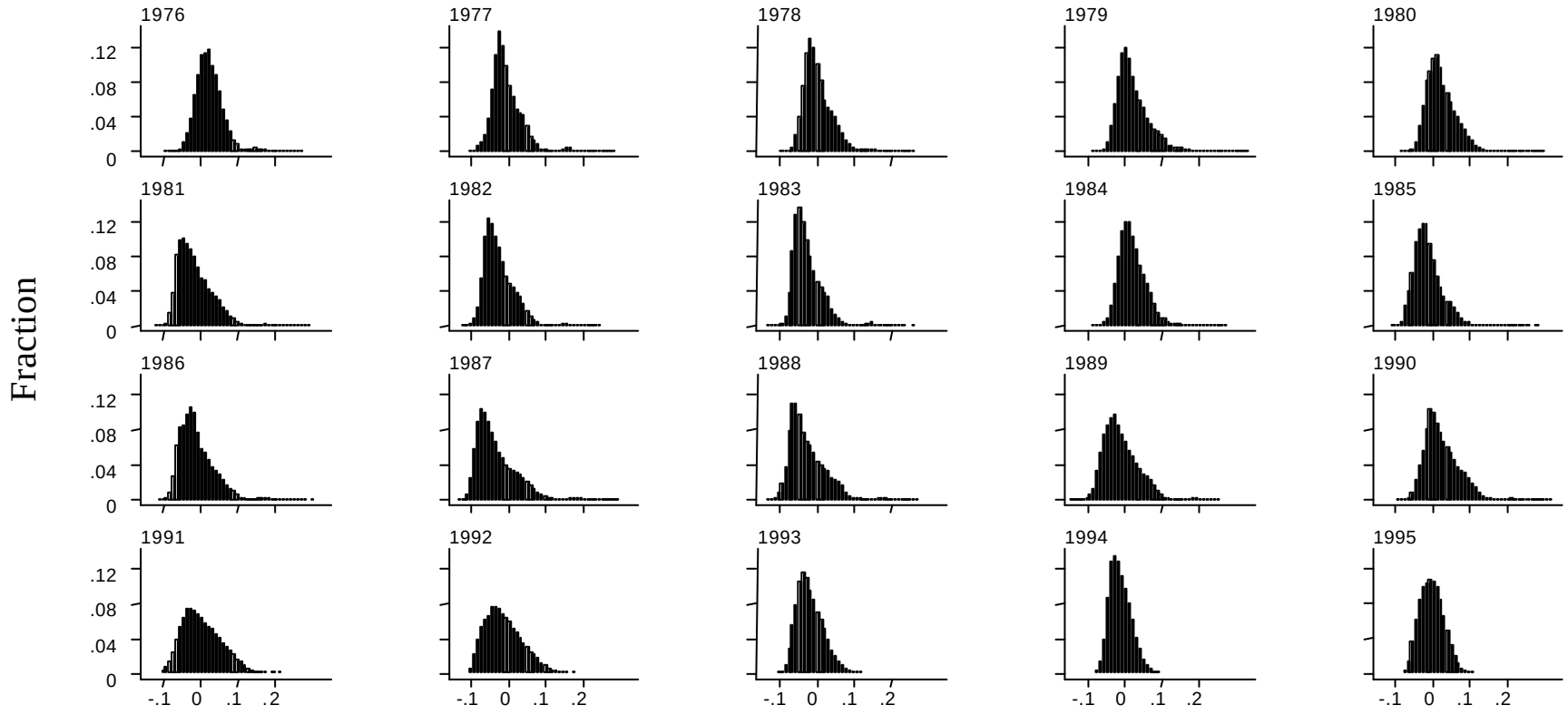
***Figure 13*:** Distribution of the wage sweep-ups and the notional wage changes for *stayers*

(a): Wage sweep-ups 1976 - 1995



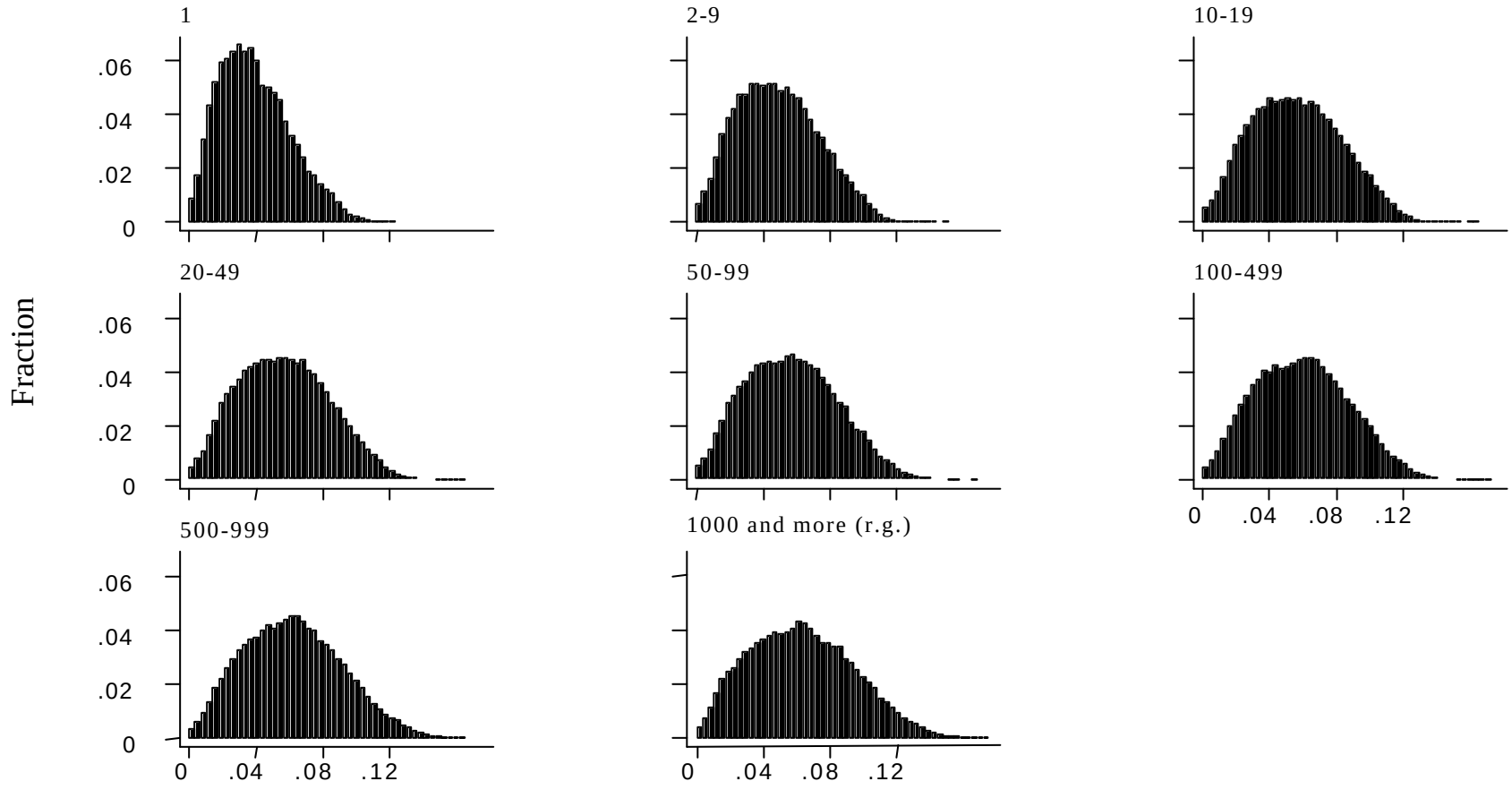
($\hat{m}$; $\hat{s}$): (0.050;0.021 / 0.080; 0.028 / 0.058; 0.025 / 0.050; 0.023 / 0.054; 0.024 / 0.073; 0.030 / 0.072; 0.030 / 0.065; 0.024 / 0.033; 0.016 / 0.054; 0.022 / 0.059; 0.026 / 0.078; 0.032 / 0.068; 0.028 / 0.057; 0.025 / 0.044; 0.022 / 0.071; 0.033 / 0.079; 0.034 / 0.055; 0.022 / 0.041; 0.017 / 0.044; 0.018)

Figure 13 continued: **(b)**: Notional wage changes 1976 – 1995 (deterministic part only)



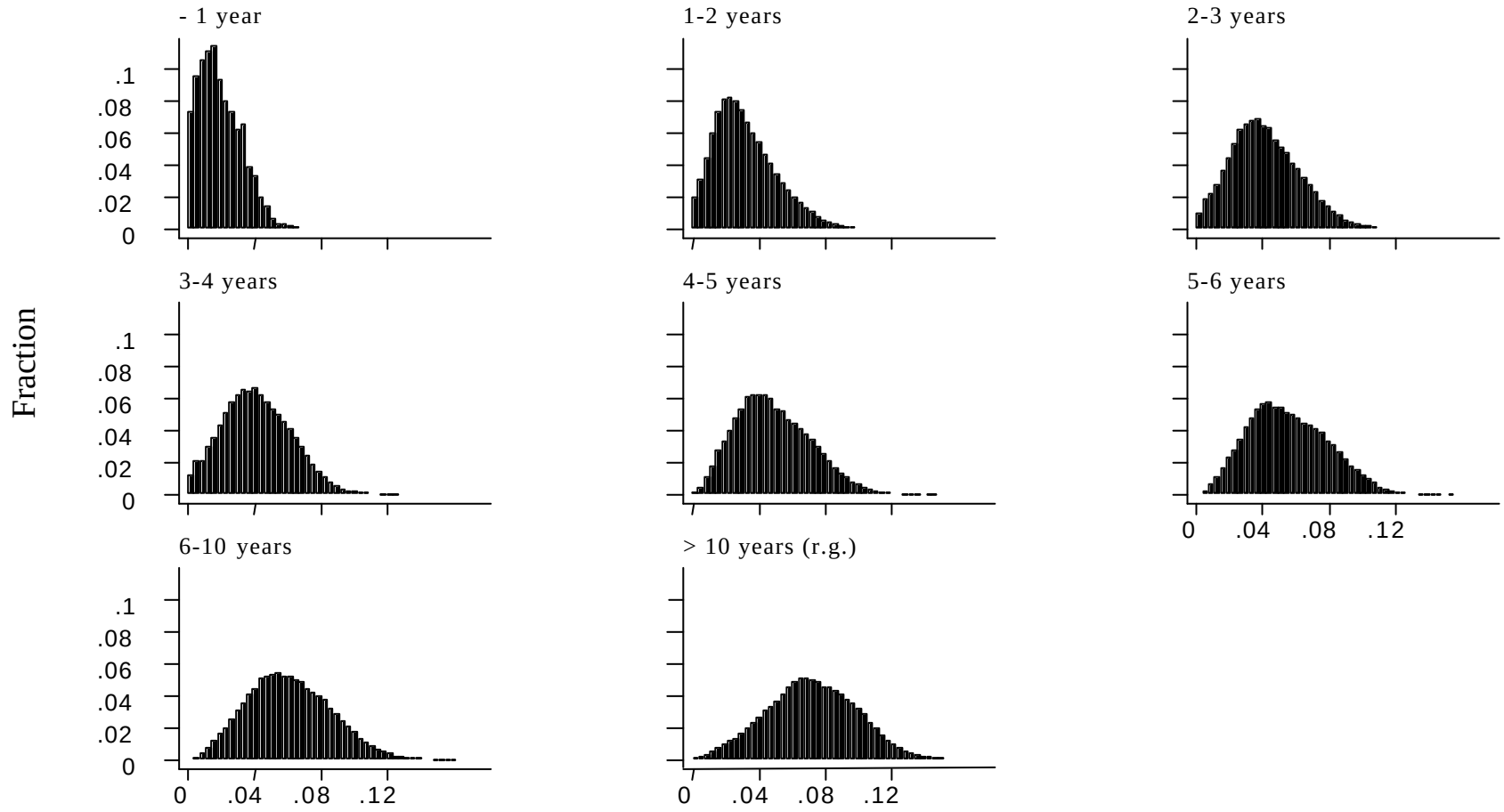
($\hat{m}; \hat{s}$): (0.026; 0.040 / -0.003; 0.045 / 0.006; 0.041 / 0.025; 0.045 / 0.026; 0.044 / -0.013; 0.048 /-0.024; 0.043 / -0.024; 0.039 / 0.022; 0.038 / -0.010; 0.041 / -0.010; 0.045 / -0.033; 0.052 / -0.024; 0.048 / -0.009; 0.046 / 0.025; 0.046 / 0.006; 0.054 / -0.011; 0.052 / -0.016; 0.036 / -0.011; 0.029 /-0.001; 0.033)

