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Job and Worker Reallocation in German Establishments: The Role of Employers' Wage Policies and Labour Market Institutions

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Abstract

Using a large linked employer-employee data set, this paper studies the relationship between job reallocation, worker reallocation and the flexibility of wages in western German manufacturing. Using the plant-specific residual wage dispersion as a proxy for wage flexibility, we find that more flexible wages are associated with less job reallocation due to demand shocks being absorbed by wage rather than by quantity adjustments. As to excess worker reallocation, our results provide evidence of a significant positive relationship between excess worker flows and residual wage dispersion. Consistent with the hypothesis that more flexible wages should help employers in dissolving bad matches, this relationship is found to be most pronounced for low-quality workers. In interacting our measure of wage flexibility with the degree of plant-specific employment protection we find that less stringent firing practices may considerably reduce the need for more flexible wages in order to attain optimal worker-firm matches.

Keywords: Job Reallocation; Worker Reallocation; Wage Dispersion
JEL-Code: J31, J63

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Non-technical summary: Using a large linked employer-employee data set, this paper studies the relationship between job reallocation, worker reallocation and the flexibility of wages in western German manufacturing. A key aspect of our study is that we attempt to control for further plant-specific characteristics that may be expected to affect both wages and employment adjustment. Particular emphasis is given to plant-specific labour market institutions, such as the existence of a works council and a collective wage contract, since these institutions are typically associated with more stringent employment protection and less flexible wages. Using the plant-specific dispersion of residual wages as a proxy for wage flexibility confirms this notion, since we find covered plants and those with a works council to be characterised by less intra-plant wage dispersion.

The key findings that emerge from our study may be summarised as follows: We document a negative association between plant-specific job destruction rates and residual wage dispersion, whereas job creation rates are found to be positively related to wage dispersion. In interacting our measure of wage flexibility with a proxy for demand shocks, we find that with more flexible wages demand shocks give rise to less job creation and destruction. These results lend strong support to the hypothesis put forward by Bertola and Rogerson (1997) who argue that a flexible wage structure should lead to lower job reallocation rates as demand shocks are more likely to be absorbed by price rather than by quantity adjustments.

A channel through which wage flexibility may affect excess worker reallocation, i.e. the amount of worker reallocation over and above the amount that is required to accommodate job reallocation, has been suggested by the theoretical literature on job search and matching. This literature generally predicts a negative association between wage flexibility and excess separations for those workers who are good matches, while, at the same time, predicting a positive association for those who are poor matches. The intuition here is that flexible wages may help employers to dissolve bad matches or to retain good matches. In relating our measure of residual wage dispersion to excess worker flows, our results provide evidence of a significant positive relationship, suggesting that the positive association between wage dispersion and excess separations of low-quality workers dominates the negative relationship between residual wage dispersion and excess separations of high-quality workers. Consistent with the hypothesis that more flexible wages should help employers in dissolving bad matches, the positive relationship is found to be most pronounced for low-quality workers. The established positive relationship is robust to the inclusion of plant-specific labour market institutions, which are typically found to be negatively related to excess worker flows. Finally, in interacting our measure of wage flexibility with the degree of plant-specific employment protection we find that less stringent firing practices may considerably reduce the need for more flexible wages in order to attain optimal worker-firm matches.

1 Introduction

In the last two decades, researchers have devoted considerable attention to the study of gross job and worker flows. While gross job flows measure the gross creation and destruction of jobs, gross worker flows refer to all movements of workers into and out of jobs. The latter may arise as an immediate result of job creation and destruction or, alternatively, as the consequence of a reevaluation of a job match. Clearly, identifying the determinants of these two fundamental processes of labour reallocation is essential to an understanding of labour market dynamics.

A central result that emerges from the empirical literature is that between-firm heterogeneity in gross job and worker flows, even within narrowly defined industries, appears to be substantial. As job and worker reallocation[1] reflect changes in the demand and supply of labour, it is natural to think of the flexibility of factor prices as constituting a key determinant of these flows. The role of wage flexibility for gross job flows has been taken up theoretically by Bertola and Rogerson (1997) who argue that a flexible wage structure may lead to lower job reallocation rates. The basic mechanism at work here is that with flexible wages shocks are more likely to be absorbed by price rather than quantity adjustments. A channel through which wage flexibility may affect excess worker reallocation, i.e. the amount of worker reallocation over and above the amount that is required to accommodate job reallocation, has been suggested by the theoretical literature on job search and matching (e.g. Burdett 1978, Jovanovic 1979). As discussed below, this literature generally predicts a negative association between wage flexibility and excess separations for those workers who are good matches, while, at the same time, predicting a positive association for those who are poor matches. The intuition here is that flexible wages may help employers to dissolve bad matches or to retain good matches by allowing them to adjust wages downwards or upwards.

While much of the empirical work has focused on the cyclical and structural determinants of gross job and worker flows (e.g. Davis and Haltiwanger 1990, 1992, Anderson and Meyer 1994, Burgess et al. 2000), less work has been done on the relationship between job and worker reallocation and wage formation. The purpose of the present paper is therefore to present an empirical analysis of the relationship between employer-specific wage policies and the extent of job and worker reallocation. Previous empirical research on the role of employer-specific wage policies has been limited by the availability of detailed micro-data providing both information on

[1]In what follows, gross job and workers flows and job and worker reallocation will be used synonymously.

employer-specific gross job and worker flows and detailed information on individual wage records as well as worker characteristics.[2] Only recently, with the increasing availability of Linked Employer-Employee data, has the relationship between gross job and worker flows and wage flexibility received some attention. One of the few studies in this field has been performed by Haltiwanger and Vodopivec (2003). Using a Linked Employer-Employee data set from Slovenia, these authors compute the employer-specific residual wage dispersion as a proxy for wage flexibility and explore the relationship between this measure and gross job and worker flow rates. A similar analysis has been conducted by Tsou and Liu (2005) for Taiwan. The evidence presented there provides valuable insights into the determinants of job and worker reallocation by documenting strong correlations between employer-specific residual wage dispersion and gross job and worker flows. Thus far, similar evidence for western European economies has been lacking. This is particularly surprising as these countries are often characterised by labour market institutions that are widely thought to impose substantial restrictions on both the flexibility of wages and employment adjustment.

In this paper we present some new evidence on the relationship between employer-specific wage policies and job and worker reallocation using a large-scale linked employer-employee data set from Germany, the Linked Employer-Employee Panel from the German Institute for Employment Research (LIAB). This data set provides a useful basis for exploring the relationship between wage flexibility and job and worker reallocation for several reasons. First, the data combine establishment-level longitudinal data with information on individual wage records and characteristics for the entire population of workers in the establishment sample. This enables us to make explicit use of the individual information to calculate year-to-year gross job and worker flows at the establishment level. Taking advantage of the information on individual wage records, we proceed to construct a measure of establishment-specific residual wage dispersion as a proxy for wage flexibility. A second strength of the data set is that the establishment-level data offer a great deal of information on establishment characteristics, such as value added, investment expenditures as well as the nature of industrial relations. The latter permits us to additionally control for the existence of plant-specific labour market institutions, such as a works council or a legally binding collective wage agreement. This is an important aspect of our study since these labour market institutions are typically associated with more

[2] This is because much of the empirical work is based upon establishment or company-level data (see. e.g. Davis and Haltiwanger 1992, Gerlach and Wagner 1993, Konings 1995, Hamermesh et al. 1996, Blanchflower and Burgess 1996). Burgess et al. (2000) use a Linked Employer-Employee data set, but do only have access to information on average employers' wages.

compressed wage policies, while at the same time providing stricter employment protection. In the absence of such institutional information it is therefore difficult to determine to what extent less flexible wages simply reflect more stringent hiring and firing practices or affect job and worker reallocation through their genuine impact on the employer's ability to adjust wages.

The remainder of the paper proceeds as follows. Section 2 contains a brief theoretical discussion of how the extent of wage flexibility may be expected to affect the magnitude of gross job and worker flows. Section 3 gives an overview of related empirical work. Section 4 provides some institutional background information on German labour market institutions that simultaneously affect the extent of employment protection and the flexibility of wages. Section 5 presents the empirical analysis. While Section 5.1. to 5.3. provide a description of the data set and a discussion of the basic measurement concepts, Section 5.4. and 5.5. present the empirical results. The final Section 6 concludes.

2 Theoretical Considerations

2.1 Wage Flexibility and Job Reallocation

Central to most theoretical explanations of simultaneous job creation and destruction are allocative shocks either in the form of idiosyncratic cost disturbances (Davis and Haltiwanger 1990, Hopenhayn 1992), or in the form of demand (Caballero and Hammour 1994) or productivity shocks (Mortensen and Pissarides 1994). With such shocks providing the main motivation for job reallocation, it is natural to think of the flexibility of factor prices as constituting a key determinant of these flows. The fact that a compressed wage structure may lead to higher job reallocation rates has been extensively discussed by Bertola and Rogerson (1997) who argue that with less flexible wages shocks are more likely to be absorbed by employment rather than wage adjustments. Moreover, these authors were the first to notice that distinct features of labour market institutions, such as stricter employment protection and wage compression, may give rise to countervailing effects on job reallocation. In looking for an explanation of strikingly similar job reallocation rates across countries with very different employment protection policies, the authors point to the stylised fact that labour market institutions providing stricter employment protection are generally associated with more compressed wage policies. As employment protection has been typically shown to have a negative effect on job reallocation (e.g. Bentolila and Bertola 1990), this may help to rationalise why job reallocation rates do not vary that much across countries with different labour market institutions.

2.2 Wage Flexibility and Excess Worker Reallocation

In the theoretical literature on job search and matching, imperfect information provides the main theoretical motivation for explaining the extent of excess worker reallocation. At the heart of this approach is the notion that the quality of a match between a firm and its workers is ex-ante uncertain and may be thought of as an experience good which is revealed over time with the accumulation of tenure (Jovanovic 1979). As long as wages may be seen as a good proxy for the value of the match, the Jovanovic learning model predicts a negative relationship between wages and excess worker reallocation. The reason is that good matches are maintained and bad matches are dissolved by lowering the wages of bad matches down to a level at which they quit. This, in turn, entails a negative association between wage flexibility and excess separations for those workers who are good matches, while, at the same time, predicting a positive association for those who are poor matches. The reason is that firms with a more flexible wage structure will be able to retain good matches by adjusting their wages upwards. This becomes particularly relevant if one allows for on-the-job search permitting workers to search for better paid jobs as in Burdett (1978). Conversely, if a more flexible wage structure helps firms to cut the wages of bad matches, this should lead to higher excess separation rates of low-quality workers.

While the Jovanovic learning model emphasises the relationship between the extent of wage flexibility and workers' quit behaviour, it is equally natural to consider the impact of wages on the hiring practices of employers. In combining the Jovanovic model with features of the matching model of Pissarides (1985), Pries and Rogerson (2005) suggest such a channel through which wage flexibility may affect employers' hiring behaviour. They develop a matching model in which employers receive a signal about the match's true quality and in which matches are formed only when the signal exceeds a threshold value. The authors argue that their model may help to explain the negative effect of minimum wage regulations on the extent of hiring through its impact on the minimum required match quality. In terms of excess worker reallocation, their model is therefore to be interpreted as predicting a positive relationship between wage flexibility and excess hiring. The intuition here is that a flexible wage structure may induce firms to become less selective to whom they hire and may therefore entail more excess turnover for a given created job. In addition to analysing minimum wages, the authors also explore the effect of various other policies, such as dismissal costs on hiring behaviour. As with minimum wages, stricter firing regulations are shown to reduce the extent of hiring. The underlying intuition here is that firms become more selective in hiring new workers if it becomes more expensive to terminate a match.