***Figure 14*:** Distribution of wage sweep-ups in 8 establishment size groups, pooled sample for *stayers*



($\hat{m}$; $\hat{s}$): (0.040; 0.021 / 0.049; 0.024 / 0.057; 0.027 / 0.058; 0.027 / 0.058; 0.028 / 0.060; 0.028 /0.062; 0.029 / 0.063; 0.031)

***Figure 15*:** Distribution of wage sweep-ups in 8 tenure groups, pooled sample for *stayers*



$(\hat{m}; \hat{s})$: (0.020; 0.013 / 0.032; 0.019 / 0.042; 0.021 / 0.042; 0.020 / 0.049; 0.022 / 0.055; 0.024 / 0.061; 0.025 / 0.072; 0.027)

***Table 1*:** Selected dynamic economic and labour market indicators for West Germany 1975 to 1995

Year	real GNP[a]	employment[a]	consumer prices	unemployment rate t	effective wages	collective wage agreements	wage drift
65 – 74 ∅	3.24	-0.12	4.14	1.0	9.60	8.77	0.83
1975/76	5.92	-0.09	4.13	4.6	5.61	5.80	-0.19
1976/77	2.97	0.76	3.22	4.5	8.01	6.68	1.33
1977/78	2.93	0.99	2.53	4.3	5.84	5.54	0.30
1978/79	4.42	2.16	4.18	3.8	5.68	4.78	0.90
1979/80	0.75	1.85	5.62	3.8	7.10	6.60	0.50
1980/81	-0.20	-0.28	6.33	5.5	6.00	5.26	0.74
1981/82	-1.48	-1.60	4.65	7.5	4.76	4.12	0.64
1982/83	2.09	-1.94	3.17	9.1	3.79	3.26	0.53
1983/84	2.95	0.22	2.51	9.1	2.65	2.80	-0.15
75 – 84 ∅	2.26	0.23	4.04	5.8	5.49	4.98	0.51
1984/85	2.25	0.79	1.68	9.3	3.52	3.37	0.15
1985/86	2.31	1.47	-0.56	9.0	4.15	4.34	-0.19
1986/87	1.67	0.93	0.45	8.9	3.96	3.86	0.10
1987/88	3.94	1.03	1.32	8.7	3.52	3.30	0.22
1988/89	4.01	1.79	2.92	7.9	3.65	3.84	-0.19
1989/90	6.05	3.73	2.63	7.2	6.35	5.38	0.97
1990/91	5.50	3.17	3.67	6.3	6.81	6.54	0.27
1991/92	1.42	1.05	3.92	6.6	6.21	6.19	0.02
1992/93	-2.28	-1.97	3.31	8.2	4.67	4.37	0.30
1993/94	2.22	-1.56	2.75	9.2	1.72	2.05	-0.33
1994/95	1.71	-1.00	1.70	9.3	3.52	2.95	0.57
84 – 95 ∅	2.62	0.85	2.16	8.2	4.37	4.20	0.17

Source: DIW Vierteljährliche Gesamtrechnung, West Germany, own calculations; all numbers are log differences (natural logarithm) t, t-1. Separate numbers from DIW Vierteljährliche Gesamtrechnung for West Germany are available only until 1994; the numbers from 1994/95 have been calculated on the basis of the Jahresgutachten 1999/2000. [a] only private economy without government share, services for private households and agriculture.

***Table 2*:** The selection of the samples from the IABS for three panels

Selection	*1975*	*1985*	*1994*
I. Key-date 30,06 *t-1*: unemployed, employed or in vocational training [a]	119.1% (193,685)	116.0% (221,224)	119.9% (221,790)
II. employed in *t-1* [b]	112.0% (182,063)	110.0% (190,704)	105.5% (195,143)
III. employed in *t-1* and *t*	162,529 (100%)	173,376 (100%)	184,961 (100%)
IV. white or blue collar worker	98.5% (160,078)	98.7% (171,095)	99.1% (183,263)
V. income difference *t-1*, *t* available [c]	92.9% (150,941)	92.2% (159,803)	92.9% (171,898)
VI. same working time category in *t-1*, *t* and without agriculture and government [d]	81.6% (132,682)	81.0% (140,445)	82.2% (151,975)
VII. samples for estimation type 1 [e]	72.4% (117,601)	70.5% (122,157)	69.9% (129,306)
Share of *movers t, t-1* in %	8.6%	6.9%	8.1%
VIII. samples for estimation type 2 [f]	61.8% (100,472)	61.5% (106,689)	60.9% (112,581)
Share of *movers t, t-1* in %	9.2%	6.5%	7.7%

[a] Additional restriction: only one spell at the key date; in 14 of the 21 cross-sections less than 2,000 observations had more than one spell; in the other cross-sections the maximum number is 6,521 in 1990; since 1992 only employees from the Western part of Germany have been selected.

[b] Apprentices; unemployed and other persons not employed; share of unemployed 1975: 0.04%; 1985: 6.05%; 1994: 8%.

[c] at *t-1* and *t* income is above the 'Geringfügigkeitsgrenze' and below the 'Beitragsbemessungsgrenze'.

[d] The following categories form the WZW in the IABS have been disregarded: 0-3, 63-64, 87-94.

[e] Most of the losses in observations from VI to VII and to VIII are the result of missing information in vocational skills; additional restriction: 1 and 99 Percentile.

[f] Incomes DEM up to 5 below the "Beitragsbemessungsgrenze" and DEM 10 above the "Geringfügigkeits-grenze" in *t* and *t-1* excluded; additional restriction: 1 and 99 Percentile.

***Table 3*:** Definition of variables and means by selected years

Year (*t-1* / *t*)	**1975/76**		**1980/81**		**1985/86**		**1990/91**		**1994/95**	
Variables / Samples	**stayer**	**mover**	**stayer**	**mover**	**stayer**	**mover**	**stayer**	**mover**	**stayer**	**mover**
Working hours in *t-1* and *t*; spells type between *t-1* and *t*; special notations										
Full time (r.g.; stayer)	0.941	0.978	0.925	0.970	0.909	0.962	0.895	0.952	0.879	0.940
Part time	0.053	0.020	0.069	0.028	0.082	0.035	0.096	0.047	0.109	0.056
Less than part time	0.005	0.003	0.006	0.002	0.009	0.002	0.010	0.002	0.012	0.004
Full spell in t-1 and t (r.g.;stayer (1))	0,688	0.009	0.792	0.008	0.795	0.007	0.764	0.008	0.417	0.006
Full spell in t-1; december, 31 in t included (2)	0,007	0.078	0.019	0.202	0.017	0.209	0.021	0.214	0.036	0.161
Full spell in t-1 (3)	0.046	0.031	0.072	0.047	0.072	0.044	0.075	0.045	0.434	0.112
Full spell in t and december, 31 in t-1 incl. (4)	0.163	0.001	0.064	0.002	0.061	0.002	0.080	0.003	0.033	0.001
Full spell in t (5)	0.124	0.242	0.014	0.308	0.013	0.297	0.020	0.336	0.005	0.108
December, 31 in t-1 and t included (6)	0.020	0.242	0.005	0.092	0.008	0.087	0.006	0.093	0.007	0.081
December, 31 in t-1 included (7)	0.048	0.056	0.016	0.025	0.014	0.024	0.018	0.028	0.044	0.041
December, 31 in t included (8)	0.005	0.157	0.006	0.144	0.008	0.165	0.006	0.132	0.003	0.094
Others ((9) r.g.; movers)	0.010	0.185	0.011	0.171	0.012	0.164	0.009	0.141	0.021	0.396
Spell according to a special notation in t-1	0.012	0.019	0.012	0.021	0.010	0.022	0.018	0.024	0.014	0.041
Spell according to a special notation in t	0.012	0.013	0.010	0.015	0.014	0.020	0.018	0.021	0.009	0.013
Blue and white collar worker, educational attainment, upskilling, occupations at *t*										
Blue collar worker	0.664	0.698	0.639	0.633	0.628	0.643	0.609	0.574	0.588	0.608
White collar worker (r.g.)	0.336	0.302	0.361	0.367	0.372	0.357	0.391	0.426	0.412	0.392
Female	0.372	0.309	0.377	0.338	0.398	0.330	0.413	0.405	0.426	0.371
Foreigner	0.099	0.147	0.095	0.108	0.086	0.089	0.087	0.089	0.091	0.088
Age 16 – 20	0.031	0.063	0.014	0.037	0.010	0.024	0.006	0.017	0.002	0.006
Age 21 – 25	0.124	0.216	0.118	0.253	0.111	0.245	0.107	0.248	0.076	0.163
Age 26 – 30	0.138	0.183	0.132	0.203	0.142	0.210	0.150	0.243	0.157	0.236
Age 31 - 35	0.129	0.145	0.129	0.144	0.132	0.146	0.140	0.149	0.150	0.175
Age 36 - 40	0.157	0.142	0.130	0.115	0.125	0.103	0.132	0.106	0.147	0.133
Age 41 - 47	0.165	0.128	0.217	0.139	0.193	0.137	0.163	0.111	0.189	0.143
Age 48 - 55	0.078	0.092	0.173	0.080	0.202	0.109	0.213	0.098	0.181	0.110
Age 56 – 65 (r.g.)	0.079	0.031	0.086	0.027	0.085	0.026	0.089	0.028	0.097	0.034
No formal degree	0.344	0.301	0.307	0.250	0.274	0.195	0.237	0.174	0.202	0.151
Apprenticeship (r.g.)	0.639	0.683	0.663	0.713	0.687	0.749	0.707	0.750	0.723	0.745
Abitur, no apprenticeship	0.003	0.003	0.004	0.003	0.004	0.004	0.005	0.005	0.006	0.004
Apprenticeship and abitur	0.005	0.006	0.008	0.011	0.013	0.020	0.022	0.036	0.031	0.044
Technical university	0.005	0.005	0.010	0.013	0.010	0.016	0.013	0.015	0.017	0.024
University	0.003	0.003	0.009	0.010	0.012	0.017	0.016	0.020	0.021	0.031

Upskilling t+1, t	0.012	0.126	0.009	0.088	0.005	0.085	0.004	0.094	0.004	0.083
Primary occupation	0.230	0.190	0.214	0.180	0.206	0.178	0.201	0.170	0.177	0.163
Secondary occupation	0.275	0.320	0.257	0.264	0.244	0.278	0.236	0.227	0.217	0.218
Tertiary occupation	0.495	0.490	0.530	0.556	0.550	0.544	0.563	0.603	0.606	0.619