Taken together, the overall view that emerges from the theoretical literature is that wage compression and stricter employment protection policies may be expected to have an offsetting impact on job flows, whereas the effects on excess worker flows tend to go into the same direction. An exception are separations of workers who are good matches, because for this group one might expect wage compression to have a positive impact on excess separations. As a consequence, any empirical analysis that attempts to quantify the impact of wage flexibility on the extent of gross job and worker flows needs to carefully disentangle its genuine impact on these flows from institutional determinants that may be correlated with specific wage policies. In terms of a multivariate regression framework, this suggests that in addition to measures of wage flexibility further institutional determinants simultaneously affecting wage formation and the extent of employment protection should be accounted for.

3 Related Empirical Literature

In the past decades, there has been a great deal of empirical work that has set out to characterise the empirical properties of gross job flows. The pioneering studies in this field were performed by Dunne et al. (1989) and Davis and Haltiwanger (1990, 1992), who exploited large datasets on U.S. manufacturing plants. Since then, several such analyses have appeared for other countries, such as those by Boeri and Cramer (1992) for Germany, Leonard and van Audenrode (1993) for Belgium, Konings (1995) as well as Blanchflower and Burgess (1996) for the UK. A principal finding that emerges from this literature is that job flow rates are substantial - ranging from 10 to 20 per cent - and that job creation and destruction typically occur simultaneously even within narrowly defined industries.

With the increasing availability of detailed micro data, a closely related literature has studied the determinants of worker flows and has attempted to quantify the relation among gross job and worker flows. Examples are the studies by Anderson and Meyer (1994), Hamermesh et al. (1996), Albaek and Soerensen (1998), Abowd et al. (1999a) as well as Burgess et al. (2000). A key finding from this literature is that job reallocation accounts for a substantial fraction of worker reallocation. This proportion typically ranges from 30 to 50 per cent, indicating that the rate at which employment positions are reallocated provides one of the major reasons for workers changing employers or entering unemployment. As with gross job flows, much of this work demonstrates that the amount of worker and excess worker flows varies greatly among employers. The impressive magnitude of between-firm heterogeneity has led researchers to inquire into the structural determinants of gross job and worker flows. One of the well documented empirical patterns is that the amount of gross job and worker flows generally declines with firm size and age and appears to be more pervasive in the non-manufacturing as compared to manufacturing industries. A further well documented empirical regularity is the importance of the idiosyncratic component in job and worker reallocation. For example, Burgess et al. (2000) find employer-specific fixed effects to account for over 50 percent in the variation of excess worker flows. Moreover, in examining the sources of the time variation of job reallocation, Davis and Haltiwanger (1992) show that employer-specific time-variant effects account for the largest fraction of the cyclical behaviour of gross job flows.

The widely established importance of employer-specific effects in explaining the level and time variation of job and worker flow rates indicates that either different firms face different circumstances and/or respond differently to similar shocks. This immediately raises the question of the role of employer-specific wage policies, allowing firms to respond differently to a change in their economic environment. Even though wage policies have been recognised as a potential source of between-employer heterogeneity (Burgess et al. 2000, Davis et al. 2006), very few empirical studies have addressed the relationship between the extent of wage flexibility and gross job and worker flows. Some indirect evidence is provided by cross-country studies that exploit international variations in labour market institutions in order to examine their impact on job and worker reallocation. Examples are the studies by Salvanes (1997) and Gomez-Salvador et al. (2004), who look at the relationship between job flows and European labour market institutions. Controlling for different degrees in the tightness of employment protection the authors find countries with more coordinated wage bargaining systems exhibit lower job reallocation rates. As more centralised wage determination is typically associated with a more compressed wage structure[3], the Bertola-Rogerson hypothesis therefore does not appear to receive much support from this cross-country evidence. Further indirect evidence is provided by establishment-level studies that look at establishment-specific institu-

[3]See e.g. Holmlund and Zetterberg (1991), Blau and Kahn (1996), Kahn (1998).

tional determinants of plant-level gross job and worker flows. Using data from the Workplace and Industrial Relations Survey, Blanchflower and Burgess (1996) explore the plant-specific determinants of job reallocation in Britain. While providing some descriptive evidence of a negative association between union recognition and the amount of job reallocation, the authors fail to detect any significant relationship between these variables in a multivariate regression framework. Note that this finding may be consistent with the Bertola-Rogerson view of countervailing effects of labour market institutions on gross job flows. Using panel data from the Italian metal sector, Lucifora (1998) finds plant-specific union density to be negatively associated with separation rates. He concludes that a possible explanation may relate to the unions' ability to raise wages above the competitive level. However, due to a lack of information on individual wages, the study does not separate the unions' impact on wage formation from other channels through which unions may affect worker separations.

Far fewer studies have attempted to measure wage flexibility and its impact on gross job and worker flows directly. Using establishment-level data from Sweden, Heyman (2001) measures wage flexibility by calculating the industry-specific variability in average establishment wages. Consistent with the Bertola and Rogerson hypothesis, he finds industry-specific job reallocation to be negatively related to the industry-specific dispersion in wages. Yet, it is clear that his measure of wage flexibility is not able to account for differences in observable worker and employer characteristics that may explain part of the variation in establishment-level wages. The study that is closest to our analysis is that by Haltiwanger and Vodopivec (2003), who use a linked employer-employee data set from Slovenia and look at the relationship between firm-specific wage dispersion and gross job and worker flow rates. After controlling for differences in observable worker characteristics, the authors find firm-specific wage dispersion to be negatively related to job reallocation and positively related to excess worker reallocation. A similar study has been performed by Tsou and Liu (2005) for Taiwan who find a negative association between firm-specific wage dispersion and job as well as worker reallocation. A drawback of these studies is that they do not control for other firm-specific characteristics, which are likely to simultaneously affect the degree of wage dispersion and turnover, such as the composition of the workforce and firm size. As noted earlier, in the German case a particularly relevant factor are plant-specific labour market institutions, which may have a simultaneous impact on wage formation and employment adjustment. In the next section we therefore provide some background information on German labour market institutions which we consider relevant in this context.

4 Institutional Background

4.1 Dismissal protection legislation

In Germany, protection against unfair dismissals is provided by the *Protection against Dismissal Act* (Kündigungsschutzgesetz) which applies to establishments employing a certain minimum number of workers. Over the last decade, the threshold for applicability has changed several times, from 5 to 10 workers in October 1996, back to 5 workers in January 1999 and then back again to 10 workers in January 2004.[4] Establishments which operate below this threshold may dismiss any worker as long as the less restrictive requirements of the *German Civil Code* (BGB) are met.[5] According to the more stringent employment protection provisions of the *Protection against Dismissal Act*, dismissals are justified in three cases only: first, in case of personal misconduct, second, as a result of the operational requirements of the employer, and, third, in case of personal incapability or illness. Establishments are also required to inform the works council where such worker representation exists. Consultation with the works council is mandatory for both individual and collective redundancies. The latter generally require the negotiation of a 'social plan' with the works council. Such a plan may, for example, stipulate severance payments and the selection of employees who are laid off (see Section 4.3). Severance payments may also result from settlements after individual dismissals out of or at the Labour Court - either because employers are not able to prove that the requirements for a legal dismissal are met or because they want to prevent workers from suing them at Court.[6]

4.2 Collective bargaining agreements

As in many other European countries, German wage determination is dominated by collective bargaining agreements. Such collective contracts are generally negotiated between industry-specific trade unions and employers' associations. While legally binding on all member firms of the employers' association and on all employees who

[4]The threshold refers to fulltime-equivalent employees. Workers employed on fixed-term contracts, other marginal workers and apprentices are generally excluded from this definition. See e.g. Bauer et al. (2007) who provide an analysis of the effects of this change in employment protection legislation on worker reallocation.

[5]An exception is if the establishment is subject to a collective bargaining contract which stipulates special dismissal protection provisions. See also Section 4.2.

[6]For a more extensive discussion on dismissal protection legislation, see e.g. Schmidt and Weiss (2000).

are members of the trade union, member firms generally extend the wage settlement to the non-unionised labour force as well. The decision to join an employers' association and to apply such a centralised agreement is generally left to the firms' discretion. An exception is if an agreement is declared to be generally binding by the Federal Ministry of Labour in which case centralised wage contracts may also apply to non-member firms and their employees. Further, there are voluntary extension mechanisms, i.e. firms without any legally binding agreement may voluntarily apply a centralised industry agreement. Finally, a minor fraction of non-member firms are engaged in bilateral negotiations with a trade union and conclude firm-specific agreements. Even though the proportion of covered establishments has been steadily declining over the last decade[7], collective bargaining is still of considerable importance to the wage-setting process. For example, in 2004 collective contracts were estimated to cover 61 per cent of employees in western Germany (Addison et al. 2006a).

The predominance of collective bargaining agreements immediately raises the question as to how such contracts leave sufficient room for firm-specific wage policies. In fact, the past two decades have seen a clear tendency even within centralised wage agreements towards more flexible wage-setting at the firm level since contractual opt-out or hardship clauses have become a widespread element of such agreements. While opt-out clauses delegate issues that are usually specified in the central agreement, such as working-time and pay-conditions, to the plant level, hardship clauses enable firms to be exempted from the centralised agreement if they are close to bankruptcy. Moreover, since bargained wages in centralised agreements merely represent a lower bound for wages, there is also sufficient scope for upward flexibility which is reflected in a major fraction of covered firms paying wages above the collectively agreed rates. Taken together, then, the institutional setting indicates that even under centralised agreements there ought to be sufficient scope for firm-specific wage policies. The question of whether this potential has really been exploited is ultimately an empirical one. Based on the same data that are used in this study, recent evidence suggests that collective wage contracts appear to suppress the responsiveness of wages to firm-specific profitability conditions (Guertzgen 2005). Empirical studies dealing with the impact of collective bargaining on the returns to individual attributes support the notion that unions compress the returns to individual attributes and tend to raise wages particularly for those workers with

[7]According to the IAB-Establishment Panel the proportion of establishments subject to an industry-wide agreement fell economy-wide from 48 per cent to 41 per cent over the time period 1996 to 2004, whereas the decline was from 10 per cent to 2 per cent for firm-specific contracts.

low observed skills (Stephan and Gerlach 2005 and Fitzenberger et al. 2007). In this regard, research based on longitudinal data has shown that this induces employers to hire the most productive workers from those with low observed skills (Guertzgen 2006).

While collective bargaining agreements primarily affect wage determination, they may also play a certain role in employment protection. A number of collective bargaining agreements include special dismissal protection provisions, such as more stringent notice periods than those provided by the German *Civil Code* or the overall exclusion of regular dismissals for certain groups of employees. The criteria defining who these provisions apply to generally relate to age and tenure. It is important to note that these regulations have priority over other statutory dismissal protection measures as discussed in Section 4.1.

4.3 Works councils

In Germany, works councils provide workers with the opportunity of employee representation at the establishment level. While being legally mandatory in all establishments with at least 5 employees, a local worker representation of this kind only takes institutional form if workers initiate a works council election. The participation rights are laid down under the German *Works Constitution Act* (Betriebsverfassungsgesetz) and include information, consultation and co-determination rights, which generally increase in scope the larger the establishment becomes. These rights concern a variety of aspects such as working hours and overtime regulations, health and safety matters, dismissal and hiring decisions as well as the remuneration of employees. Clearly, the latter two issues are those that are most relevant to our analysis.