***Table 3*:** Continued

Tenure at *t* (only *stayers*)										
Less than 1 year	0.006	-	0.001	-	0.002	-	0.001	-	0.001	-
1 – 2 years	-	-	0.125	-	0.104	-	0.144	-	0.104	-
2 – 3 years	-	-	0.097	-	0.077	-	0.096	-	0.091	-
3 – 4 years	-	-	0.083	-	0.065	-	0.075	-	0.092	-
4 – 5 years	-	-	0.078	-	0.068	-	0.066	-	0.091	-
6 – 7 years	-	-	-	-	0.069	-	0.059	-	0.077	-
7 – 10 years	-	-	-	-	0.227	-	0.163	-	0.181	-
10 years and more (r.g.)	0.994[a]	-	0.530[b]	-	0.387	-	0.395	-	0.363	-
History of unemployment until *t-1* (*stayers*); employment history between *t-1* and *t* (*movers*), probability of unemployment at *t*										
Never unemployed (r.g.)	1.000	-	0.903	-	0.782	-	0.682	-	0.634	-
0 – 3 month	-	-	0.047	-	0.074	-	0.090	-	0.099	-
3 – 6 month	-	-	0.023	-	0.045	-	0.057	-	0.063	-
6 – 12 month	-	-	0.020	-	0.053	-	0.075	-	0.085	-
12 month and more	-	-	0.007	-	0.046	-	0.097	-	0.120	-
Estimated unemployment probability	0.011	0.010	0.033	0.034	0.055	0.052	0.043	0.036	0.077	0.064
unemployment spell t-1, t	-	0.000	-	0.196	-	0.240	-	0.121	-	0.162
days of unemployment t-1, t	-	0.009	-	15.814	-	21.845	-	9.092	-	13.210
Plant size at *t*										
1 employee	n.a.	n.a.	0.012	0.023	0.014	0.018	0.015	0.019	0.015	0.021
2 – 9 employees	n.a.	n.a.	0.113	0.189	0.125	0.193	0.141	0.177	0.133	0.188
10 – 19	n.a.	n.a.	0.082	0.119	0.085	0.118	0.084	0.115	0.093	0.127
20 – 49	n.a.	n.a.	0.117	0.163	0.119	0.157	0.119	0.154	0.132	0.164
50 – 99	n.a.	n.a.	0.100	0.108	0.097	0.118	0.100	0.118	0.108	0.119
100 – 499	n.a.	n.a.	0.249	0.229	0.245	0.227	0.246	0.239	0.251	0.216
500 – 999	n.a.	n.a.	0.091	0.061	0.090	0.053	0.091	0.065	0.088	0.059
1,000 and more (r.g.)	n.a.	n.a.	0.235	0.109	0.234	0.115	0.218	0.112	0.180	0.106
Change of plant size *t-1, t*; change of industry *t-1, t* (*movers*), change of region after 1992 (*movers*)										
Sizeup	n.a.	n.a.	0.042	0.379	0.053	0.345	0.058	0.331	0.038	0.358
Sizedown	n.a.	n.a.	0.043	0.377	0.034	0.399	0.027	0.393	0.040	0.345
Samesize (r.g.)	n.a.	n.a.	0.915	0.244	0.913	0.255	0.915	0.276	0.922	0.297
change of industry	-	0.472	-	0.505	-	0.466	-	0.484	-	0.425

always West Germany (r.g.)	-	-	-	-	-	-	-	-	-	0.943
West in t-1; East in t	-	-	-	-	-	-	-	-	-	0.028
East in t-1; West in t	-	-	-	-	-	-	-	-	-	0.029

Source: IABS; own calculations; note that all variables with the exception of *Estimated unemployment probability* and *days of unemployment* are of the 0,1 type. r.g.: reference group; n.a.: not available in the IABS (plant size is not available in 1975 and 1976);
[a] one year and more; [b] six years and more

Table 4: Income growth, collective wage agreements and sample sizes, descriptive evidence 1975 - 1995
Part 1: Plant *stayers*

Year	Number of observations	Nominal income growth, $? y_t$				Collective wage agreements, r_t			
		Minimum	Maximum	Median	Mean	Minimum	Maximum	Median	Mean
1976	91,213	-0.232	0.483	0.070	0.077	0.025	0.076	0.054	0.054
1977	93,462	-0.235	0.504	0.073	0.077	0.047	0.089	0.068	0.068
1978	94,819	-0.243	0.503	0.060	0.065	0.031	0.075	0.051	0.050
1979	96,807	-0.232	0.533	0.065	0.076	0.031	0.075	0.051	0.050
1980	99,959	-0.220	0.548	0.072	0.080	0.042	0.074	0.060	0.060
1981	101,924	-0.223	0.511	0.055	0.060	0.043	0.069	0.054	0.053
1982	103,757	-0.239	0.486	0.044	0.048	0.031	0.055	0.044	0.043
1983	104,608	-0.232	0.459	0.037	0.041	0.028	0.040	0.033	0.034
1984	100,334	-0.228	0.478	0.047	0.056	0.018	0.036	0.027	0.027
1985	98,379	-0.226	0.488	0.036	0.044	0.014	0.038	0.030	0.029
1986	99,730	-0.219	0.504	0.042	0.050	0.010	0.040	0.031	0.030
1987	100,344	-0.230	0.519	0.038	0.045	0.024	0.049	0.039	0.038
1988	99,619	-0.230	0.515	0.035	0.044	0.016	0.045	0.026	0.028
1989	99,700	-0.229	0.523	0.049	0.049	0.012	0.037	0.025	0.025
1990	98,601	-0.211	0.566	0.061	0.071	0.016	0.147	0.035	0.035

1991	101,734	-0.223	0.566	0.068	0.077	0.019	0.090	0.060	0.059
1992	106,273	-0.228	0.521	0.061	0.068	0.034	0.074	0.059	0.059
1993	106,864	-0.276	0.435	0.037	0.039	0.011	0.065	0.040	0.039
1994	105,854	-0.262	0.390	0.024	0.030	-0.050	0.034	0.017	0.017
1995	103,944	-0.253	0.422	0.038	0.043	0.018	0.036	0.028	0.028

Table 4: Continued
Part 2: Plant *movers*

Year	Number of observations	Nominal income growth, $? y_t$				Collective wage agreements, r_t			
		Minimum	Maximum	Median	Mean	Minimum	Maximum	Median	Mean
1976	9,259	-0.232	0.483	0.090	0.106	0.025	0.076	0.055	0.055
1977	9,284	-0.235	0.504	0.097	0.115	0.047	0.089	0.064	0.067
1978	9,056	-0.243	0.505	0.089	0.105	0.031	0.075	0.052	0.053
1979	9,220	-0.232	0.535	0.109	0.129	0.040	0.071	0.051	0.053
1980	9,758	-0.220	0.549	0.114	0.135	0.042	0.074	0.062	0.061
1981	8,792	-0.223	0.511	0.088	0.110	0.043	0.069	0.054	0.054
1982	7,365	-0.238	0.486	0.066	0.083	0.031	0.055	0.043	0.043
1983	6,348	-0.232	0.460	0.051	0.067	0.029	0.040	0.033	0.034
1984	6,340	-0.233	0.498	0.069	0.087	0.018	0.036	0.027	0.028
1985	6,604	-0.226	0.489	0.064	0.087	0.014	0.038	0.029	0.028
1986	6,959	-0.219	0.505	0.077	0.099	0.010	0.040	0.030	0.029
1987	7,549	-0.230	0.521	0.072	0.093	0.024	0.049	0.038	0.036
1988	7,760	-0.235	0.531	0.075	0.098	0.016	0.045	0.026	0.028
1989	7,999	-0.229	0.552	0.082	0.105	0.012	0.037	0.025	0.027

1990	10,098	-0.201	0.560	0.095	0.125	0.016	0.147	0.035	0.035
1991	9,432	-0.223	0.567	0.119	0.137	0.019	0.090	0.059	0.059
1992	9,144	-0.228	0.524	0.102	0.120	0.034	0.074	0.058	0.058
1993	8,789	-0.276	0.435	0.064	0.077	0.011	0.065	0.040	0.039
1994	7,979	-0.261	0.392	0.047	0.057	-0.050	0.034	0.017	0.018
1995	8,637	-0.253	0.423	0.062	0.075	0.018	0.036	0.028	0.028

Source: IABS, Federal Statistical Office; own calculations.

Table 5: Shares of workers in different earnings regimes 1975 - 1995

Year	*Stayer*				*Mover*			
	< 0	$= 0$	$0 - r$	$> r$	< 0	$= 0$	$0 - r$	$> r$
1976	8.38	4.84	23.37	63.41	19.31	4.48	13.52	62.68
1977	7.87	4.34	32.45	55.34	17.85	3.06	17.26	61.89
1978	9.77	5.00	24.75	60.48	20.32	3.50	13.12	63.06
1979	7.08	4.35	23.49	65.08	16.75	2.78	11.55	68.93
1980	6.59	3.58	27.24	62.58	16.07	2.61	13.58	67.79
1981	10.83	4.70	32.96	51.51	19.04	2.93	15.35	62.67
1982	13.30	5.72	29.21	51.77	22.50	3.58	13.90	60.01
1983	14.42	6.83	24.56	54.20	24.80	4.46	11.83	58.92
1984	11.85	5.83	13.63	68.68	21.74	3.41	7.43	67.43
1985	14.95	7.32	20.38	57.35	23.15	3.41	9.12	64.32
1986	13.14	6.51	16.49	63.87	21.30	3.05	7.99	67.67
1987	14.80	6.90	27.76	50.54	22.33	3.30	10.60	63.77

1988	14.83	7.07	20.04	58.06	20.70	3.43	8.75	67.13
1989	13.53	6.46	16.83	63.18	20.79	2.65	7.46	69.10
1990	9.56	4.10	14.29	72.06	14.47	2.06	12.46	71.01
1991	9.12	3.67	29.41	57.80	16.15	1.92	13.76	68.17
1992	10.71	3.86	32.94	52.49	18.31	1.98	15.14	64.58
1993	18.79	5.42	28.05	47.74	25.00	2.71	12.64	59.65
1994	21.50	7.24	13.92	57.34	28.63	3.17	6.28	61.93
1995	15.93	5.77	16.77	61.53	24.64	2.20	8.50	64.66

Source: Own calculations based on the IABS; for the sample of workers see *Table 4*.

Table 6: Summary statistics

Part 1: ***Stayers***

Sample	L (opt.) ($l = a$)	s_e	s_m	OLS: adj. R^2	L (opt.) restricted 1 [a] (1 d. o. f)	L (opt.) restricted 2 [b] (<23 d. o. f)	L (opt.) restricted 3 [c] (<24 d. o. f)
1976	118,205	0.104	0.032	0.093	117,936	116,856	109,728
1977	127,158	0.118	0.030	0.094	125,938	125,226	114,155
1978	131,231	0.106	0.027	0.089	130,382	128,770	119,534
1979	133,606	0.106	0.024	0.112	132,884	131,411	119,987
1980	139,980	0.106	0.024	0.101	138,834	137,474	124,787
1981	148,221	0.110	0.023	0.110	145,565	145,650	133,175
1982	156,193	0.108	0.021	0.100	153,213	153,383	141,316
1983	162,377	0.102	0.020	0.099	160,067	159,777	148,350
1984	139,141	0.089	0.027	0.117	139,033	137,751	132,428
1985	142,935	0.103	0.022	0.105	141,805	141,317	132,899

1986	144,198	0.103	0.027	0.109	143,511	142,632	133,728
1987	146,939	0.116	0.023	0.124	143,074	144,721	134,624
1988	145,011	0.112	0.024	0.109	143,690	143,680	134,433
1989	140,341	0.108	0.027	0.103	139,747	139,226	131,570
1990	127,929	0.103	0.033	0.111	127,832	126,805	119,197
1991	131,930	0.119	0.030	0.107	130,314	130,313	120,223
1992	142,245	0.120	0.028	0.089	139,675	140,061	129,854
1993	151,339	0.100	0.021	0.080	148,520	149,414	142,913
1994	153,474	0.091	0.021	0.052	152,777	152,342	147,779
1995	147,902	0.092	0.025	0.059	147,506	146,982	140,894

[a] This model is restricted to the case where wage reductions in the nominal regime are not restricted to start from zero.

[a] This model is restricted to the case where the probability of being covered by CWAs is the same for all observations.

[a] This model is restricted to the case where there are only nominal wage rigidities and no rigidities stemming from CWAs.

Table 6: continued

Part 2: *movers*

Year	L (opt.) ($l = a$)	s_e	s_m	OLS: adj. R^2
1976	5,278	0.154	0.042	0.050
1977	5,321	0.161	0.038	0.065
1978	4,947	0.157	0.048	0.061
1979	4,652	0.163	0.038	0.060
1980	5,130	0.162	0.045	0.077
1981	5,200	0.159	0.038	0.085
1982	4,784	0.155	0.040	0.072
1983	4,665	0.148	0.035	0.058
1984	4,074	0.152	0045	0.074

1985	4,234	0.153	0.038	0.101
1986	4,168	0.153	0.043	0.088
1987	4,588	0.161	0.049	0.094
1988	4,691	0.161	0.041	0.091
1989	4,563	0.158	0047.	0.088
1990	6,367	0.157	0.017	0.106
1991	4,826	0.161	0.057	0.089
1992	5,049	0.154	0.048	0.087
1993	5,428	0.147	0.039	0.084
1994	5,665	0.134	0.037	0.065
1995	5,762	0.143	0.042	0.062

Table 7: Wage rigidities and wage sweep-ups: summary statistics 1975-95.
Part 1: Plant *stayers*

t	wage sweep-ups, $?$	employees with wage growth at or above r, Ω (%)	employees with rigidities at r, $?$ (%)	hypothetical wage sweep-ups, only due to CWA, $?^{CWA}$	nominal rigidities, a	employees with nominal rigidities (%)	hypothetical wage sweep-ups, only nominal, $?^{nom}$	employees with "true" wage reductions (%)
1976	5.0	76.6	46.8	6.0	3.8	2.8	1.3	6.4
1977	8.0	74.4	53.8	9.4	10.5	7.1	3.7	5.4
1978	5.8	72.2	48.0	7.1	6.3	5.2	2.4	7.1
1979	5.0	72.6	44.5	6.0	6.3	4.5	2.0	5.5
1980	5.4	72.7	46.3	6.5	7.0	5.0	2.1	5.1
1981	7.3	66.6	48.4	8.9	10.0	9.8	3.9	7.6

1982	7.2	64.9	47.7	8.8	9.9	10.6	4.2	9.2
1983	6.5	64.7	46.5	7.9	8.7	10.1	3.8	10.0
1984	3.3	76.1	40.3	4.1	1.2	1.4	0.4	8.1
1985	5.4	63.4	42.3	6.7	7.4	8.4	3.1	10.0
1986	5.9	75.9	49.7	6.8	5.4	4.5	2.4	7.3
1987	7.8	62.2	45.1	9.4	12.5	13.4	5.3	8.8
1988	6.8	70.3	48.0	7.9	9.1	8.1	4.0	8.1
1989	5.7	76.3	47.9	6.6	5.9	4.8	2.5	7.0
1990	4.4	83.4	45.8	5.0	1.0	1.0	0.3	4.9
1991	7.1	71.7	48.3	8.4	10.7	7.6	3.6	5.2
1992	7.9	67.6	48.1	9.5	12.0	10.5	4.4	6.2
1993	5.5	52.0	37.1	7.6	8.0	12.7	3.3	13.5
1994	4.1	59.7	37.8	5.4	4.2	6.6	1.9	14.4
1995	4.4	71.2	44.2	5.6	3.2	3.9	1.4	10.3

Table 7: Continued
Part 2: plant *movers*

t	wage sweep-ups, $?$	Employees with wage growth at or above r, Ω (%)	employees with rigidities at r, $?$ (%)	hypothetical wage sweep-ups, only due to CWA, $?^{CWA}$	nominal rigidities, a	employees with nominal rigidities (%)	hypothetical wage sweep-ups, only nominal, $?^{nom}$	Employees with "true" wage reductions (%)
1976	2.1	34.8	15.7	5.0	1.1	1.5	0.3	17.4
1977	2.6	36.8	17.3	5.1	1.9	2.4	0.5	16.0
1978	2.3	38.1	17.7	5.3	0.5	0.6	0.1	17.5
1979	1.7	36.1	13.9	4.3	0.5	0.5	0.1	15.2
1980	2.2	38.4	16.1	4.6	1.3	1.4	0.3	13.4

1981	2.6	37.0	16.8	5.4	2.8	3.5	0.8	15.5
1982	3.2	43.2	21.8	6.2	1.9	2.4	0.7	18.3
1983	3.4	43.7	22.9	6.3	2.3	3.2	0.9	19.8
1984	2.9	53.2	23.7	5.0	0.0	0.0	0.0	15.9
1985	2.7	40.8	18.9	5.2	2.0	2.5	0.7	17.5
1986	2.3	45.0	19.0	4.5	0.4	0.5	0.1	16.0
1987	3.5	43.7	21.1	5.9	3.9	4.4	1.3	15.2
1988	3.0	49.8	21.5	5.1	1.4	1.5	0.5	15.0
1989	2.5	47.9	19.4	4.5	0.8	0.8	0.3	14.6
1990	1.9	41.0	14.8	3.8	1.3	1.4	03	13.6
1991	2.4	42.9	17.8	4.6	1.8	1.8	0.4	11.8
1992	2.1	36.7	15.9	4.8	1.3	1.6	0.3	14.8
1993	2.2	37.2	18.0	5.5	0.2	0.4	0.1	21.8
1994	2.0	40.3	18.4	4.8	0.0	0.0	0.0	23.3
1995	2.4	45.9	21.2	4.9	0.0	0.0	0.0	19.1

Source: Calculations from Maximum Likelihood estimations based on the IABS.

***Table 8*:** Comparison of OLS and ML estimation for the determinants of wage changes in two selected samples.

Part 1: Plant *stayers*

Samples	1981/82				1989/90			
Estimation method	OLS		ML		OLS		ML	
Variables	Coefficients	t-statistics	Coefficients	z-statistics	Coefficients	t-statistics	Coefficients	z-statistics
Part time	-0.000	-0.185	0.018	8.872	0.007	7.363	0.023	13.40
Less than part time	-0.009	-3.664	0.010	1.954	-0.004	-1.676	0.010	2.027
Spell type 2	-0.023	14.73	0.072	23.84	0.033	19.88	0.067	25.42
Spell type 3	0.023	-26.81	-0.001	-0.648	-0.024	-24.27	-0.015	-8.265
Spell type 4	-0.006	-6.614	0.020	10.36	-0.007	-7.007	0.005	2.695
Spell type 5	-0.030	12.10	0.080	17.02	0.031	11.12	0.061	14.07

Spell type 6	0.005	1.935	0.037	7.183	0.011	3.661	0.034	6.916
Spell type 7	-0.035	-19.27	-0.023	-6.264	-0.041	-21.70	-0.039	-12.10
Spell type 8	0.023	9.424	0.070	15.24	0.018	5.767	0.046	9.518
Spell type 9	0.003	1.305	0.035	8.836	-0.011	-3.976	0.063	0.716
Special notation in t-1	-0.006	-1.969	-0.006	-1.142	0.007	2.227	0.009	1.774
Special notation in t	0.015	7.868	0.025	6.282	0.013	6.677	0.022	6.800
Blue collar worker	-0.006	-10.31	0.004	2.552	-0.001	-2.086	-0.003	-2.101
Female	0.005	8.306	0.012	8.797	0.001	1.288	0.000	0.122
Foreigner	-0.006	-4.824	0.014	5.239	-0.000	-0.359	0.008	4.842
Age 16 – 20	0.119	45.65	0.182	35.43	0.164	46.43	0.210	36.43
Age 21 – 25	0.030	25.52	0.069	26.43	0.057	27.45	0.097	23.68
Age 26 – 30	0.011	11.86	0.031	14.31	0.031	14.43	0.062	14.63
Age 31 – 35	0.007	7.176	0.017	7.336	0.023	10.53	0.048	11.30
Age 36 - 40	0.005	4.124	0.010	3.674	0.017	7.962	0.036	8.545
Age 41 - 47	0.003	2.220	0.005	1.786	0.011	5.811	0.024	6.252
Age 48 - 55	0.000	-0.425	-0.002	-0.953	0.005	3.630	0.011	3.793
No formal degree	0.006	3.856	0.002	0.860	0.008	6.315	0.013	5.857
Abitur. no apprenticeship	0.014	4.185	0.025	3.664	0.009	2.593	0.016	2.608
Apprenticeship and Abitur	0.019	6.653	0.029	4.773	0.021	9.785	0.033	8.822
Technical university	0.017	5.278	0.019	2.787	0.011	4.177	0.016	3.277
University	0.018	6.608	0.026	4.285	0.014	5.970	0.023	5.666
Upskilling t+1, t	-0.002	-0.909	-0.004	-0.863	0.008	1.966	0.012	1.803
Primary occupation	-0.007	-9.818	-0.013	-7.861	-0.003	-3.787	-0.004	-2.459
Secondary occupation	-0.005	-7.476	-0.010	-6.325	-0.004	-4.516	-0.006	-3.991

***Table8*: Continued**

Tenure less than 1 year	-0.012	-2.343	0.005	0.463	0.028	4.324	0.058	6.110
Tenure 1 – 2 years	0.014	16.42	0.035	19.06	0.025	25.53	0.052	29.49
Tenure 2 – 3 years	0.008	10.86	0.026	15.26	0.016	16.50	0.040	22.51
Tenure 3 – 4 years	0.008	10.16	0.027	14.82	0.020	19.69	0.045	24.20
Tenure 4 – 5 years	0.003	3.761	0.017	8.969	0.009	8.845	0.027	14.04
Tenure 6 – 7 years	0.002	1.887	0.012	6.133	0.005	4.974	0.019	9.042
Tenure 7 – 10 years	-0.000	0.470	0.008	3.961	0.003	4.394	0.012	8.382
Unemploy. 0 – 3 month	-0.003	-3.322	-0.008	-3.981	-0.003	-3.405	-0.006	-3.771
Unemploy.. 3 – 6 month	-0.004	-2.964	-0.008	-2.949	-0.003	-3.190	-0.007	-3.516
Unemploy 6 – 12 month	0.002	1.699	0.004	1.510	-0.003	-3.335	-0.006	-1.578
Unem. 12 month and more	0.003	1.583	0.006	1.448	-0.003	-1.291	-0.003	5.175
Unemployment probability	0.058	0.890	-0.137	-1.025	-0.001	5.014	0.315	-6.729
Plant size: 1 employee	0.002	-6.243	-0.027	6.649	0.156	-12.86	-0.034	-7.864
Plant size: 2 – 9 employees	0.001	-6.418	0.014	6.845	-0.279	-14.74	-0.022	-11.97
Plant size: 10 – 19	0.001	-6.392	0.003	1.387	-0.015	-7.895	-0.017	-8.140
Plant size: 20 – 49	0.001	-3.940	0.000	0.148	-0.009	-5.295	-0.009	-4.966
Plant size: 50 – 99	0.001	-4.835	0.004	1.736	-0.005	-2.855	-0.005	-2.822
Plant size: 100 – 499	0.001	-1.249	0.000	0.150	-0.003	-3.888	-0.003	-3.692
Plant size: 500 – 999	0.001	2.114	0.002	1.047	-0.001	-1.510	0.005	-1.596
Sizeup	0.001	-2.474	0.006	2.511	0.002	1.765	0.004	2.742
Sizedown	0.001	10.53	-0.004	-2.118	0.003	1.713	0.006	2.236
Constant	0.004	18.67	-0.043	-4.519	0.030	6.981	-0.009	-8.209
Adjusted R^2	0.100				0.111			