Particularly with respect to employment protection, works councils are known to have a rather strong position in limiting employers' discretionary hiring and firing powers. According to Section 102 of the *Works Constitution Act,* any dismissal requires prior consultations with the works council who enjoys the right to object to the dismissal. If such a formal objection is lodged, the respective workers may stay employed until a settlement has been reached out of or at the Labour Court. In case of collective dismissals, works councils may object to the dismissal if they consider the criteria for the selection of dismissed employees to be inappropriate. Especially with regard to quits the works council's impact may not only stem from its direct participation rights but may also work through its collective voice function, enabling workers to express discontent. Finally, works councils' co-determination rights are not restricted to dismissals but also extend to hiring decisions as Section 99 of the *Works Constitution Act* provides works councils in establishments with at least 20 employees with the opportunity to formally object to the recruitment of new employees. While these considerations together predict works councils to have a strong negative effect on job and worker reallocation, the empirical evidence is somewhat inconclusive. Previous studies have primarily focused on works councils' effects on worker reallocation, rather than job and excess worker reallocation. These studies generally document a negative effect on separations, whereas the evidence on hirings is rather mixed (see Frick 1996, Backes-Gellner et al. 1997, Addison et al. 2001).

As to wages, according to the dual nature of the German system of industrial relations works councils are formally prohibited from negotiating over issues that are normally dealt with in collective bargaining agreements. Yet, despite this legal ban they are widely recognised to have a substantial impact on wages for at least two reasons. The first stems from works councils being traditionally involved in the implementation of collective bargaining agreements at the establishment level. Along with their consent right with respect to the placement of workers in certain wage groups works councils are therefore likely to be actively engaged in wage setting. Second, the payment of wages above the collectively agreed rate may also be expected to result from the local bargaining between works councils and the management. Consistent with these ideas, a large number of empirical studies have documented a significant impact of works councils on the level and the structure of wages. A key finding that emerges from this literature is that works councils appear to raise the level of wages (see e.g. Addison et al. 1997, Hübler and Jirjahn 2003) and tend to compress the wage structure by raising wages particularly at the lower part of the wage distribution (Addison et al. 2006b).

5 Empirical Analysis

5.1 Data

The data used in this paper are taken from the IAB Linked Employer-Employee Panel (LIAB) which combines data from the *IAB-Establishment Panel* and the *Employment Statistics Register*. The *IAB-Establishment Panel* is based on an annual survey of western German establishments administered since 1993 by the research institute of the Federal Employment Services in Nuremberg. Eastern German establishments entered the panel in 1996. The sampling frame encompasses all German establishments that employ at least one employee paying social security contributions. New establishments are added to the survey every year to incorporate births and to correct for panel mortality and exits in order to preserve the panel's representative character. The survey provides a great deal of information on establishment structure and performance, such as sales, the share of materials in sales, investment expenditures as well as information on industrial relations, such as the existence of a works council or a legally binding collective wage agreement (see e.g. Bellmann et al. 2002).

The second data source is the *Employment Statistics Register,* which is an administrative data set based on reports from employers in compliance with the notifying procedure for the German social security system (see e.g. Bender et al. 2000). This procedure obliges employers to provide a notification at the beginning and the end of each employment relationship for all employees who are covered by the German social security system. In addition, there is at least one annual compulsory notification on the 31^{st} December of each year. The notifications provide individual information on the gross daily wage, age, gender, nationality, employment status (blue/white-collar, part/fulltime, apprentice), educational status (six categories)[8] and on the date of entry into the establishment.

The data set is constructed in two steps: First, we select establishments from the establishment panel data set. From the available waves, we use the years 1995 to 2004. Since information on a number of variables, such as investment expenditures and sales are gathered retrospectively for the preceding year, we lose information on the last year. Moreover, we restrict our sample to establishments in western Germany from the mining and manufacturing sector with at least two employees. In order to be able to compute gross job and worker flows, only establishments with consistent information on the establishment characteristics of interest and at least two consecutive annual time series observations are included in our sample. From the establishment level data we gain information on a number of establishment characteristics, which are likely to impact upon gross job and worker flows. In line with the empirical literature, these include establishment size, establishment age and a dummy variable indicating whether the establishment is part of a single plant or a multi-plant enterprise. To capture institutional differences, we further retrieve information on the existence of a works council and a legally binding collective bargaining

[8] The categories are: No degree, vocational training degree, highschool degree (*Abitur*), highschool degree and vocational training, technical college degree and university degree. Missing and inconsistent data on education are corrected according to the imputation procedure described in Fitzenberger et al. (2006). This procedure relies, roughly speaking, on the assumption that individuals cannot lose their educational degrees.

contract. We also construct a measure of value added and the capital-labour-ratio in order to control for demand shocks and differences in production technologies. Table A1 in the appendix provides a detailed description of the construction of the establishment variables.

In a second step, the establishment data are merged with the individual data using a unique establishment identifier which is available from the establishment and worker data. The currently available version of the data allows us to merge the selected establishment data with notifications for all those employment spells comprising the June 30^{th} of each year. Since the focus of our analysis is on gross job and worker flows pertaining to standard core employment relationships we exclude observations for homeworkers from the individual data. Moreover, for those workers who have multiple employers we include only the employment relationship with the dominant employer.[9] The resulting sample comprises 898,111 individuals in 1,639 establishments with a total of 5,867 establishment observations and 3,017,246 individual observations. We exploit the individual information to calculate establishment-specific means of individual attributes, which may be expected to have an impact upon job and worker flow rates. These include the share of females, part time workers, apprentices, skill groups as well as the median age and tenure of the workforce. Table A2 in the appendix contains a description of the establishment means of individual characteristics gained from the *Employment Statistics Register*. Finally, Table A3 provides a summary of descriptive statistics of the establishment covariates.

Further, we make explicit use of the individual information to calculate annual gross job and worker flows at the establishment level. To do so, we proceed as follows. Given the structure of the matched worker-firm data, the number of jobs in establishment j at time t is defined as the number of employment spells comprising the June 30th in year t. A worker accession in establishment j in period t is defined as an employment relationship which is observed at June 30th in period t but not in year $t-1$ (at the same point-in-time). Similarly, a worker separation at time t is an employment relationship observed at $t-1$ but not in period t. From these definitions it becomes clear that gross job and worker flows cannot be calculated for the first time-series observation of an establishment in the panel. Note that recovering the worker and job flow measures from the individual data is a particular strength of our

[9]This exclusion affects less than 1 per cent of all observations. The dominant employer is inferred from the maximum amount of daily earnings. We also exclude marginal employment relationships (those with earnings below a certain threshold value), since these are included in *Employment Statistics Register* only from 1999 onwards.

data set. The first advantage is that due to its administrative nature the *Employment Statistics Register* offers very reliable information on the number of spells at the relevant point-in-time. Second, and more importantly, the individual data enable us to gain individual-specific job and worker flow measures. This provides us with the opportunity to explore whether the hypothesised relationship between excess worker reallocation and wage flexibility varies with the quality of the match.

However, the data offer some other clear disadvantages as well. First, establishments may enter and exit the *IAB-Establishment Panel* in each time period, and the data do not allow a distinction between panel attrition and the death of establishments and between establishments entering the panel and the birth of plants, respectively. As a result, we are not able to identify accessions due to births and separations due to deaths of establishments. Thus, the measures of gross job and worker flows described below will relate to job and worker reallocation in surviving establishments that are observed for a least two consecutive years in the panel. Second, since the establishment data are linked with employment spells comprising June 30th in a particular year t, the data do not include spells that begin after June 30th in year $t-1$ and dissolve before June 30th in year t. As a result, we are not able to calculate measures of within-year job and worker reallocation and, therefore, have to confine the analysis to year-to-year job and worker flows.[10] A final disadvantage of the data set is that the *Employment Statistics Register* lacks explicit information on why an employment relationship has been terminated. As a consequence, the data do not permit a separate analysis of employer initiated separations (dismissals) and employee initiated separations (quits).

5.2 Definition of Job and Worker Flow Rates

Following Davis and Haltiwanger (1992), job flow rates for any given establishment are defined as follows. The year-to-year net job growth rate in establishment j is

$$JGR_{jt} = \frac{X_{jt} - X_{jt-1}}{(X_{jt} + X_{jt-1})/2}, \tag{1}$$

where X_{jt} and X_{jt-1} measure the stock of employment at June 30th in year t and $t-1$. Correspondingly, the year-to-year job creation rate in establishment j is

[10] An alternative version of the LIAB data merges the *IAB-Establishment Panel* with individual employment histories including also spells beginning after and dissolving before June 30th. However, this version of the data is restricted to a subset of establishments that are surveyed continuously from 1999-2001 or from 2000-2002. In order to be able to consider a longer time-period and to include as many establishments in our analysis as possible, we deliberately make use of the above described version of the data.

$$JCR_{jt} = \max(0, \frac{X_{jt} - X_{jt-1}}{(X_{jt} + X_{jt-1})/2}), \tag{2}$$

whereas the year-to-year job destruction rate is given by

$$JDR_{jt} = \max(0, \frac{X_{jt-1} - X_{jt}}{(X_{jt} + X_{jt-1})/2}). \tag{3}$$

The job reallocation rate for any establishment is given by the absolute value of either JCR_{jt} or JDR_{jt} :

$$JRR_{jt} = \left| \frac{X_{jt} - X_{jt-1}}{(X_{jt} + X_{jt-1})/2} \right| \tag{4}$$

Similarly, the gross job creation rate within a particular sector s (such as an industry or size class) is defined as the sum over all employment gains in sector s, divided by average sector size, where the latter is given by $(X_{st} + X_{st-1})/2$. The job destruction rate within sector s is obtained by totalling all job losses and dividing by average sector size. Sector-specific job-creation rates are therefore size-weighted averages of growth rates among establishments where employment is increasing, while sector-specific job-destruction rates are size-weighted averages of growth rates among establishments where employment is falling. The job reallocation rate in sector s is defined as the sum of its job creation and destruction rate, measuring the rate at which employment positions are reallocated across establishments in a particular sector. Note that the job reallocation rate represents an upper bound on the worker flow rate required to accommodate the reallocation of employment positions within a particular sector s. Similarly, a lower bound is given by $\max[JDR, JCR]$ taking into account that job losers may directly switch to new jobs at expanding establishments (Davis and Haltiwanger 1992).