***Table 8*:** Continued

Part 2: Plant *movers*

Samples	1981/82				1989/90			
Estimation method	OLS		ML		OLS		ML	
Variables	Coefficients	t-statistics	Coefficients	z-statistics	Coefficients	t-statistics	Coefficients	z-statistics
Spell type 1	-0.018	-1.167	-0.065	-2.640	0.005	0.361	-0.012	-0.654
Spell type 2	-0.000	-0.068	-0.013	-1.706	0.014	2.841	0.010	1.680
Spell type 3	-0.024	-2.756	-0.031	-2.747	-0.023	-3.555	-0.032	-3.585
Spell type 4	0.014	0.455	0.002	0.044	-0.035	-1.258	-0.065	-1.731
Spell type 5	0.019	3.660	0.015	2.292	0.039	8.288	0.039	6.919
Spell type 6	-0.006	-0.843	-0.023	-2.434	0.005	0.825	-0.010	-1.312
Spell type 7	-0.011	-1.033	-0.014	-0.996	-0.039	-3.934	-0.052	-4.341
Spell type 8	0.018	3.181	0.018	2.491	0.042	7.516	0.045	6.963
Special notation in t-1	-0.005	0.426	-0.005	-0.325	0.009	0.905	0.011	0.986
Special notation in t	0.030	2.306	0.035	2.066	0.051	4.9.0	0.059	4.953
Female	0.008	2.103	0.008	1.516	0.008	2.608	0.018	4.653
Foreigner	0.010	1.870	0.023	3.052	0.017	3.287	0.021	3.470
Age 16 – 20	0.106	8.483	0.158	9.039	0.150	10.408	0.188	10.072
Age 21 – 25	0.071	7.496	0.119	8.340	0.097	10.888	0.136	10.155
Age 26 – 30	0.047	4.933	0.089	6.165	0.066	7.412	0.105	7.943
Age 31 – 35	0.029	2.914	0.062	4.253	0.046	5.096	0.079	6.049
Age 36 - 40	0.023	2.310	0.056	3.771	0.038	4.141	0.066	5.037
Age 41 - 47	0.013	1.318	0.039	2.653	0.023	2.501	0.045	3.440
Age 48 - 55	0.000	0.043	0.018	1.189	0.008	0.879	0.019	1.519
Upskilling t+1. t	0.016	2.674	0.026	3.466	0.023	4.647	0.023	4.832
Primary occupation	-0.007	-1.494	-0.006	-0.932	-0.004	-1.028	0.007	1.416
Secondary occupation	-0.022	-5.392	-0.020	-3.787	-0.006	-1.691	0.004	0.876
Unemployed. t. t-1	-0.010	-1.639	0.015	2.004	0.003	0.381	0.013	1.636
Days of unemployment	-0.000	-3.609	-0.000	-3.592	-0.000	-2.942	-0.000	-2.628
Change of sector	0.012	3.798	0.031	6.820	0.026	8.792	0.034	8.144
Sizedown	0.018	4.311	0.033	5.787	0.032	8.985	0.041	9.062
Sizeup	-0.012	-2.849	-0.010	-1.743	-0.010	-2.877	-0.009	-1.999
Constant	0.039	3.803	-0.055	-2.864	0.026	2.721	-0.038	-2.469
Adjusted R^2	0.072				0.106			

Source: Estimation based on the IABS: note that the estimates for *stayers* contain 63 sector dummies in addition.

***Table 9*:** Summary of significant coefficients of notional wage change determination

Part 1: Plant *stayer*

ß / *t*	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Working hours in *t-1* and *t*; spells type between *t -1* and *t*; special notations																				
Part time	**0.015**	**0.020**	**0.020**	**0.013**	**0.024**	**0.020**	**0.018**	**0.012**	0.006	**0.012**	**0.025**	**0.019**	**0.014**	**0.023**	**0.023**	**0.026**	**0.017**	**0.015**	**0.01**	**0.013**
Less than part time	**0.028**	**0.023**	**0.023**	**0.018**	**0.015**	-	**0.010**	**0.013**	-	**0.018**	**0.019**	**0.026**	-	**0.018**	-	**0.029**	**0.027**	**0.019**	-	**0.012**
Spell type 2	**0.065**	**0.071**	**0.074**	**0.051**	**0.060**	**0.070**	**0.072**	**0.067**	**0.050**	**0.065**	**0.071**	**0.087**	**0.072**	**0.032**	**0.067**	**0.069**	**0.073**	**0.064**	**0.042**	**0.020**
Spell type 3	0.012	-	0.008	0.016	0.012	-	-	0.003	0.008	**0.007**	**0.008**	**0.015**	-	0.008	0.015	0.01	**0.005**	-	-	**0.004**
Spell type 4	**0.013**	**0.011**	**0.016**	**0.007**	**0.01**	**0.025**	**0.020**	**0.016**	**0.006**	**0.016**	**0.017**	**0.020**	**0.009**	-	**0.005**	**0.017**	**0.021**	**0.024**	**0.015**	**0.007**
Spell type 5	**0.048**	**0.072**	**0.063**	**0.058**	**0.062**	**0.085**	**0.080**	**0.072**	**0.049**	**0.078**	**0.070**	**0.092**	**0.078**	**0.049**	**0.061**	**0.074**	**0.078**	**0.073**	**0.061**	**0.079**
Spell type 6	**0.046**	**0.035**	**0.044**	-	**0.028**	**0.046**	**0.037**	**0.038**	**0.028**	**0.047**	**0.044**	**0.047**	**0.023**	**0.022**	**0.034**	**0.053**	**0.038**	**0.05**	**0.031**	**0.012**
Spell type 7	0.025	0.021	0.017	0.045	0.029	0.025	0.023	0.017	0.017	0.01	-	0.016	0.022	0.032	0.04	0.037	0.021	0.012	0.014	-
Spell type 8	**0.028**	**0.053**	**0.048**	**0.037**	**0.062**	**0.078**	**0.070**	**0.059**	**0.050**	**0.039**	**0.046**	**0.052**	**0.050**	**0.048**	**0.046**	**0.075**	**0.065**	**0.052**	**0.048**	**0.041**
Spell type 9	**0.027**	**0.020**	**0.029**	-	**0.020**	**0.032**	**0.035**	**0.024**	**0.016**	**0.03**	**0.033**	**0.018**	**0.023**	-	-	**0.018**	**0.021**	**0.03**	**0.027**	**0.018**
Special notation in t-1	-	-	-	-	-	-	-	-	**0.013**	-	**0.018**	-	-	0.019	-	**0.019**	-	-	0.016	**0.022**
Special notation in t	**0.014**	**0.021**	**0.032**	**0.031**	**0.038**	**0.027**	**0.025**	**0.027**	**0.016**	**0.010**	**0.012**	**0.016**	**0.020**	**0.030**	**0.022**	**0.042**	**0.024**	**0.017**	**0.015**	0.037
Blue and white collar worker, educational attainment, upskilling, occupations at *t*																				
Blue collar worker	**0.009**	**0.004**	-	**0.011**	**0.009**	**0.004**	-	**0.007**	0.015	**0.004**	**0.006**	-	-	-	-	0.005	0.007	-	0.003	-
Female	-	-	-	0.015	**0.007**	**0.022**	**0.012**	**0.006**	0.013	-	-	-	-	-	-	**0.008**	**0.012**	**0.006**	-	-
Foreigner	**0.030**	**0.022**	**0.017**	**0.014**	**0.011**	**0.017**	**0.014**	**0.018**	-	**0.008**	**0.005**	-	**0.009**	**0.012**	**0.008**	**0.006**	-	-	**0.007**	-
Age 16 – 20	**0.168**	**0.182**	**0.155**	**0.161**	**0.188**	**0.194**	**0.182**	**0.193**	**0.162**	**0.172**	**0.189**	**0.222**	**0.205**	**0.213**	**0.210**	**0.228**	**0.192**	**0.075**	**0.070**	**0.075**
Age 21 – 25	**0.072**	**0.071**	**0.066**	**0.077**	**0.083**	**0.080**	**0.069**	**0.074**	**0.049**	**0.069**	**0.081**	**0.101**	**0.094**	**0.098**	**0.097**	**0.110**	**0.098**	**0.058**	**0.056**	**0.065**
Age 26 – 30	**0.051**	**0.045**	**0.034**	**0.050**	**0.048**	**0.038**	**0.031**	**0.036**	**0.021**	**0.030**	**0.052**	**0.059**	**0.057**	**0.063**	**0.062**	**0.074**	**0.062**	**0.043**	**0.044**	**0.051**
Age 31 – 35	**0.041**	**0.030**	**0.021**	**0.037**	**0.031**	**0.020**	**0.017**	**0.017**	**0.018**	**0.019**	**0.035**	**0.041**	**0.038**	**0.046**	**0.048**	**0.056**	**0.041**	**0.028**	**0.030**	**0.038**
Age 36 – 40	**0.037**	**0.027**	**0.013**	**0.033**	**0.024**	**0.014**	**0.010**	**0.013**	**0.016**	**0.016**	**0.031**	**0.034**	**0.030**	**0.035**	**0.036**	**0.046**	**0.032**	**0.022**	**0.025**	**0.031**
Age 41 – 47	**0.033**	**0.019**	**0.010**	**0.027**	**0.020**	-	-	-	**0.011**	**0.009**	**0.021**	**0.021**	**0.020**	**0.024**	**0.024**	**0.032**	**0.023**	**0.016**	**0.020**	**0.023**
Age 48 – 55	**0.019**	**0.010**	-	**0.015**	**0.011**	-	-	-	-	-	**0.011**	**0.012**	-	**0.013**	**0.011**	**0.014**	-	-	**0.008**	**0.008**
Abitur. no apprenticeship	-	**0.007**	-	-	-	-	-	0.013	**0.012**	**0.013**	**0.019**	**0.025**	**0.014**	**0.012**	**0.013**	**0.014**	**0.015**	**0.007**	**0.005**	-
Apprenticeship	-	-	-	-	-	**0.025**	**0.025**	-	**0.029**	**0.027**	**0.029**	**0.042**	**0.026**	**0.021**	**0.016**	**0.031**	**0.039**	**0.021**	**0.015**	-
Apprenticeship and Abitur	-	**0.036**	**0.017**	**0.033**	**0.028**	**0.018**	**0.029**	-	**0.041**	**0.044**	**0.054**	**0.071**	**0.044**	**0.039**	**0.033**	**0.03**	**0.046**	**0.026**	**0.018**	**0.021**
Technical university	-	**0.025**	-	-	-	-	**0.019**	-	**0.037**	**0.032**	**0.033**	**0.048**	**0.033**	**0.017**	**0.016**	**0.021**	**0.034**	**0.026**	**0.019**	**0.014**
University	-	-	-	**0.024**	**0.016**	-	**0.026**	-	**0.043**	**0.026**	**0.037**	**0.038**	**0.037**	**0.017**	**0.023**	**0.013**	**0.021**	**0.031**	**0.018**	**0.018**