Following Burgess et al. (2000) worker accessions and separation rates in establishment j are defined as

$$ACCR_{jt} = \frac{ACC_{jt}}{(X_{jt} + X_{jt-1})/2} \text{ and } SEPR_{jt} = \frac{SEP_{jt}}{(X_{jt} + X_{jt-1})/2} \tag{5}$$

where ACC_{jt} and SEP_{jt} denote the number of accessions and separations at the establishment level as defined earlier. The worker flow rate is the sum of the hiring and separation rate

$$WFR_{jt} = \frac{ACC_{jt} + SEP_{jt}}{(X_{jt} + X_{jt-1})/2}$$

and the excess worker flow rate is the amount of worker flows in excess of job reallocation, i.e. worker flows in excess of the amount that is required to accomplish an establishment's growth or decline:

$$EXWFR_{jt} = \frac{WFR_{jt} - JRR_{jt}}{(X_{jt} + X_{jt-1})/2}. \quad (6)$$

Sector-specific rates (e.g. by industry or size class) are defined analogously to the sector-specific job reallocation rates described above. Note that if the job and worker flow measures are aggregated over all individual characteristics at an establishment j, the difference between hiring and separations must be equal to the change in employment, i.e.

$$ACC_{jt} - SEP_{jt} = X_{jt} - X_{jt-1}. \quad (7)$$

This definition of job flows reflects the standard concept in the literature in defining jobs flows as the net change in employment at an establishment j. This is based upon the notion of a job as a worker-employer match and therefore relates job flows to the change in the number of such matches.[11]

5.3 A Measure of Firm-Specific Wage Flexibility

Following Haltiwanger and Vodopivec (2003), wage flexibility will be proxied by plant-specific residual wage dispersion. This measure is intended to capture that part of the within-plant variability in wages that may not be explained by differences in observable characteristics. Based upon the notion that excess separations and accessions depend critically on the employer's ability to pay wages that deviate from the average employer-specific wage premium, one might argue that this measure of wage dispersion is well suited for explaining the heterogeneity in excess worker flows. Yet, in explaining the heterogeneity in job flows such a cross-sectional measure is certainly open to several criticisms, with the most important one being that it fails to capture any dynamic dimension of wage flexibility. Ideally, one would like to obtain a measure that reflects the extent to which wages respond to changes in economic conditions, such as demand or productivity shocks. Even

[11] As noted by Davis and Haltiwanger (1992) and Burgess et al. (2000), an alternative view would be to associate a job with a particular employment position or skill-level. Thus, the replacement of a job of one particular skill-type with another skill-type could equally be referred to as job creation and destruction. This alternative view of job reallocation could be accounted for by skill-specific measures of job flows. However, eq. (7) need not necessarily hold in this case, since a change in the skill configuration at establishment j may either be accomplished by external accessions and separations or, alternatively, by internal accessions and separations that occur through skill-upgrading or downgrading (see e.g. Abowd et al. (1999a) and Bauer and Bender (2004) for such a skill-specific analysis).

though our data set offers information on value added as a proxy for such shocks, it presents us with severe difficulties in obtaining such a dynamic measure that varies across plants. The reason is that any employer-specific measure would involve plant-specific regressions of wages on a measure of time-specific shocks, which requires a sufficient number of establishments which can be tracked over a longer time period. Since in our data set the average number of time-series observations is about 3.6, we resort to the plant-specific dispersion of residual wages to explain both worker and job reallocation.[12] However, later on we will interact this measure with a proxy for demand shocks in order to examine whether establishments with a more dispersed wage structure respond differently to these shocks than those with a more compressed wage structure.

To construct the measure of residual wage dispersion, we proceed as follows. First, we estimate an individual wage equation taking the following form:

$$\ln wage_{it} = \mu + \beta \cdot x'_{it} + \delta \cdot u'_{i} + \eta \cdot w'_{jt} + \rho \cdot q'_{j} + \alpha_i + \phi_j + \epsilon_{ijt}, \tag{8}$$

with $i = 1,..., N$ individuals and a total of $N^* = \sum T_i$ total worker-year observations. j refers to the establishment which employs individual i at time t, i.e. we have $j = j(i,t)$, with $j = 1, ..., J$. The dependent variable, $\ln wage_{it}$, is the individual log daily wage. The explanatory variables consist of a vector of time-varying individual covariates, x'_{it}, with a coefficient vector β, a vector of individual time-constant characteristics, u'_i with a coefficient vector δ, and vectors of time-varying and time-constant $j-$level covariates, w'_{jt} and q'_j, with coefficient vectors η and ρ. Time dummies are included to capture common macroeconomic effects. Finally, α_i represents an individual unobserved effect, ϕ_j denotes establishment-specific unobserved heterogeneity, and ϵ_{ijt} represents a time-specific error term.

To account for individual and establishment-specific unobservable characteristics, we present estimates of a fixed-effects specification which eliminates α_i as well as ϕ_j (see Abowd et al. 1999b). To remove $\alpha_i + \phi_j$, we first-difference eq. (8) within each individual-establishment combination, also referred to as individual-establishment-'spells' (Andrews et al. 2005). Defining $\theta_s = \alpha_i + \phi_j$ in eq. (8) as the unobserved spell-level effect for spell s, first-differencing of eq. (8) yields:

$$\Delta \ln w_{it} = \beta \cdot \Delta x'_{it} + \eta \cdot \Delta w'_{jt} + \Delta \epsilon_{ijt}, \tag{9}$$

where first-differencing within each spell sweeps out θ_s. From eq. (9) it becomes clear that spell first-differencing eliminates time-constant individual characteristics

[12]For instance, only 331 out of 1,639 establishments are observed over a time-period of more than 6 years, whereas only 179 plants are observed for more than 7 years.

u_i' as well as time-constant establishment variables q_j', so that the coefficient vectors δ and ρ cannot be identified. For this reason, it is common to subsume observable time-constant and unobservable attributes into one single individual- and establishment effect, i.e. $\varphi_i = \delta \cdot u_i + \alpha_i$ as well as $\vartheta_j = \rho \cdot q_j + \phi_j$. Since previous research on German wage determination has documented significant differences in the returns to firm-specific attributes across different bargaining institutions (Stephan and Gerlach 2005, Guertzgen 2006), we include interactions between collective bargaining status (firm-specific contract, industry contract) and some of the time-varying $j-$level covariates, w_{jt}'.

The *Employment Statistics Register* contains individual information on gross daily wages, which are reported inclusive of fringe-benefits as long as such wage supplements are subject to social security contributions. Since there is an upper contribution limit to the social security system, gross daily wages are top-coded. In our sample, top-coding affects 12.9 per cent of all observations. To address this problem, we construct 54 cells based on education, gender and year. For each cell, a Tobit regression is estimated with log daily wages as the dependent variable and individual and establishment covariates as explanatory variables (see Table A4 in the appendix). As described in Gartner (2005), right-censored observations are replaced by wages randomly drawn from a truncated normal distribution whose moments are constructed by the predicted values from the Tobit regressions and whose (lower) truncation point is given by the contribution limit to the social security system. After this imputation procedure, nominal wages are deflated by the Consumer Price Index of the Federal Statistical Office Germany normalised to 1 in 2000.

To estimate eq. (9), we exclude observations for apprentices and part time workers from the worker data, because the *Employment Statistics Register* lacks explicit information on hours worked. Moreover, we consider only those individuals for whom the individual covariates reported in Table A4 and at least two consecutive time series observations per spell are available. This reduces the estimation sample to 659,784 individuals, yielding an unbalanced panel containing 2,525,188 individual observations. Table A4 in the appendix reports individual-level descriptive statistics as well as the estimates resulting from the fixed-effects specification. The figures show that except for some of the educational variables all individual covariates enter the specification with their expected sign and are significant at the 1% or 5%-level. Moreover, from the establishment-level covariates the coefficients on establishment size and per-capita value added are found to be significant at the 1% or 5%-level.

Similar to what has been found in earlier work (Guertzgen 2005, 2006) centralised contracts are associated with a significant lower responsiveness of wages to firm-specific productivity conditions.[13]

After having estimated eq. (9), an estimator of the unobserved spell effect $\theta_s = (\varphi_s + \vartheta_s)$ is computed as follows:

$$\widehat{\theta}_s = \overline{\ln w}_s - \beta \cdot \overline{x}_s - \eta \cdot \overline{w}_s \tag{10}$$

where variables with bars denote averages over all time-series observations within each spell. We then calculate for each establishment and each year the mean and the standard deviation of $\widehat{\theta}_s$. From these estimates we obtain a time-varying plant-specific mean, $\overline{\theta}_{jt}$, standard deviation $sd(\theta)_{jt}$ and coefficient of variation, $CV(\theta)_{jt}$ of $\widehat{\theta}_s$.[14] Table 1 provides descriptive statistics of the plant-specific mean and standard deviation of $\widehat{\theta}$ averaged over all establishment observations separately by bargaining coverage and the existence of a works council. To obtain reasonable measures of plant-specific wage dispersion, the descriptive statistics are restricted to plants with at least 10 employees. The upper part of Table 1 shows that individuals in covered plants are characterised by higher unobserved individual and plant-specific effects. Moreover, the intra-plant dispersion of this unobserved wage component is smaller in covered plants, which exhibit a smaller coefficient of variation of $\widehat{\theta}$ than uncovered establishments. Note that the smaller variability in $\widehat{\theta}$ in covered establishments is consistent with the view that in covered establishments observable and unobservable individual characteristics are likely to be negatively correlated. The reason is that, if collective contracts raise wages particularly for those with low observed skills and tend to decrease wages for those with high observed skills by reducing the returns to observable attributes, jobs in covered firms are particularly desirable for observably low-skilled workers and less attractive for those with high observed skills. As a result, employers have the incentive to hire the most productive workers from those with low observed skills, whereas workers with high observed skills should be negatively selected (see also Card 1996, Lemieux 2000). Finally, the last rows indicate that similar results hold for the co-determination regimes. Works council plants have, on average, a higher unobserved individual and plant-specific wage component, which shows less within-plant dispersion compared with plants without

[13]We have also experimented with a specification including interaction terms between all of the individual characteristics and collective bargaining status. However, the estimated interaction coefficients turned out to be insignificant, so that we decided to employ the more parsimonious specification reported below. Note that the insignificant interactions support the notion that workers with low observable skills are positively selected and workers with high observable skills are negatively selected into covered establishments (see Guertzgen 2006).

[14]In what follows, when referring to $\overline{\theta}_{jt}$, $sd(\theta)_{jt}$ and $CV(\theta)$, we suppress the hat over θ for expositional convenience.

any works council. Overall, Table 1 therefore appears to support the notion that labour market institutions that provide more stringent employment protection are typically associated with less intra-plant residual wage dispersion.

Table 1: Residual wage dispersion by labour market institutions

	$\overline{\theta}$	$sd(\theta)$	$CV(\theta)$
Collective bargaining			
No coverage	4.185	0.240	0.058
Industry-level contract	4.243	0.236	0.056
Firm-level contract	4.289	0.248	0.055
Works council			
Works council exists	4.278	0.223	0.052
No works council	4.189	0.248	0.060

Source: LIAB 1995-2004. The figures are weighted using the sample weights and are restricted to establishments with at least 10 employees. (1,411 establishments, 5,090 establishment observations).

5.4 Descriptive Evidence

5.4.1 Time-series features

Before we relate our measure of plant-specific residual wage dispersion to job and worker reallocation, we begin by presenting some elementary features about gross job and worker flows in our sample establishments. Table 2 shows annual rates of job reallocation, worker reallocation and excess worker reallocation over the time period 1996 to 2003. Even though we report weighted figures using the sample weights from the *IAB-Establishment Panel* it has to be kept in mind that the figures are unlikely to be representative as we confine our sample to establishments with at least two consecutive time period observations. For comparison purposes, the last column displays employment growth statistics reported by the German Federal Statistical Office for the western German mining and manufacturing industries. While these offical statistics show that employment contracted by 1 per cent, our sample establishments exhibit an average annual contraction rate of -0.8 per cent over the sample period, indicating that our sample selection appears to be slightly in favour of expanding establishments. The first noteworthy fact that emerges from Table 2 is that in all years there is simultaneous job creation and destruction. Even though employment contracted over the sample period, there are job creation rates ranging from 3.0 per cent in 2002/2003 to 4.8 per cent in 1999. Job destruction rates range from 2.9 per cent in 2001 to 5.7 per cent in 1997. Over the whole period, gross job creation and destruction averaged 3.8 and 4.6 per cent respectively, indicating that employers created 3.8 jobs per 100 workers and destroyed 4.6 jobs per 100 workers. Worker reallocation averages a rate of about 24.2 per cent, suggesting that about one in four matches either forms or breaks up each year. The average worker reallocation rate is almost three times as high as the average job reallocation rate, suggesting that excess worker flows account for at least two thirds of total worker flows. The upper bound on the worker flow rate required to accommodate shifts in the distribution of employment positions across plants is 8.4 per cent, while the lower bound is given by 4.6 per cent. These figures therefore indicate that about one fifth to one third of total worker reallocation arises to accommodate job reallocation, suggesting that the reshuffling of job opportunities across plants accounts for a substantial fraction of worker reallocation. It is interesting to note that this proportion is remarkably similar to what has been found earlier in the literature for other countries.[15]