Upskilling t+1, t	**0.016**	-	-	**0.019**	**0.012**	**0.013**	-	-	-	-	**0.018**	-	-	**0.026**	-	**0.030**	-	**0.020**	-	**0.031**
Primary occupation	0.003	0.008	0.006	-	-	0.012	0.013	0.011	0.009	-	0.009	0.015	0.010	0.006	-	0.012	0.014	0.016	0.004	-
Secondary occupation	-	0.006	0.008	-	-	0.010	0.010	0.009	0.009	0.009	0.008	0.013	0.009	0.012	0.006	0.008	0.007	0.010	0.008	0.006

***Table 9*: Continued**

ß / t	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Tenure at *t*																				
Less than 1 year	-	**0.031**	-	**0.035**	-	**0.043**	-	**0.040**	0.025	**0.026**	**0.040**	**0.051**	**0.036**	**0.040**	**0.058**	-	**0.041**	**0.026**	**0.027**	-
1 – 2 years	n.a.	**0.028**	**0.028**	**0.033**	**0.037**	**0.040**	**0.035**	**0.038**	**0.026**	**0.039**	**0.049**	**0.055**	**0.054**	**0.054**	**0.052**	**0.055**	**0.052**	**0.037**	**0.038**	**0.045**
2 – 3 years	n.a	n.a	**0.019**	**0.024**	**0.026**	**0.031**	**0.026**	**0.030**	**0.018**	**0.035**	**0.043**	**0.041**	**0.043**	**0.041**	**0.040**	**0.041**	**0.035**	**0.024**	**0.025**	**0.026**
3 – 4 years	n.a	n.a	n.a	**0.018**	**0.022**	**0.032**	**0.027**	**0.028**	**0.015**	**0.027**	**0.048**	**0.051**	**0.047**	**0.046**	**0.045**	**0.048**	**0.040**	**0.015**	**0.019**	**0.017**
4 – 5 years	n.a	n.a	n.a	n.a	**0.014**	**0.019**	**0.017**	**0.016**	**0.005**	**0.013**	**0.026**	**0.027**	**0.026**	**0.029**	**0.027**	**0.028**	**0.028**	**0.017**	**0.016**	**0.019**
6 – 7 years	n.a	n.a	n.a	n.a	n.a	**0.012**	**0.012**	**0.013**	-	**0.008**	**0.014**	**0.017**	**0.018**	**0.016**	**0.019**	**0.019**	**0.024**	**0.013**	**0.015**	**0.013**
7 – 10 years	n.a	n.a	n.a	n.a	n.a	n.a	**0.008**	**0.009**	-	**0.005**	**0.008**	**0.010**	**0.009**	**0.010**	**0.012**	**0.014**	**0.010**	**0.007**	**0.010**	**0.008**
History of unemployment until *t-1*; probability of unemployment at *t*																				
0 – 3 month	n.a	-	-	-	0.007	0.010	0.008	0.011	0.012	0.010	0.008	0.013	0.008	0.009	0.006	0.009	0.012	-	-	0.004
3 – 6 month	n.a	-	-	0.009	-	-	0.008	-	0.007	0.010	0.008	0.013	0.008	0.013	0.007	0.006	-	0.005	-	-
6 – 12 month	n.a	-	0.018	-	-	-	-	-	0.003	0.005	0.009	0.010	0.009	0.008	0.006	-	-	-	-	-
12 month and more	n.a	-	0.036	**0.019**	-	-	-	-	-	-	-	-	-	0.005	-	-	-	-	-	-
Unemployment probability	**1.492**	**0.887**	-	**0.844**	-	-	-	0.549	-	-	**0.563**	**0.587**	**0.299**	**0.219**	**0.315**	**0.386**	**0.283**	**0.101**	**0.122**	**0.089**
Plant size at *t*																				
1 employee	n.a	n.a	**0.030**	**0.018**	**0.024**	**0.029**	**0.027**	**0.020**	0.036	-	0.018	**0.026**	-	-	0.034	-	**0.029**	**0.024**	-	0.023
2 – 9 employees	n.a	n.a	**0.019**	**0.011**	**0.013**	**0.017**	**0.014**	**0.008**	0.022	0.012	0.018	**0.009**	-	0.005	0.022	-	**0.010**	**0.009**	**0.005**	0.020
10 – 19	n.a	n.a	**0.012**	**0.007**	**0.010**	**0.006**	-	-	0.021	0.018	0.019	-	-	0.010	0.017	-	-	-	-	0.018
20 – 49	n.a	n.a	**0.009**	**0.007**	**0.008**	**0.006**	-	-	0.017	0.014	0.012	-	-	-	0.009	-	-	-	-	0.015
50 – 99	n.a	n.a	**0.013**	**0.006**	**0.007**	-	**0.004**	-	0.012	0.010	0.005	-	-	-	0.005	-	-	-	-	0.009
100 – 499	n.a	n.a	**0.009**	-	**0.005**	-	-	-	0.007	0.009	0.005	-	-	-	0.005	**0.005**	**0.005**	-	-	0.009
500 – 999	n.a	n.a	-	-	-	-	-	-	0.007	0.008	0.002	-	-	-	-	-	-	-	-	0.007
Change of plant size *t-1*, *t*																				
Sizeup	n.a	n.a	**0.008**	-	-	**0.007**	-	-	-	-	-	-	**0.006**	**0.009**	**0.005**	**0.009**	**0.006**	**0.006**	**0.009**	**0.006**
Sizedown	n.a	n.a	-	-	-	-	-	-	-	0.007	-	-	-	-	-	-	-	0.005	-	-

***Table 9*: Continued**

Part 2: Plant *mover*

ß / *t*	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
type of spell between *t-1* and *t*																				
Spell type 1	-	-	-	-	-	-	0.065	-	-	-	-	-	-	-	-	-	-	-	-	-
Spell type 2	**0.041**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spell type 3	-	-	0.027	0.043	0.027	0.035	0.031	-	-	0.051	0.032	0.038	-	0.037	0.032	0.046	0.047	0.046	0.046	0.027
Spell type 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spell type 5	**0.028**	**0.046**	**0.029**	**0.037**	**0.055**	**0.036**	**-**	**0.020**	**0.034**	**0.039**	**0.032**	**0.033**	**0.032**	**0.031**	**0.039**	**0.047**	**0.027**	0.035	**0.021**	0.046
Spell type 6	**0.021**	-	-	-	-	-	-	-	-	-	-	-	**0.026**	-	-	-	0.024	-	-	-
Spell type 7	-	0.036	0.042	0.052	0.050	-	-	0.059	-	0.043	-	0.055	-	0.061	0.052	0.053	0.057	-	0.037	-
Spell type 8	**0.030**	**0.041**	**0.022**	**0.031**	**0.029**	**0.023**	**-**	**0.026**	**0.046**	**0.042**	**0.039**	**0.045**	**0.031**	**0.035**	**0.045**	**0.044**	0.028	**0.045**	**0.032**	**0.033**
Special notation in t-1	-	-	-	-	-	-	-	-	-	-	-	-	**0.038**	0.057	-	-	-	-	-	-
Special notation in t	**-**	**-**	**-**	**-**	**0.041**	**0.041**	**-**	**-**	**-**	**-**	**-**	**-**	**0.034**	**-**	**0.059**	**-**	**0.043**	**0.036**	-	-
Age at t, other characteristics																				
Female	0.012	0.016	-	0.015	-	-	-	-	0.017	-	-	-	-	-	**0.018**	-	-	-	-	-
Foreigner	**0.034**	**0.037**	**0.028**	**0.022**	**0.037**	**-**	**0.022**	-	-	-	-	0.025	-	-	0.021	-	-	-	-	-
Age 16 – 20	**0.155**	**0.170**	**0.158**	**0.168**	**0.156**	**0.139**	**0.158**	**0.162**	**0.189**	**0.176**	**0.213**	**0.173**	**0.226**	**0.212**	**0.188**	**0.165**	**0.165**	**0.067**	**0.086**	**0.075**
Age 21 – 25	**0.094**	**0.104**	**0.102**	**0.100**	**0.089**	**0.079**	**0.119**	**0.113**	**0.108**	**0.114**	**0.148**	**0.121**	**0.145**	**0.136**	**0.136**	**0.122**	**0.104**	**0.060**	**0.074**	**0.081**
Age 26 – 30	**0.060**	**0.062**	**0.067**	**0.061**	**0.055**	**0.053**	**0.089**	**0.078**	**0.081**	**0.080**	**0.106**	**0.079**	**0.107**	**0.112**	**0.105**	**0.090**	**0.072**	**0.046**	**0.061**	**0.066**
Age 31 – 35	**0.046**	**0.046**	**0.055**	**0.056**	**0.037**	**0.032**	**0.063**	**0.060**	**0.056**	**0.056**	**0.087**	**0.063**	**0.088**	**0.091**	**0.079**	**0.059**	**0.044**	**0.033**	**0.055**	**0.052**
Age 36 - 40	**0.032**	**0.045**	**0.041**	**0.048**	**-**	**0.027**	**0.056**	**0.049**	**-**	**-**	**0.081**	**-**	**0.061**	**0.072**	**0.066**	**0.055**	**0.039**	**-**	**0.042**	**0.039**
Age 41 - 47	**-**	**0.033**	-	-	-	-	**0.039**	**0.040**	**-**	**-**	**0.059**	**-**	**0.050**	**0.065**	**0.045**	**0.039**	-	-	-	-
Age 48 - 55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upskilling t+1, t	**0.017**	**0.035**	**0.018**	**0.022**	**0.025**	**0.017**	**-**	**0.029**	**-**	**0.038**	**-**	**0.034**	**0.033**	**-**	**0.028**	**0.032**	**0.023**	**0.035**	**0.024**	**0.024**
Primary occupation	-	0.015	-	-	-	0.022	-	0.018	-	-	-	0.021	-	0.015	-	0.026	0.028	0.027	0.016	-
Secondary occupation	-	-	-	-	-	0.011	0.020	-	0.017	-	0.016	-	-	0.019	-	0.014	0.013	0.017	-	-
Unemployment history between *t-1* and *t*																				
Unemploy.spell t-1, t [a]	-	-	-	-	-	-	**0.015**	**0.015**	-	-	-	-	-	-	-	-	-	-	-	-
100 days of une. t-1, t [a]	-	-	-	-	-	-	0.022	0.012	0.019	-	-	-	0.015	-	0.020	-	-	-	0.013	0.017
Change of plant size *t-1, t*; change of industry *t-1, t*																				

Sizeup	n.a.	n.a.	**0.026**	**0.022**	0.032	**0.027**	**0.033**	**0.021**	**0.041**	**0.045**	**0.043**	**0.056**	**0.045**	**0.039**	**0.041**	**0.045**	**0.041**	0.012	**0.021**	**0.034**
Sizedown	n.a	n.a	-	-	0.015	-	-	-	-	-	-	-	0.014	-	-	-	0.018	-	-	-
Change of industry	**0.026**	**0.032**	**0.013**	**0.025**	**0.042**	**0.014**	**0.031**	**0.019**	**0.033**	**0.031**	**0.039**	**0.039**	**0.034**	**0.045**	**0.034**	**0.049**	**0.045**	**0.036**	**0.016**	**0.023**
West in t-1; East in t	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.030	0.034	0.033
East int-1; West in t	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	**0.156**	**0.110**	**0.088**

Source: Maximum Likelihood-estimations based on the IABS; - not significant at the 1 % and for [a] at the 5 % level; bold numbers: positive values, normal numbers: negative values; note that all estimates for *stayers* furthermore contain 63 sector dummies.