Table 2: Time-series variation in job- and worker flows

Year	*JCR*	*JDR*	*JRR*	*JGR*	*ACCR*	*SEPR*	*WFR*	*EXWFR*	Growth[1)]
All	0.038	0.046	0.084	-.008	0.117	0.125	0.242	0.158	-.010
1996	0.033	0.046	0.079	-.013	0.106	0.119	0.225	0.146	-.028
1997	0.033	0.057	0.089	-.024	0.106	0.130	0.236	0.147	-.019
1998	0.044	0.040	0.084	0.004	0.122	0.118	0.240	0.156	0.002
1999	0.048	0.051	0.099	-.003	0.128	0.131	0.259	0.160	-.010
2000	0.044	0.050	0.094	-.006	0.125	0.131	0.256	0.162	0.005
2001	0.046	0.029	0.076	0.017	0.141	0.123	0.264	0.188	0.001
2002	0.030	0.046	0.076	-.016	0.110	0.126	0.236	0.160	-.024
2003	0.030	0.050	0.080	-.020	0.102	0.122	0.225	0.145	-.028
$\rho(X,JGR)$	0.845	-.864	-.069	1.000	0.937	-.204	0.775	0.860	
$p-$value	0.008	0.006	0.871		0.001	0.628	0.024	0.006	

Source: LIAB 1995-2004. 1,639 establishments, 5,867 establishment observations. Aggregate figures are calculated as described in Section 5.2 and are weighted using the sample weights. [1)]Employment growth in manufacturing, mining, electricity and water supply as reported by the German Federal Statistical Office (Series 13311LJ003). $\rho(X, JGR)$ is the Pearson correlation between the variable X and JGR.

As far as the cyclical properties are concerned, the figures show that job creation

[15]For example, using (quarterly) Maryland administrative data Burgess et al. (2000) report a worker flow rate of 19.4 per cent and a job reallocation rate of 7.4 per cent for the manufacturing industries (1985-1994). Anderson and Mayer (l994) report accession rates and separations rates three times as high as job creation and destructions rates for eight U.S. states over the period 1978-1984. Using Dutch annual firm-level data, a similar proportion of worker to job flows is found by Hamermesh et al. (1996) for the years 1988 and 1990.

is clearly procyclical, whereas job destruction is countercyclical (with significant simple correlation coefficients of about 0.85 and -0.86). Job reallocation does not exhibit any cyclical behaviour, reflecting the fact that the procyclical and countercyclical time variation of job creation and destruction are of a similar magnitude.[16] For worker reallocation and excess worker reallocation, in contrast, the figures provides evidence of a significant procyclical behaviour. While the correlation coefficient between worker flows and net job growth is 0.78 with a p-value below 0.05, the correlation coefficient between excess worker flows and net job growth is 0.86 with a p-value below 0.01. Note that the latter results are in line with what has been found by other authors (e.g. Albaek and Soerensen 1998, Burgess et al. 2000). The procyclical behaviour of excess worker reallocation is consistent with the view that economic expansions increase the number of quits as workers find better paid jobs elsewhere.[17] This pattern underscores the importance of firm-specific wage polices for worker flows. Finally, a closer look at the cyclical behaviour of separation and accession rates reveals that accessions are procyclical and separations are countercyclical. The correlations show that the procyclical pattern of worker reallocation is largely driven by the procyclical variation in accession rates, indicating that employers reduce hirings in economic downturns instead of increasing separations. This tendency of employers to rely on entry flows to adjust employment suggests that employment protection institutions should play an additional major role in determining the extent of worker reallocation.

5.4.2 Cross-sectional features

This section sets out some of the basic features of the cross-sectional variation in job and worker reallocation rates. Table A5 in the appendix displays job and worker flow rates cross-tabulated by two-digit industries, size classes as well as establishment age classes. All figures are size-weighted averages of the eight annual values. The upper panel of Table A5 shows that employment in our sample establishments contracted in 11 sectors of the 16 two-digit industries over the sample period, ranging from 0.2 per cent in Basic Metals to 6.2 per cent in Textiles. Despite these net contractions each of these two-digit industry experienced gross job creation, ranging from 2.4 per cent in Chemicals to 5.3 per cent in Optical Equipment. Conversely, of those industries

[16] This stands in contrast to the results by Davis and Haltiwanger (1992), Konings (1995) and Burgess et al. (2000) who report a countercyclical behaviour of gross job flows. However, the often asserted empirical regularity of countercyclical gross job flows has been contended by some authors, such as Boeri (1996), Albaek and Soerensen (1998) as well as Gielen and van Ours (2006).

[17] In particular, this result runs counter to the hypothesis put forward by Burda and Wyplosz (1994) that excess worker reallocation exhibits a countercyclical pattern due to plants restructuring their labour force in recessions.

that grew over the sample period, each of the expanding sectors experienced gross job destruction, ranging from 2.1 per cent in Transport Equipment to 6.2 per cent in Wood Products. The annual average job and worker reallocation rate shows considerable cross-industry variation, with job reallocation rates ranging from 5.2 per cent in Motor Vehicles to 13.6 per cent in Wood Products and excess worker flow rates ranging from 11.8 per cent in Motor Vehicles to 23.3 per cent in Food, Beverages and Tobacco.

The second panel of Table A5 shows that job reallocation is consistently higher in smaller establishments, ranging from 2.6 per cent in very large plants to 14.8 per cent in plants with less than 50 employees. The same is true for worker and excess worker flows, which also decline sharply with establishment size. Similar to what has been found in other studies, job reallocation rates are found to be larger in younger plants. However, this appears to be mainly driven by higher job creation rates, as job destruction rates are of a similar magnitude. Thus, theories based upon selection effects associated with passive learning about initial conditions in the spirit of Jovanovic (1982) do not receive much support by this pattern. Finally, worker and excess worker flows also decrease with establishment age, indicating that factors contributing to match re-evaluation vary across younger and more mature plants.

Table 3: Institutional variation in job- and worker flows

A. Dispersion θ	*JCR*	*JDR*	*JRR*	*JGR*	*ACCR*	*SEPR*	*WFR*	*EXWFR*
1. quartile $CV(\theta)$	0.041	0.040	0.081	0.001	0.111	0.110	0.221	0.140
2. quartile $CV(\theta)$	0.026	0.036	0.062	-.010	0.103	0.093	0.196	0.134
3. quartile $CV(\theta)$	0.032	0.040	0.072	-.008	0.112	0.120	0.232	0.160
4. quartile $CV(\theta)$	0.038	0.052	0.090	-.014	0.131	0.145	0.276	0.186
B. Coverage								
Industry-level contract	0.030	0.043	0.073	-.013	0.104	0.117	0.221	0.147
Firm-level contract	0.028	0.039	0.067	-.011	0.097	0.108	0.205	0.138
No coverage	0.056	0.036	0.092	0.020	0.151	0.131	0.282	0.190
C. Works council								
Works council exists	0.029	0.043	0.072	-.014	0.099	0.113	0.212	0.140
No works council	0.056	0.037	0.093	0.019	0.158	0.139	0.298	0.205

Source: LIAB 1995-2004. Aggregate figures are calculated as described in Section 5.2 and are weighted using the sample weights. The figures are restricted to establishments with at least 10 employees.

The preceding descriptive statistics indicate that there is considerable variation in the amount of job and worker reallocation, even within quite narrowly defined industries and size classes. This variation provides strong motivation for an inquiry into the underlying sources of the establishment-level heterogeneity. To assess the potential role of firm-specific wage policies, Table 3 displays job and worker flow rates cross-tabulated by different wage policies and labour market institutions. In Panel A, establishments are ranked according to their coefficient of variation of θ, $CV(\theta)$. The figures show that job destruction is found to be largest in the last quartile of the distribution of $CV(\theta)$. Plants falling into the first and last quartile of the distribution of $CV(\theta)$ exhibit significant higher job creation rates than those falling into the second and third quartile, indicating a U-shaped relationship between wage flexibility and job creation rates. These observations are clearly at variance with our expectation that more flexible wages should reduce the extent of gross job flows. Instead, they suggest that there may be other factors that interfere with more flexible wage polices. In fact, Panel B and C show that uncovered plants and those without a works council, which typically feature a less compressed wage structure, exhibit larger job creation and reallocation rates, suggesting that the effect of less stringent hiring and firing regulations and more flexible wages are likely to offset each other.

While the relationship between job reallocation and the intra-plant dispersion of θ does not reveal any straightforward pattern, the association between excess worker reallocation and $CV(\theta)$ appears to be more clear-cut. Closer inspection of the rightmost column in Panel A of Table 3 shows that excess worker reallocation is higher in plants falling into the upper two quartiles of the distribution of $CV(\theta)$. In this context, it is interesting to note that according to Panel B and C excess worker reallocation rates are considerably smaller in covered plants and in those plants with a works council, i.e. in those plants exhibiting more compressed wage policies. This raises the question as to how the established relationships between worker flows and wage flexibility holds if one controls for the existence of collective bargaining contracts and the existence of a works council. These questions will be subsequently addressed in a multivariate regression framework.

5.5 Multivariate Results

In this section, we present the results from the multivariate regression analysis. In the regressions, establishment-specific job and worker flow rates are explained by our measures of firm-specific wage flexibility, as detailed in Section 5.3, and a set of additional control variables. To obtain reasonable measures of plant-specific wage dispersion, we restrict the multivariate analysis to plants with at least 10 employees.

Moreover, as we include lagged explanatory variables such as lagged growth in value added, we keep only those plants with at least three consecutive time-series observations. This reduces the sample to 927 establishments with 3,205 observations. Table A3 in the appendix compares summary statistics of the restricted sample with those of the original sample.

As the job and worker flow rates are restricted to the interval [0;2], the results are based upon estimates from a Tobit model. A further important concern is that our measures of firm specific wage policies, $CV(\theta)$ and $\overline{\theta}$, are likely to be endogenous. A natural source of bias is a standard simultaneity bias which occurs if employment and wages are jointly determined. Note that this is particularly relevant for the association between job reallocation and the mean value of θ, if, for example, expanding firms pay more on average in order to attract or retain workers. This is supported by the evidence provided by Belzil (2000) who finds that job creation positively affects individual wages whereas worker reallocation appears to have no systematic impact on wages. Second, the extent of job and worker reallocation may also have a direct impact upon the distribution wages, if, for example, the extent to which demand shocks affect wages varies across the intra-plant wage distribution. To address this problem, we include lagged values of $CV(\theta)$ and $\overline{\theta}$ as explanatory variables in our regressions. However, we are aware that this may not fully rule out the endogeneity problem particularly in the presence of correlated shocks or if future shocks are anticipated in wage determination.

Table 4 reports the results of running a series of Tobit regressions of the plant-specific values of JDR and JCR on $CV(\theta)$ and $\overline{\theta}$ and a set of additional controls. Column (1) in the left panel includes industry and time dummies as well as lagged values of $CV(\theta)$ and $\overline{\theta}$ as explanatory variables for job creation. In column (1), $CV(\theta)$ enters the equation with an unexpected positive sign and is found to be insignificant. In column (2), we add institutional characteristics, such as the existence of a works council and a collective bargaining contract to the equation. The results indicate that compared with uncovered establishments covered plants and those with a works council experience significantly lower job creation rates. Even though the inclusion of institutional characteristics leads to a decrease in the coefficient on $CV(\theta)$, its coefficient remains positive and insignificant. Note that the decrease in the coefficient on $CV(\theta)$ captures the negative association between our plant-specific labour market institutions and wage dispersion. Column (3) includes as further explanatory variables average worker characteristics, lagged establishment size as well as a dummy for establishment age and multi-establishment employers. The inclusion of these covariates leads again to an increase in the estimated coefficient. The results suggest that establishments with an older and more tenured workforce in particular experience significantly less job creation. From the remaining covariates, only the share of apprentices and part time workers and the plant-age dummy are found to be significant at conventional levels.