***Table 10*:** Summary of marginal effects on the probability of being attached to CWAs, Ω , and on *a* (%)

Part 1: *stayers*

t	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
										Ω										
r	-1.5[n]	0.4	-5.0	-8.5	-3.4	-2.6	-9.9	-7.9	-5.6	3.4	6.0	-15.5	-8.2	-11.3	-6.4	-4.8	-12.2	7.9	-0.3[n]	-11.2
Full time employees	17	18	4.7	1.4	5.6	8.7	3.9	16	13	9.1	9.2	3.2	8.6	3.6	13	8.3	1.5	3.1	4.3	2.5
Spell type 1	19	31	7.0	2.4	11	15	6.2	37	38	45	23	6.7	18	8.1	21	15	2.7	21	40	3.4
Blue collar worker	-30	-27	-15	-3.6	-11	-18	-12	-16	-8.8	-11	-13	-6.4	-13	-6.7	-3.9	-4.4	-0.8	-3.3	-8.3	-2.2
Female	3.4	0.2[n]	-0.4[n]	-0.7	-0.6[n]	4.2	1.2	6.3	14	11	8.5	3.5	6.3	2.7	2.4[n]	5.6	1.1	7.1	19	3.9
Foreigner	-20	-16	-12	-3.0	-14	-17	-6.8	-10	-17	-9.2	-14	-4.5	-12	-4.9	-13.7	-10	-2.3	-3.8	-5.2	-3.6
No formal degree	-1[n]	-13[n]	-0.6[n]	-0.6	-2.4	-3.5	-1.4	-4.5	-1.6[n]	-0.7[n]	-3.5	-1.5	-2.9	-1.3	-3.0	-3.1	-0.7	-2.1	-6.4	-2.7
Tenure less than 1 year	-11[n]	-26[n]	-35[n]	-7.3[n]	-5.2[n]	-46[n]	-35[n]	-28[n]	-4.2[n]	-5.3[n]	-5.7[n]	-8.8[n]	-47[n]	-63[n]	-75[n]	-32[n]	-10[n]	-8.1[n]	-31[n]	-85[n]
1 – 2 years	n.a	-10	-3.7	-12	-6.2	-5.2	-1.4	-3.8	-13	-6.3	-11	-0.2[n]	-11	-9.2	-15	-5.9	-0.8	-1.1	-9.3	-12
2 – 3 years	n.a.	n.a.	-3.5	-18	-9.3	-6.0	-2.6	-6.6	-16	-11	-19	-3.2	-12	-11	-20	-12	-1.6	-2.2	-8.9	-5.7
3 – 4 years	n.a.	n.a.	n.a.	-10	-6.5	-8.1	-2.9	-5.7	-14	-9.2	-20	-4.3	-15	-12	-20	-12	-1.6	-1.7	-7.6	-3.9
4 – 5 years	n.a.	n.a.	n.a.	n.a.	-3.8	-4.3	-2.6	-4.3	-11	-2.9[n]	-13	-2.3	-9.5	-7.2	-11	-7.4	-1.3	-1.5	-8.0	-3.5
6 – 7 years	n.a.	n.a.	n.a.	n.a.	n.a.	-2.2	-1.6	-4.5	-7.3	-2.2[n]	-6.3	-1.4	-6.5	-5.1	-6.4	-4.2	-1.1	-1.4	-5.7	-2.4
7 – 10 years	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.9[n]	-1.2[n]	-6.9	-2.1	-2.3[n]	-0.5[n]	-3.1	-2.1	-4.1	-3.5	-0.4[n]	-0.9	-4.8	-1.5
Never unemployed	n.a.	10	-3.5	-8.6	-2.0	-2.4	-1.2	-1.8	-4.2	-1.0	-4.1	-1.5	-1.7	-0.6	-1.9	-3.1	-0.5	-4.2[n]	-0.7[n]	0.8
Plant size: 1 employee	n.a.	n.a.	-6.7	-6.4	-74	-66	-67	-27	-5.0[n]	-23	-23	-76	-47	-17	-14	-60	-71	-9.9	3.9[n]	-3.8
2 – 9 employees	n.a.	n.a.	-20	-10	-27	-29	-19	-18	-2.9[n]	-12	-12	-18	-16	-5.3	-3.1[n]	-23	-7.7	-6.2	-2.1[n]	-3.8
10 – 19	n.a.	n.a.	-7.2	-4.2	-8.7	-11	-9.5	-12	0.2[n]	-5.5	-8.0	-8.4	-6.2	-0.6[n]	2.1[n]	-5.6	-2.3	-3.5	-1.4[n]	-2.9
20 – 49	n.a.	n.a.	-5.0	-2.0	-5.3	-9.8	-6.8	-10	0.8[n]	-4.8	-5.8	-5.4	-5.1	0.0[n]	-1.2[n]	-22[n]	-1.9	-2.8	1.2[n]	-2.2
50 – 99	n.a.	n.a.	-4.6	-1.7	-3.5	-7.4	-6.3	-7.5	-0.7[n]	-4.0	-6.4	-4.7	-3.5	-0.6[n]	-0.5[n]	-3.2	-1.5	-2.2	-13[n]	-2.6
100 – 499	n.a.	n.a.	-2.5	-1.4	-1.9	-6.4	-4.2	-5.9	-0.1[n]	-2.8	-5.2	-3.0	-3.7	0.0[n]	-1.1[n]	-2.5	-1.3	-1.6	3.9[n]	-1.2
500 – 999	n.a.	n.a.	-1.9	-0.8	-8.2[n]	-2.7	-2.5	-3.5	2.1[n]	-1.3[n]	-1.5[n]	-1.2	-1.7[n]	0.7[n]	-1.3[n]	-1.4[n]	-0.5	-0.5	2.1[n]	0.5[n]
										a										

r	1.3	1.2	0.6	-0.8	0.5	1.0	2.1	1.1 [n]	0.5 [n]	0.8	1.8	1.0	2.1	1.8	0.6	1.3	1.7	0.4	0.4	1.4
Full time	0.2 [n]	1.9	0.8 [n]	11	8.6	0.8	0.2	0.8	0.0 [n]	1.8	0.3	1.7	0.7	0.4	0.3	0.8	0.5	1.2	0.7	0.1
Spell type 1	0.3 [n]	5.6	4.3	12	1.1	1.4	0.5	1.5	0.0 [n]	3.6	0.1 [n]	3.4	0.9	0.1	-0.2	0.7	0.8	2.2	0.7	0.0
Female	-0.6	-1.7	0.1 [n]	1.9 [n]	-0.2	-0.2	0.0	-0.2	0.0 [n]	0.1 [n]	0.1	0.3 [n]	-0.3	-0.1	0.0 [n]	-0.1	-0.1	0.0 [n]	-0.1	0.0
Foreigner	-0.8	-2.2	-0.9	-12	-0.6	-0.6	-0.2	-0.7	0.0 [n]	-1.8	0.1 [n]	0.8	-0.4	-0.1	-0.1 [n]	-0.2	-0.2	-0.4	-0.2	0.0

***Table 10*:** Continue

Part 2: *movers*

t	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
									Ω											
Spell type 9	-18	-16	-9.9	-29	-14	-16	-9.9	-25	-5.9 [n]	-30	-12	-8.0 [n]	-5.4 [n]	-15	-18	-13	-20	-17	-24	3.1 [n]
Blue collar worker	-30	-27	-23	-21	-19	-18	-12	-14	-7.9	-7.1	-8.0	-11	-9.4	-6.0	-26	-4.5 [n]	-9.1	-12	-11	-8.6
Foreigner	-46	-49	-23	-19	-17	-35	-11	-2.8 [n]	-11	-28	-16	-24	-6.1 [n]	-7.1 [n]	-3.2 [n]	-7.1 [n]	-15 [n]	-14 [n]	-6.8 [n]	-7.4 [n]
Change of industry sector	-36	-25	-24	-38	-33	-24	-22	-19	-22	-35	-32	-25	-22	-34	-17	-43	-47	-40	-38	-22
Larger firm size	-	-	-11	-5.8 [n]	-7.7	-11	-15	-4.1 [n]	-10	-12	-6.2 [n]	-15	-10	-9.8	-10	-18	-7.7 [n]	-10	-7.2	-12
Smaller firm size	-	-	-2.6 [n]	2.3 [n]	-4.0 [n]	1.4 [n]	-4.0 [n]	-3.4 [n]	-3.8 [n]	2.2 [n]	3.1 [n]	-1.8 [n]	-7.8	-6.3 [n]	-6.8	-12	-5.1 [n]	-11	-8.1	-9.5
Unemployment period	-	-59	-53	-76 [n]	-46	-64	-64	-69	-31	-51	-50	-61	-46	-35	-73 [n]	-36	-59	-42	-57	-77

Source: Calculations based on Maximum Likelihood estimation; to calculate the marginal probabilities the original coefficients have been transformed (logistic transformation), the coefficients from estimations are available upon request; [n] indicates that the original coefficient is not significant at the 1 percent level; the marginal impacts for 0,1 variables are calculated as the difference between the probabilities of 0 and 1, holding the other factors constant; [a] Marginal impact of a 1 percent higher growth rate of CWA on the probability of attachment to CWA, ΔW, and on nominal wage rigidities, Δa..

Table 11: One year consequences of wage sweep-ups on unemployment, plant mobility, plant size reduction and wage changes

Outcome, Y	Unemployment *t, t +1*		Plant mobility *t, t +1*		Plant size reduction *t, t +1*		Wage changes *t, t +1*
T	% [a]	*d* [b]	% [a]	*d* [b]	% [a]	*d* [b]	*d* [b]
1976	3.3	0.05 (0.9)	11.9	-0.94 (-5.4)	n. a.	n. a.	-0.15 (-0.45)
1977	3.4	-0.25 (-5.7)	12.5	-0.98 (-5.9)	n. a.	n. a.	-0.19 (-0.92)
1978	0.2	-0.01 (-1.0)	11.0	-0.22 (-1.6)	5.5	0.13 (1.2)	-0.04 (-1.73)
1979	2.6	0.00 (0.0)	11.2	-0.38 (-2.5)	5.5	0.49 (4.3)	0.01 (0.63)
1980	3.1	-0.09 (-2.3)	10.2	-0.08 (-0.6)	6.3	0.61 (4.4)	0.01 (0.46)
1981	3.8	-0.07 (-2.1)	9.2	0.48 (4.4)	6.9	0.28 (2.4)	-0.02 (-1.23)
1982	3.9	-0.09 (-2.5)	8.7	0.30 (2.7)	6.1	0.52 (4.4)	-0.00 (-0.22)
1983	3.5	-0.04 (-1.2)	8.8	0.16 (1.2)	5.3	0.59 (4.9)	0.01 (0.29)
1984	3.9	0.04 (1.0)	8.8	0.39 (2.7)	5.2	0.98 (7.4)	0.01 (0.25)
1985	3.7	-0.06 (-1.9)	8.9	-0.34 (-2.6)	4.9	0.74 (7.4)	0.04 (1.60)
1986	3.5	-0.01 (-0.4)	9.1	-0.73 (-5.9)	5.1	0.52 (5.0)	-0.01 (-0.54)
1987	3.2	-0.02 (-0.8)	9.3	-0.24 (-0.1)	4.9	0.42 (5.0)	-0.01 (-0.56)
1988	2.6	-0.01 (-0.3)	9.4	-0.61 (-4.6)	4.8	0.29 (2.7)	-0.00 (-0.17)
1989	2.2	-0.04 (-1.6)	10.3	-0.59 (-3.7)	4.8	0.48 (4.1)	0.02 (1.05)
1990	2.1	-0.07 (-2.5)	10.6	-1.03 (-6.2)	4.9	0.52 (4.2)	-0.01 (-0.23)
1991	2.2	-0.04 (-1.8)	10.2	-0.46 (-4.3)	5.6	0.73 (8.2)	-0.00 (-0.06)
1992	2.3	-0.03 (-1.2)	6.8	0.20 (1.9)	7.2	0.76 (7.2)	0.00 (0.08)
1993	2.5	-0.04 (-1.4)	6.4	-0.44 (-4.3)	6.7	0.65 (5.0)	0.05 (2.62)
1994	2.4	-0.13 (-3.1)	6.8	-0.04 (-0.3)	6.2	0.09 (0.6)	0.01 (0.34)

Remarks: All values presented are based on the samples of *stayers*, *t-1* and *t*. Information on unemployment, plant mobility, plant size reduction and wage changes between *t* and *t+1* has been merged to these samples. [a] These columns contain the share of employees who have experience unemployment, who changed the plant or whose plant size have been lower in *t+1* compared to *t*. [b] These columns contain the marginal effects of the wage sweep-ups on the probability of the outcome variable or the future wage changes (z-value in brackets). n.a.: Firm size not available in 1975 and 1976.