Overall, the results indicate that establishments with more flexible wages do not appear to experience significantly less job creation. As a result, the Bertola-Rogerson hypothesis does not receive much support by this evidence. To provide a more direct test of this hypothesis, we further add the lagged growth of total value added as a proxy for demand shocks as well as its interaction with $CV(\theta)$ to the equation. Given that with more flexible wages demand shocks are less likely to be absorbed by employment rather than by wage adjustments, one might expect a positive coefficient on value added growth as well as a negative coefficient on the interaction term. The results are presented in column (4). Interestingly, even though the interaction term is only weakly significant and the coefficient on value added growth borders significance (with a $p-$value of 0.11), both variables enter the equation with their expected sign. Overall, these results argue against the view that there is no empirical support for the Bertola-Rogerson hypothesis. Instead, they suggest that even though establishments with a more flexible wage structure generally experience more employment growth, wage dispersion may have a significant negative impact on job creation arising primarily from the absorption of positive shocks by wage adjustments.

To investigate the relationship between wage flexibility and negative job growth rates, the right panel of Table 4 presents the results with the job destruction rate as the dependent variable. The estimates indicate that after controlling for different subsets of plant characteristics, establishments with more flexible wages experience significantly less job destruction. The results suggest that job destruction declines with the share of part time workers, while it increases with the share of female workers and apprentices. Note that the negative association between the fraction of part time workers and job destruction appears to reflect employers' increased flexibility in the use of labour. Further, establishments with an older and more tenured workforce experience significantly larger job destruction rates. In column (4), even though the coefficients on lagged value added growth and its interaction with $CV(\theta)$ are estimated fairly imprecisely, they enter the equation with their expected sign.

In sum, the picture that emerges from Table 4 is that higher wage dispersion produces lower negative and higher positive growth rates, suggesting a positive relationship between residual wage dispersion and overall establishment growth, but no significant association with job reallocation. The inclusion of lagged value added and its interaction with $CV(\theta)$ strongly supports the view that a negative impact of wage dispersion on job reallocation primarily arises from absorbing shocks by wage adjustments. To assess the overall impact of $CV(\theta)$, it is useful to compute the marginal effect of $CV(\theta)$ conditional on positive job creation and destruction rates.[18] For the job creation rate, the marginal effect evaluated at the mean of the covariates conditional on positive value added growth in $t-1$ is about 0.15, suggesting that the overall effect is still positive even for those establishments that experience a positive demand shock. In the job destruction equation, the marginal effect of $CV(\theta)$ conditional on negative value added growth in $t-1$ is about -0.41. Given the descriptive statistics in Table 1 this implies that a one standard deviation increase in $CV(\theta)$ decreases the job destruction rate by roughly 0.8 percentage points. According to the mean values of job destruction reported in Table 2 this is a non-negligible change.

To explore the role of residual wage dispersion for worker flows, Table 5 shows the results of running the corresponding regressions with $ACCR$ and $SEPR$ as the dependent variables. When interpreting these results, it is helpful to place the results in Table 5 alongside the results in Table 4. In particular, it has to be kept in mind that worker flows may be decomposed into those flows that directly result from job flows and into excess worker flows. A comparison of the estimates therefore suggests that significant covariates in the job flow regressions that are not significantly related to worker flows or even reverse their sign ought to have a reverse effect on excess worker flows. The left panel of Table 5 shows the results for the accession regressions: The estimates in column (4) show that similar to the job creation regressions the coefficient on $CV(\theta)$ is estimated to be positive, but turns out to be insignificant at conventional levels.

[18]The marginal effect of $CV(\theta)$ conditional on a positive value of y is given by: $\frac{\partial E(y|x,y>0)}{CV(\theta)} = (\beta_{CV(\theta)} + \beta_{CV(\theta)\_VA\_Gr} VA\_Gr_{t-1})\{1 - \lambda(\frac{x\beta}{\sigma})[\frac{x\beta}{\sigma} + \lambda(\frac{x\beta}{\sigma})]\}$, where λ denotes the inverse Mills ratio. See e.g. Wooldridge (2002), Chapter 16.

Table 4: Tobit Estimates Job Creation and Destruction Rates

Dependent Variable:	*JCR*	*JCR*	*JCR*	*JCR*	*JDR*	*JDR*	*JDR*	*JDR*
	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)
Covariates:	*(1)*	*(2)*	*(3)*	*(4)*	*(1)*	*(2)*	*(3)*	*(4)*
$CV(\theta)_{t-1}$	.183 (.402)	.014 (.388)	.381 (.402)	.556 (.378)	.061 (.361)	.226 (.362)	-.884** (.420)	-1.206** (.509)
$\overline{\theta}_{t-1}$	.050* (.028)	.084*** (.027)	.027 (.036)	.054 (.041)	.004 (.029)	-.025 (.029)	-.006 (.041)	-.025 (.048)
Works council		-.040*** (.009)	-.018** (.009)	-.018* (.010)		.036*** (.011)	.023* (.012)	.022 (.015)
Industry-level contract		-.033*** (.010)	-.007 (.010)	-.015 (.012)		.024** (.011)	.009 (.011)	.013 (.013)
Firm-level contract		-.035** (.014)	-.029** (.013)	-.033** (.016)		.016 (.016)	.010 (.015)	.013 (.019)
Share female workers			-.056 (.034)	-.040 (.037)			.143*** (.043)	.146*** (.047)
Share apprentices			-.280*** (.089)	-.334*** (.099)			.636*** (.171)	.824*** (.205)
Share part time			.144** (.067)	.169** (.074)			-.235*** (.082)	-.297*** (.094)
Share skilled workers			-.011 (.025)	.013 (.028)			-.024 (.030)	-.034 (.037)
Share high-skilled			.033 (.063)	.021 (.070)			.130 (.094)	.151 (.112)
Median age			-.007*** (.001)	-.006*** (.001)			.008*** (.002)	.009*** (.002)
Median tenure			-.001*** (.000)	-.001*** (.000)			.000* (.000)	.000* (.000)
Multi-establishment			.004 (.007)	.004 (.009)			.007 (.010)	.008 (.012)
Young			.021* (.011)	.005 (.012)			-.022 (.016)	-.011 (.019)
$Employee_{t-1}$			-.000 (.000)	-.000 (.000)			-.000 (.000)	-.000 (.000)
K/L			.000 (.000)	.000* (.000)			.000 (.000)	-.000 (.000)
VA-growth$_{t-1}$				.003 (.002)				-.008 (.007)
VA-growth$_{t-1}$*CV_{t-1}				-.053* (.031)				.123 (.121)
Industry-Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (Plants)	3,205 (927)	3,205 (927)	3,205 (927)	2,281 (927)	3,205 (927)	3,205 (927)	3,205 (927)	2,281 (927)

Source: LIAB 1995-2004. Standard errors are in parentheses and are adjusted for clustering at the establishment level.

VA-growth$_{t-1}$ = lagged growth in total value added. ***significant at 1%-level, **significant at 5%-level , *significant at 10%-level.

Table 5: Tobit Estimates Accession and Separation Rates

Dependent Variable:	*ACCR*	*ACCR*	*ACCR*	*ACCR*	*SEPR*	*SEPR*	*SEPR*	*SEPR*
	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)	Coeff. (S.E)
Covariates:	*(1)*	*(2)*	*(3)*	*(4)*	*(1)*	*(2)*	*(3)*	*(4)*
$CV(\theta)_{t-1}$	.364 (.294)	.171 (.282)	.132 (.297)	.362 (.259)	.517** (.235)	.453* (.238)	-.198 (.283)	-.235 (.336)
$\overline{\theta}_{t-1}$	-.002 (.022)	.031 (.021)	-.004 (.027)	.015 (.030)	-.015 (.021)	-.007 (.020)	-.022 (.031)	-.033 (.034)
Works council		-.045*** (.007)	-.026*** (.006)	-.023*** (.007)		-.016** (.007)	-.008 (.007)	-.005 (.009)
Industry-level contract		-.027*** (.007)	-.010 (.007)	-.013 (.008)		-.002 (.006)	.000 (.006)	.003 (.007)
Firm-level contract		-.024*** (.009)	-.018** (.008)	-.019** (.009)		-.003 (.009)	-.002 (.009)	.000 (.010)
Share female workers			.015 (.024)	.019 (.025)			.100*** (.028)	.094*** (.031)
Share apprentices			.042 (.059)	.037 (.064)			.534*** (.126)	.659*** (.153)
Share part time			.048 (.051)	.076 (.058)			-.131*** (.049)	-.126** (.055)
Share skilled workers			-.005 (.017)	.009 (.020)			.012 (.019)	.009 (.022)
Share high-skilled			.049 (.040)	.041 (.046)			.166*** (.064)	.203*** (.076)
Median age			-.004*** (.001)	-.003*** (.001)			.001 (.001)	.002 (.001)
Median tenure			-.000*** (.000)	-.000*** (.000)			-.000*** (.000)	-.000* (.000)
Multi-establishment			.004 (.004)	.004 (.005)			.005 (.006)	.007 (.007)
Young			.014 (.010)	.001 (.010)			-.006 (.010)	-.003 (.012)
$Employee_{t-1}$			-.000 (.000)	-.000* (.000)			-.000** (.000)	-.000** (.000)
K/L			-.000*** (.000)	-.000** (.000)			-.000*** (.000)	-.000*** (.000)
$VA\text{-}growth_{t-1}$				.002* (.001)				.001 (.002)
$VA\text{-}growth_{t-1} * CV_{t-1}$				-.031* (.017)				-.020 (.029)
Industry-Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,205 (927)	3,205 (927)	3,205 (927)	2,281 (927)	3,205 (927)	3,205 (927)	3,205 (927)	2,281 (927)

Source: LIAB 1995-2004. Standard errors are in parentheses and are adjusted for clustering at the establishment level.
***significant at 1%-level, **significant at 5%-level , *significant at 10%-level.

In the separation equation, in contrast, we do find a reverse effect of $CV(\theta)$ on worker flows as compared with the job flow regressions. While the results in Table 4 suggested a significant negative association between job destruction and $CV(\theta)$, the coefficient on $CV(\theta)$ is found to be insignificant in column (4) in the separation regressions. This finding is indicative of a positive effect on excess separations. In column (1), $CV(\theta)$ even enters the equation with a positive sign. However, including institutional characteristics in column (2) as well as further establishment characteristics in column (3) renders the coefficient insignificant and reverses its sign. The decrease in the coefficient on $CV(\theta)$ in column (2) shows that differences in plant-specific labour market institutions account for parts of the positive association between separation rates and residual wage dispersion. In column (4), contrary to the job destruction equations, the coefficient on the lagged value added growth is estimated to be positive. Given that this variable entered the job destruction equation with a negative sign, this is indicative of a positive effect on excess worker flows.

The latter conjecture is confirmed by the estimates in Table 6, which presents the regression results for excess worker flows. The coefficient on value added growth shows that positive demand shocks are associated with a significant increase in excess worker reallocation. A possible interpretation suggested by Burgess et al. (2000) is that positive shocks that tend to give rise to more job creation may increase the possibility for subsequent mismatches, thereby increasing the extent of excess worker reallocation. The coefficient on $CV(\theta)$ confirms the results of Table 5 that plants with a larger degree of residual wage dispersion experience significantly larger excess worker reallocation. However, the coefficient on the interaction term with value added growth indicates that a larger degree of residual wage dispersion also has a negative impact on excess worker flows by reducing its response to positive demand shocks. The intuition here is that the response of job creation and subsequent excess worker reallocation to demand shocks decreases with a more flexible wage structure.

As to the remaining covariates, in Section 4 it has been shown that even though the existence of collective bargaining contracts may play a certain role in employment protection, the greatest effect may be expected from works councils either through their direct co-determination rights or via their collective voice function. Note that this idea is borne out by our estimates. The results show that the coefficient on works councils is estimated to be negative and highly significant, whereas the coefficients on collective bargaining contracts are found to be insignificant. The estimates further indicate that establishments with an older and more tenured labour force experience significantly lower excess worker reallocation. This may reflect the fact that hiring and firing restrictions impose costs on the employer that increase in general with age and tenure. For this reason, employers have an incentive to dissolve bad matches in early stages of an employment relationship. The negative association between excess worker reallocation and tenure is also consistent with theories that stress the acquisition of firm-specific human capital (e.g. Parsons 1972), since the accumulation of such firm-specific skills increases the costs of dissolving a match for both the employer and the employee. Interestingly, the fraction of high-skilled workers is found to be positively related to excess worker reallocation. Given that for this group excess turnover costs are likely to be particularly relevant, this result may be interpreted as evidence that the degree of mobility varies greatly among different skill groups. Further, the coefficient on the share of female workers and apprentices is also positive and significant, which is consistent with the view that these groups are likely to have less stable employment relationships. A further interesting finding that emerges from the excess worker flow regression is that, similar to the job and worker flow results, the coefficient on the average residual wage, $\overline{\theta}_{t-1}$, is found to be insignificant, although $\overline{\theta}_{t-1}$ enters the equation with its expected sign. Note that this stands in contrast to previous findings from the literature (e.g. Burgess et al. 2000, Haltiwanger and Vodopivec 2003) and may largely be attributed to our control for other plant characteristics.

Taken together, the picture that emerges from Table 6 is that the overall effect of higher residual wage dispersion on excess worker reallocation is ambiguous. While a more flexible wage structure leads to an increase in the level of excess worker flows, it simultaneously reduces the amount of job creation and subsequent excess worker reallocation in response to recent demand shocks. Given these two countervailing effects, it is instructive to compute the overall marginal effect of $CV(\theta)$ on excess worker flow rates. Evaluating the marginal effect at the sample mean of lagged value added growth gives a value of 0.47, suggesting that the net effect is positive. Along with the descriptive statistics in Table 1 this result implies that a one standard deviation increase in $CV(\theta)$ raises the excess worker reallocation rate by about 1 percentage point.

Table 6: Tobit Estimates Excess Worker Reallocation Rates

Dependent Variable:	*EXWFR*		*EXWFR1*		*EXWFR2*		*EXWFR3*		*EXWFR4*		*EXWFR*	
	All		1. Quartile		2. Quartile		3. Quartile		4. Quartile		All[1)]	
Covariates:	Coeff.	(S.E)	Coeff.	(S.E)	Coeff.	(S.E)	Coeff.	(S.E)	Coeff.	(S.E)	Coeff.	(S.E)
$CV(\theta)_{t-1}$	.591**	(.255)	1.176**	(.512)	.490	(.503)	.957**	(.465)	.353	(.604)	.675**	(.260)
$\overline{\theta}_{t-1}$	-.042	(.028)	.145***	(.042)	.064	(.041)	.050	(.039)	-.010	(.050)	-.036	(.027)
Works council	-.022***	(.008)	.025	(.015)	.035**	(.015)	.021	(.014)	.062	(.018)	-.022***	(.008)
Industry-level contract	-.002	(.008)	-.013	(.013)	-.007	(.013)	.008	(.014)	-.013	(.019)	-.000	(.009)
Firm-level contract	-.004	(.010)	-.010	(.020)	-.008	(.017)	.001	(.018)	-.030	(.024)	-.000	(.011)
Share female workers	.038*	(.022)	.069*	(.041)	.081**	(.040)	.061*	(.035)	.025	(.049)	.017	(.022)
Share apprentices	.298***	(.063)	-.097	(.100)	-.094	(.102)	-.082	(.103)	-.054	(.166)	.293***	(.063)
Share part time	.033	(.051)	-.074	(.091)	.050	(.081)	-.016	(.076)	-.055	(.103)	.052	(.051)
Share skilled workers	.022	(.016)	-.022	(.026)	-.063	(.024)	-.033	(.027)	-.048	(.034)	.020	(.017)
Share high-skilled	.103***	(.034)	.023	(.073)	.068	(.067)	.040	(.062)	.202	(.085)	.093**	(.040)
Median age	-.004***	(.001)	-.006***	(.002)	-.003***	(.002)	-.002	(.002)	-.002	(.002)	-.004***	(.000)
Median tenure	-.000***	(.000)	-.000	(.000)	-.000	(.000)	-.000	(.000)	.000	(.000)	-.000***	(.000)
Multi-establishment	.005	(.005)	.015*	(.009)	.001	(.008)	.015*	(.009)	.021*	(.011)	.003	(.005)
Young	-.000	(.011)	-.002	(.017)	-.018	(.016)	-.006	(.016)	-.020	(.021)	-.004	(.011)
$Employee_{t-1}$	-.000	(.000)	.000*	(.000)	.000*	(.000)	.000	(.000)	.000*	(.000)	-.000	(.000)
K/L	-.000***	(.000)	-.000**	(.000)	-.000**	(.000)	-.000	(.000)	-.000	(.000)	-.000***	(.000)
$VA\text{-}growth_{t-1}$	.004***	(.001)	.005	(.013)	.003**	(.001)	-.021	(.019)	-.003	(.014)	.005**	(.002)
$VA\text{-}growth_{t-1}{*}CV_{t-1}$	-.060***	(.021)	-.102	(.288)	-.060***	(.022)	.296	(.346)	.021	(.304)	-.074***	(.028)
$Small{*}(t{=}1998){*}CV_{t-1}$											-1.587***	(.588)
$Small{*}(t{\neq}1998){*}CV_{t-1}$											-.483*	(.270)
Industry-Dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Time-Dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Observations (Plants)	2,281 (927)		2,281 (927)		2,281 (927)		2,281 (927)		2,281 (927)		2,399 (975)	

Source: LIAB 1995-2004. Standard errors are in parentheses and are adjusted for clustering at the establishment level.

[1)] Sample extended to all plants with at least 5 employees.

***significant at 1%-level, **significant at 5%-level, *significant at 10%-level.

The established positive relationship suggests that the positive association between residual wage dispersion and excess hiring as well as between excess separations of those workers who a bad matches dominates a potential negative relationship between wage dispersion and excess separations of good matches. To explore whether the relationship between wage dispersion and excess reallocation varies with the quality of the match, we proceed as in Haltiwanger and Vodopivec (2003). Based on the notion that the residual wage component, θ, may serve as a proxy for the quality of the match, we rank workers in terms of quartiles of the plant-specific distribution of θ. Doing so allows us to compute excess worker reallocation rates for each of the quartile groups within each establishment and to run the regressions separately for each quartile.[19]

The results from these quartile-specific regressions are reported in column (2) to (5) of Table 6. Even though we fail to detect a monotonically decreasing relationship between $CV(\theta)$ and excess worker reallocation, the results indicate that the association appears to be most pronounced for the lowest quartile. For the highest quartile we obtain the smallest estimate for the coefficient on $CV(\theta)$, which turns out to be insignificant. This finding lends strong support to the hypothesis that a larger degree of residual wage dispersion may have ambiguous effects on excess worker reallocation of good matches as flexible wages may help employers to retain good matches, thereby decreasing the extent of excess separations of high-quality workers.

In a final step, we look at the interactions between wage flexibility and the degree of employment protection. Our earlier considerations suggested that a more flexible wage structure might give rise to more excess separations of bad matches since flexible wages do allow firms to dissolve these employment relationships by lowering wages. In a similar vein, it has been argued that flexible wages should lead to more excess accessions as employers become less selective to whom they hire. Clearly, these mechanisms should be the more relevant the more stringent firing regulations are. The reason for this is twofold: First, with low employment protection employers do not have to rely on wage cuts to dissolve bad matches. Second, the extent to which a compressed wage structure reduces excess accessions is likely to be the larger the more expensive it is to terminate a bad match. To test the hypothesis that

[19] To do so, we proceed as follows. A worker separation within a particular quartile at time t is an employment relationship observed at $t-1$, but not in period t based upon the quartiles of the plant distribution of θ in $t-1$. A worker accession in period t is defined as an employment relationship which is observed in period t but not in year $t-1$ based upon the quartiles of the plant distribution of θ in $t-1$.

the positive effect of residual wage dispersion varies with the degree of employment protection, we additionally included interaction terms between $CV(\theta)$ and our plant-specific labour market institutions. Surprisingly, none of these interaction terms turned out to be insignificant, and for the sake of expositional brevity the results are not reported here. A possible explanation for this finding may relate to the fact that our estimation sample is confined to establishments with at least 10 employees, which are all subject to the German *Protection against Dismissal Act* (see Section 4.1). This may have the consequence that our sample establishments do not exhibit sufficient institutional variation in firing practices, making it impossible to identify a significant interaction effect. To obtain somewhat more institutional variation in employment protection, we extended our estimation sample to establishments with at least 5 employees. Even though this extension raises the problem of a quite imprecise estimate of the residual wage dispersion, it provides us with the opportunity of observing plants to which the *Protection against Dismissal Act* did not apply during the time period October1996 to January 1999. Note that the annual flows that are likely to be affected by this legislation change are those between 1997 and 1998, as the amendment in October 1996 became immediately effective only for newly hired workers. We therefore constructed two dummy variables taking on the value of unity if an establishment employs less than 10 employees, one for the year 1998 and one for the remaining observation period. The results from including an interaction term between these two dummy variables and $CV(\theta)$ are displayed in column (6). The coefficients on the interaction terms indicate that the association between residual wage dispersion and worker reallocation turns out to be significantly lower in establishments with less than 10 employees. Moreover, the differential effect is particularly large for the year 1998 when small establishments with more than 5 and less than 10 employees had been exempted from the *Protection against Dismissal Act*. This finding strongly supports the notion that less stringent firing practices may substantially decrease the need for more flexible wages in order to attain optimal worker-firm matches.

6 Summary and Conclusions

Drawing on a large-scale Linked Employer-Employee data set, this paper provides evidence on the role of employers' wage policies for job and worker reallocation in western German manufacturing. A key aspect of our study is that we attempt to control for further plant-specific characteristics that may be expected to affect both wages and employment adjustment. Particular emphasis is given to plant-specific labour market institutions, such as the existence of a works council and a collective wage contract, since these institutions are typically associated with more stringent employment protection and less flexible wages. Using the plant-specific dispersion of residual wages as a proxy for wage flexibility confirms this notion, since we find covered plants and those with a works council to be characterised by less intra-plant wage dispersion.