Table 12: Four year consequences of wage sweep-ups on unemployment, plant mobility and plant size reduction

Outcome, *Y*	Unemployment *t, t+4*		Plant mobility *t, t+4*		Plant size reduction *t, t+4*	
t	% [a]	*d q* [b]	% [a]	*d q* [b]	% [a]	*d q* [b]
1976	7.7	0.03 (0.2)	22.9	0.17 (0.5)	n.a.	n.a.
1977	7.4	-1.28 (-9.1)	22.2	-2.78 (-9.4)	n.a.	n.a.
1978	8.4	-0.83 (-6.0)	21.3	-1.49 (-5.7)	13.7	-0.49 (-2.2)
1979	10.4	-0.57 (-3.6)	20.2	-0.88 (-3.2)	14.4	0.52 (2.1)
1980	11.6	-0.79 (-4.2)	19.0	-0.06 (-0.2)	15.2	0.57 (2.1)
1981	12.1	-0.52 (-3.4)	18.2	0.18 (0.8)	14.2	0.46 (2.2)
1982	11.7	-0.75 (-4.7)	18.2	-0.04 (-0.2)	12.5	-0.02 (-0.1)
1983	10.7	-0.51 (-3.1)	18.3	-0.85 (-3.3)	11.0	0.05 (0.2)
1984	10.5	-0.43 (-2.3)	19.3	0.29 (0.9)	10.7	1.07 (4.5)
1985	10.0	-0.82 (-5.1)	19.7	-0.57 (-2.1)	10.8	0.77 (3.7)
1986	9.3	-0.77 (-5.4)	20.7	-0.18 (-0.7)	10.9	0.41 (2.1)
1987	8.6	-0.57 (-5.2)	21.7	0.17 (0.8)	10.6	0.01 (0.1)
1988	7.6	-0.54 (-4.0)	22.1	-0.07 (-0.3)	10.9	0.19 (1.0)
1989	7.6	-0.76 (-4.8)	22.1	-0.29 (-0.9)	12.5	-0.04 (-0.2)
1990	9.3	-0.76 (-4.0)	21.9	0.76 (2.2)	14.6	0.93 (3.4)

Remarks: All values presented are based on the samples of *stayers, t-1* and *t.* Information on unemployment, plant mobility and plant size reduction between *t* and *t+4* has been merged to these samples. [a] These columns contain the share of employees who have experience unemployment, who changed the plant or whose plant size have been lower in *t+4* compared to *t.* [b] These columns contain the marginal effects of the wage sweep-ups on the probability of the outcome variables (z-value in brackets).

Table 13: Share of employees. standard and actual wages and wage sweep (pooled samples)

Plants sector of activity [a]	Employ-ment 95 (in ´000)	Employm. growth *t-1, t*	Employm. growth *t-1, t+1*	Standard wage growth, *r*	Income growth, *? y*	Wage sweep-up, *?*
Energiewirtschaft. Kohlebergbau. Erzbergbau (4, 5, 6)	383.0	-1.0	-0.8	3.6	5.7	6.1
Chemische Industrie (9)	531.6	-0.2	0.2	4.0	5.7	6.6
Chemiefaserherstellung (10)	130.8	-1.5	-1.3	4.0	4.8	7.2
Kunststoffverarbeitung (12)	320.7	2.2	2.4	4.0	5.3	6.1
Steine und Erden (14)	192.5	-0.8	-0.9	4.2	4.8	6.0
Feinkeramik (15)	54.54	-1.5	-3.3	3.7	4.8	6.6
Glas (16)	73.50	-1.1	-0.7	3.9	4.7	6.8
Eisen- und Stahlerzeugung (17)	148.1	-3.7	-1.1	3.7	4.8	6.5
NE - Metallerzeugung (18)	548.4	-1.1	-1.4	3.8	5.3	6.0
Gießerei (19)	95.78	-1.4	0.9	3.8	4.8	5.9
Ziehereien und Kaltwalzwerke (20)	44.66	-1.8	2.6	3.8	5.0	5.2
Stahlverformung. Härtung (21)	161.4	0.6	3.6	3.7	4.9	5.6
Schlosserei (22)	84.12	2.5	1.8	3.7	5.0	5.5
Metall- und Behälterbau (23)	201.1	0.1	0.1	3.7	5.1	5.9
Lüftungs-. -wärmeanlagen (25)	170.8	1.7	0.3	3.8	5.2	6.0
Maschinenbau (26)	590.5	-0.3	1.0	3.8	5.3	5.9
Zahnräder-. Getriebeherstellung (27)	324.7	-0.1	1.2	3.8	5.3	5.6
Kraftwagenherstellung. Krafträderherstellung (28. 29)	870.8	0.9	-3.1	3.6	5.2	6.0
Kraftfahrzeugreparaturen (30)	73.62	0.9	1.6	3.7	5.7	6.1
Schiffbau (31)	39.20	-3.5	-1.1	3.8	4.9	5.3
Luftfahrzeugbau (32)	52.50	1.5	0.2	3.7	5.5	5.7
Datenverarbeitungsanlagen (33)	57.28	-1.4	-0.0	3.9	6.1	5.6
Elektrotechnik (34)	927.3	-0.2	0.4	3.9	5.6	5.9
Feinmechanik und Optik (35)	185.7	-0.2	-3.0	3.9	5.5	6.1
EBM – Waren (37)	405.1	0.2	-0.6	3.9	5.2	6.5
Spielwarenherstellung. Schmuck (38. 39)	71.42	-3.1	0.6	4.0	5.0	6.3
Holz (40)	82.32	-0.2	-0.7	4.3	4.9	6.7
Möbel (41)	302.2	0.6	0.3	4.2	4.9	6.5
Sonstiges Holz (42)	38.08	-0.6	0.5	4.2	4.6	6.3
Papier (43)	163.3	-0.2	-0.7	4.2	5.2	6.4
Druck (44)	222.0	0.3	0.3	4.0	5.2	6.9
Leder. Schuhe. Textilien. Polsterei (45, 46, 47, 49, 50, 53)	68.84	-3.1	0.5	3.8	4.7	6.5
Baumwolle (48)	35.08	-5.1	-3.0	3.9	4.8	6.0

Sonstige Textilien (51)	113.6	-3.0	-4.5	3.9	4.9	6.1
Bekleidungsgewerbe (52)	127.4	-4.5	-2.7	3.8	5.1	6.2
Nahrungsmittel. Tabakverarbeitung (54, 58)	373.0	0.5	-4.1	4.1	5.3	6.1
Süßwaren (55)	55.12	-0.2	0.7	4.1	5.3	6.2
Fleischverarbeitung (56)	156.7	0.5	0.4	4.1	4.8	6.1
Getränkeherstellung (57)	94.28	-1.4	0.7	4.4	4.9	7.2
Bauhauptgewerbe (59)	953.2	-0.6	-1.0	4.2	5.3	5.8
Zimmerei und Dachdeckerei(60)	136.3	2.4	-0.7	4.2	5.5	5.3
Ausbau- und Bauhilfsgewerbe (61)	480.4	1.4	2.5	4.0	5.0	5.6
Handel (62)	3,098	1.1	1.6	3.9	5.8	5.5
Straßenverkehr (65)	35.95	2.1	1.2	4.0	4.5	6.6
Schifffahrt (66)	47.08	-2.6	2.3	3.9	4.9	6.4
Spedition (67)	289.4	2.7	-2.4	3.6	5.4	5.6
Luftfahrt (68)	137.4	2.7	2.9	3.6	6.7	5.5
Kredit- und Versicherungsgewerbe (69)	873.1	1.4	3.1	3.9	6.7	6.6
Gaststätten (70)	56.31	2.7	1.6	3.9	5.0	6.4
Heime (71)	377.3	5.3	2.9	3.9	5.6	5.6
Reinigung (72)	240.5	3.3	5.4	4.0	5.1	4.8
Friseure (73)	106.4	0.7	3.9	3.9	6.6	5.3
(Hoch-) Schulen (74)	423.8	1.6	1.0	3.8	5.1	4.6
Sonstige Unterrichtsanstalten (75)	245.7	3.5	1.4	3.9	5.6	5.9
Kunst. Theater. u. a. Medien (76)	107.9	2.0	3.4	3.8	5.9	5.0
Verlags-. Literatur- und Pressewesen (77)	145.9	1.1	2.3	3.8	6.1	4.0
Gesundheits- und Veterinärwesen (78)	1,312	3.0	1.2	3.8	5.7	7.1
Rechts- und Wirtschaftsberatung (79)	390.0	5.2	3.0	3.9	7.1	6.2
Architektur- und Ingenieurbüros (80)	372.0	4.2	5.3	3.8	6.2	5.9
Grundstücks- und Wohnungswesen (81)	214.7	3.9	4.4	3.9	5.7	5.7
Wirtschaftswerbung und Ausstellungswesen. Fotografisches Gewerbe (82, 83)	98.86	3.5	3.9	3.9	5.9	6.2
Hygiene. Leihhäuser. Versteigerungsgewerbe (84, 85)	176.3	3.8	3.9	3.9	5.1	6.3
Sonstige Dienstleistungen (86)	330.3	7.4	7.2	3.9	5.6	4.8

Source: Own calculations from the IABS and the Federal Statistical Office; [a] Original classification from the Federal Employment Services which is used in the IABS.

***Table 14*:** Weighted fixed effects estimates on panel data from 63 sectors, 1977 - 1995

Part 1: Coefficient of .... with dependent variable sector employment growth, $?L$

	$?_t$	$?_t^{nom}$	$? y_t$	r_t
$? L_{t, t-1}$	-0.49 (-6.5)	-0.73 (-6.5)	0.82 (10.9)	0.39 (3.4)
$? L_{t+1, t-1}$	-0.61 (-10.0)	-0.87 (-9.7)	0.81 (13.1)	0.14 (1.5)
$? L_{t+2, t-1}$	-0.86 (-10.9)	-0.76 (-9.8)	0.66 (12.3)	0.04 (0.5)
$? L_{t+3, t-1}$	-0.40 (-8.5)	-0.48 (-6.9)	0.50 (10.1)	0.12 (1.7)

Part 2: Coefficient of r_t with dependent variable wage sweep-up, hypothetical nominal wage sweep-up, and income change

$?_t$	0.53 (12.1)
$?_t^{nom}$	0.52 (19.4)
$? y_t$	0.30 (6.9)

Remarks: The equations have been estimated with weighted least squares and contain in addition to the documented coefficients 62 sector dummies and between 14 and 17 time dummies; t-statistics in brackets. sample means: $?$: 5.9 %; $?^{nom}$: 2.9 %; r: 3.9 %; $? y$: 5.3 %; $? L_{t, t-1/ t+1,t-1/t+2,t-1/t+3,t-1}$: 0.52 %/ 0.65 %/ 0.70 %/ 0.73 %