Our results may be summarised as follows: We document a negative association between plant-specific job destruction rates and residual wage dispersion, whereas job creation rates are found to be positively related to wage dispersion. However, in interacting our measure of wage flexibility with a proxy for demand shocks, we find that with more flexible wages demand shocks are more likely to be absorbed by wage rather than by quantity adjustments. Overall, these findings therefore lend strong support to the Bertola-Rogerson hypothesis. The results further indicate that accounting for plant-specific labour market institutions leads to a decline in the positive association between wage dispersion and job creation, as plants with a firm-level contract and a works council exhibit significantly less job creation. This result is consistent with the Bertola-Rogerson view of countervailing effects of labour market institutions that are associated with more stringent employment protection and a larger degree of wage compression. However, this appears to be true only for job creation, since we fail to detect any significant association between labour market institutions and job destruction rates. At least for job destruction rates, the evidence presented here documents not only a statistically, but also an economically significant impact of employer-specific wage policies: an increase in the plant-specific coefficient of variation of one standard deviation decreases the job destruction rate by about 0.8 percentage points, which is non-negligible given that both job creation and destruction average rates of about 4.6 per cent over the sample period.

As to excess worker reallocation, our results provide evidence of a positive relationship between excess worker flows and residual wage dispersion. This finding suggests that the positive association between wage dispersion and excess separations of bad matches dominates the negative relationship between residual wage dispersion and excess separations of good matches. The established positive relationship is robust to the inclusion of plant-specific labour market institutions, which are typically found to be negatively related to excess worker flows. Further, the quartile-specific regressions indicate that the positive association between excess worker reallocation and wage dispersion is significantly lower in the highest quartiles of the residual wage distribution. This is consistent with the hypothesis that a higher degree of wage flexibility may have an offsetting impact on excess worker turnover of higher quality worker by decreasing excess separations. We find that an increase in the plant-specific coefficient of variation of one standard deviation raises excess worker reallocation by about 1 percentage point. Given that excess worker reallocation averages a rate of about 16 per cent over the period under consideration, this finding suggests that the economic importance of wage policies for excess worker reallocation is somewhat smaller in magnitude as compared with job destruction.

Our results have strong welfare implications with respect to the role of wage flexibility for labour market dynamics. In finding a negative association between residual wage dispersion and job reallocation our findings suggest that a compressed wage structure may lead to unduly unstable employment relationships as it prevents shocks from being absorbed by wage adjustments. However, it should also be noted that flexible wages may impose constraints on the expansion of successful firms if positive shocks are absorbed by wage instead of employment increases. The established association between residual wage dispersion and excess worker flows, in contrast, suggests that a compressed wage structure may reduce employers' ability to achieve or sustain optimal worker-firm matches. In establishing the result that increased wage flexibility matters the more the more stringent firing regulations are, our findings suggest that more flexible wages and less stringent employment protection may be viewed as substitutes in helping firms to achieve optimal matches.

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A Appendix

Variable	Definition
Value added	Value added is constructed by subtracting material costs from annual sales. Per-capita values are obtained by dividing by average establishment size (*Size*). The latter is calculated by averaging the number of employees for the month June over the present and preceding year. Nominal values are deflated by the sector-specific producer price index obtained from the German Federal Statistical Office, which is merged to the data based upon a two-digit sector classification.
K/L Capital-labour ratio	Constructed by using the perpetual inventory method starting from the capital value in the first observation year and using the information on expansion investments. The initial capital value is proxied by dividing investment expenditures in each establishment's first observation year by a pre-period growth rate of investment, g, and a depreciation rate of capital, d.*) Capital-stocks in subsequent periods are calculated by adding real expansion investment expenditures. Nominal investment expenditures are deflated by the producer price index of investment goods of the Federal Statistical Office Germany. The capital-labour ratio is constructed by dividing the resulting capital proxy by establishment size.
Works council	Dummy=1 if works council is present. In some years (1995 and 1997) only those plants who enter the panel are asked to report the existence of a works council. For the remaining establishments the missing information is imputed based upon the information in the following year.
Firm-level contract	Dummy=1 if establishment is covered by a firm-specific agreement.
Industry-level contract	Dummy=1 if establishment is covered by an industry-specific agreement.
Young	Dummy=1 if establishment was founded in 1990 or later.
Multi-establishment	Dummy=1 if establishment belongs to a multi-plant enterprise.

Note: *) To calculate the capital stock in the first period, we set d=0.1 and g=0.05.

Table A1: Construction of establishment variables from the *IAB-Establishment Panel*

Variable	**Definition**
Share of female workers	Number of female workers divided by number of employees (the latter defined as the number of employment spells comprising June 30th)
Share of part time workers	Number of part time workers divided by number of employees
Share of apprentices	Number of apprentices divided by number of employees
Share of skilled workers	Number of employees with vocational (*Vocational Degree* = 1) and vocational-plus- high school degree (*Voc-High*=1) divided by the number of employees
Share of high-skilled	Number of employees with technical college (*Technical University* = 1) or university degree (*University* = 1) divided by the number of employees
Median age	Median of age of all employees with an employment spell comprising the 30th June
Median tenure	Median of tenure in months of all employees with an employment spell comprising the 30th June

Table A2: Description of individual characteristics and establishment means of individual characteristics gained from the *Employment Statistics Register*

Variables	Original Sample Mean	Original Sample Std.-Dev.	Final Sample Mean	Final Sample Std.-Dev.
$CV(\theta)$	0.058	0.034	0.056	0.019
$\overline{\theta}$	4.139	0.291	4.229	0.229
Works council	0.201	—	0.457	—
Industry-level contract	0.556	—	0.606	—
Firm-level contract	0.058	—	0.092	—
Share female workers	0.289	0.269	0.241	0.205
Share apprentices	0.064	0.113	0.040	0.056
Share part time	0.085	0.135	0.055	0.070
Share skilled workers	0.769	0.232	0.739	0.200
Share high-skilled	0.030	0.079	0.043	0.070
Median age (years)	38.318	7.116	39.692	4.767
Median tenure (months)	82.560	55.737	93.940	51.981
Multi-establishment	0.192	—	0.297	—
Young	0.239	—	0.212	—
Employee	45.162	254.335	104.791	412.000
K/L	4.148	31.676	9.515	53.726
Value added growth$^{*)}$	0.149	2.732	0.221	4.381
Observations (Plants)	5,867 (1,639)		3,205 (927)	

The final sample includes establishment with at least 10 employees and at least 3 time-series observations. Figure are weighted using the sample weights.$^{*)}$Note: Growth in total value added. Capital-labour ratio is measured in DM 100,000. 1 € is DM 1.95583.

Table A3: Establishment Statistics

DESCRIPTIVE STATISTICS			FIXED-EFFECTS RESULTS		
VARIABLE	Mean	Std.-Dev.	VARIABLE	Coeff.	Std.-Err.
INDIVIDUAL CHARACTERISTICS					
log(*Wage*)	5.29	(0.31)	Δlog(*Wage*)		
Female	0.17	—			
Age (years)	40.80	(10.13)	Δ*Age*	0.029***	(0.009)
			ΔAge^2	-.000***	(0.000)
Tenure (months)	142.86	(95.39)	Δ*Tenure*	0.002***	(0.000)
			$\Delta Tenure^2$	-.000***	(0.000)
Foreign	0.11	—			
White-collar	0.40	—	Δ*White-collar*	0.058***	(0.007)
Vocational degree	0.65	—	Δ*Vocational degree*	0.014	(0.007)
High school	0.01	—	Δ*High school*	-.019	(0.034)
Voc-High	0.03	—	Δ*Voc-High*	0.026***	(0.009)
Technical University	0.06	—	Δ*Technical University*	0.117***	(0.016)
University	0.06	—	Δ*University*	0.128***	(0.016)
ESTABLISHMENT CHARACTERISTICS					
Size	4,454.32	(6,682,12)	Δ log(*Size*)	0.016***	(0.007)
*Value added**)	1.97	(1.62)	Δ log(*Value added*)	0.011**	(0.005)
Works council	0.96	(0.17)	Δ log(*Value added*)×*Industry-level*	-.020***	(0.008)
Industry-level contract	0.85	—	Δ log(*Value added*)×*Firm-level*	0.003	(0.008)
Firm-level contract	0.10	—	Δ *Works council*	0.007	(0.007)
K/L	1.78	(4.11)	Δ *Works council*×*Industry-level*	0.100	(0.100)
Young	0.08	—	Δ *Works council*×*Firm-level*	0.045***	(0.017)
Multi-establishment	0.70	—	Δ*Industry-level contract*	-.002	(0.003)
			Δ*Firm-level contract*	-.007	(0.005)
			Δ*K/L*	0.000	(0.000)

Source: LIAB 1995-2004. 659,784 individuals, 1,639 establishments, 2,525,188 observations. Descriptive statistics are non-weighted. *)Note: Measured as per-capita value added. Per-capita value added and capital-labour ratio are measured in DM 100,000, whereby 1 € is DM 1.95583.
The fixed-effects specification includes 1,857,729 differenced observations and 6 time dummies.
Standard errors are in parentheses and are adjusted for clustering at the establishment level.

Table A4: Descriptive Statistics and Fixed-Effects Regression Results

A. Two-Digit Industry	*JCR*	*JDR*	*JRR*	*JGR*	*ACCR*	*SEPR*	*WFR*	*EXWFR*
Mining, energy, water supply	0.032	0.045	0.077	-.013	0.095	0.108	0.203	0.126
Food, beverages, tobacco	0.046	0.038	0.084	0.008	0.163	0.154	0.317	0.233
Textiles and leather	0.027	0.089	0.116	-.062	0.121	0.183	0.304	0.188
Pulp, paper, publishing	0.029	0.048	0.077	-.019	0.122	0.103	0.225	0.148
Wood (excluding furniture)	0.074	0.062	0.136	0.013	0.172	0.160	0.332	0.196
Chemicals, coke, petroleum	0.024	0.043	0.067	-.019	0.100	0.118	0.218	0.151
Rubber and plastic products	0.045	0.051	0.096	-.006	0.137	0.143	0.280	0.184
Non-metallic mineral products	0.039	0.045	0.084	-.006	0.130	0.136	0.266	0.182
Basic metals	0.035	0.037	0.072	-.002	0.104	0.106	0.210	0.138
Fabricated metals	0.047	0.043	0.090	0.003	0.128	0.125	0.253	0.163
Machinery	0.038	0.048	0.086	-.010	0.111	0.121	0.232	0.146
Motor vehicles	0.025	0.027	0.052	-.002	0.084	0.086	0.170	0.118
Other transport equipment	0.037	0.021	0.058	0.016	0.106	0.090	0.196	0.138
Electrical equipment	0.039	0.055	0.094	-.016	0.118	0.133	0.251	0.157
Optical equipment	0.053	0.056	0.109	-.003	0.141	0.144	0.285	0.176
Furniture, N.E.C.	0.043	0.037	0.080	0.006	0.132	0.126	0.258	0.178
B. Size class								
1-50	0.067	0.080	0.147	-.013	0.167	0.180	0.347	0.200
50-100	0.033	0.047	0.080	-.014	0.116	0.130	0.246	0.166
100-200	0.048	0.045	0.093	0.003	0.128	0.125	0.253	0.160
200-500	0.033	0.037	0.070	-.004	0.112	0.116	0.228	0.158
500-1000	0.023	0.041	0.065	-.018	0.108	0.090	0.198	0.133
1000-2000	0.028	0.029	0.057	-.001	0.094	0.095	0.189	0.132
2000-5000	0.018	0.027	0.044	-.009	0.081	0.090	0.171	0.127
5000-10000	0.024	0.020	0.044	0.004	0.089	0.085	0.174	0.130
10000+	0.005	0.021	0.026	-.015	0.066	0.081	0.147	0.121
C. Age								
Founded before 1990	0.035	0.046	0.081	-.011	0.113	0.124	0.237	0.156
Founded after 1990	0.057	0.048	0.105	0.009	0.143	0.134	0.277	0.172

Source: LIAB 1995-2004. Aggregate figures are calculated as described in Section 5.2 and are weighted using the sample weights.

Table A5: Cross-sectional variation in job and worker flows