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Working Paper

Should low-wage workers care about where they work? Assessing the impact of employer characteristics on low-wage mobility

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Non-technical summary:

The present paper studies the importance of employer-specific determinants in escaping low earnings in Germany. In our empirical analysis, we draw particular attention to the role of employer size and the nature of industrial relations. We hypothesise employer size to have an ambiguous impact on low-wage mobility for two reasons. On the one hand, employer size is typically viewed a good proxy for the presence of internal job ladders, thereby promoting intra-firm wage mobility. On the other hand, larger employer are likely to face a higher degree of information asymmetries about workers' true productivity, which may hamper intra-firm wage growth. Industrial relations may be viewed as a potential means to overcome these informational problems as, e.g., local worker representations are actively involved in monitoring promotions and reducing information asymmetries concerning workers' productivity levels.

Using data from a large-scale linked employer-employee panel data set, our findings indicate that employer characteristics play an important role in helping workers to escape their low pay status, though they point to different patterns across gender. While for male workers from the service sector the probability of escaping low pay tends to increase with employer size, female workers rather benefit from collective bargaining coverage contracts and the presence of local works councils. While these findings provide evidence that internal labour markets are an important ingredient of male within-firm wage growth, they do not necessarily contradict the view that internal labour markets may also exist for female low-wage workers. The only conclusion that can be inferred from our findings is that for females there are potential countervailing effects of plant size which might arise from a larger degree of asymmetric information. Along with the differences in the industrial relations effects this leads us to conclude that the removal of asymmetric information appears to be more relevant in explaining female workers' wage transitions as compared with their male counterparts. This finding is consistent with incomplete information about workers' true productivity being particularly relevant for individuals whose employment careers are more frequently characterised by earlier career interruptions, making it difficult to value their productivity based upon previous work performance.

Das Wichtigste in Kürze:

Die vorliegende Studie untersucht die Bedeutung von betriebsspezifischen Charakteristika für die Lohnmobilität von Geringverdiener/innen. Besonderes Augenmerk gilt hierbei der Wirkung der Betriebsgröße sowie der industriellen Beziehungen auf die Aufstiegschancen. Von der Betriebsgröße sind zwei gegenläufige Effekte auf die Aufstiegswahrscheinlichkeit zu erwarten, so dass der Nettoeffekt a-priori uneindeutig ist. Zum einen weisen größere Arbeitgeber häufiger interne Arbeitsmärkte auf, was die Aufstiegschancen positiv beeinflussen sollte. Zum anderen treten in größeren Betrieben eher Informationsprobleme im Hinblick auf die wahre Produktivität der Beschäftigten auf, was im Gegenzug zu niedrigerer Lohnmobilität führen kann. Industrielle Beziehungen, insbesondere in Form von Betriebsräten, können diese Informationsprobleme aufgrund von Mitspracherechten bei der Beförderungen erheblich abmildern.

Insgesamt deuten die Ergebnisse auf Basis von deutschen Linked Employer-Employee Daten darauf hin, dass die obigen Merkmale die Aufstiegswahrscheinlichkeiten von Geringverdiener/innen signifikant beeinflussen. Hierbei ergeben sich jedoch unterschiedliche Muster in Abhängigkeit vom Geschlecht. So haben Männer in größeren Betrieben signifikant höhere Aufstiegschancen, profitieren jedoch nicht von Betriebsräten und Tarifverträgen. Im Gegensatz hierzu profitieren Frauen insbesondere von der Existenz eines Betriebrates, jedoch nicht von der Betriebsgröße. Die Ergebnisse liefern somit Evidenz dafür, dass interne Arbeitsmärkte eine wichtige Determinante der Aufstiegschancen männlicher Geringverdiener sind. Für Frauen hingegen lassen sich hinsichtlich der Bedeutung interner Arbeitsmärkte keine eindeutigen Aussagen treffen. Hier lassen die Ergebnisse lediglich die Schlussfolgerung zu, dass der gegenläufige Effekt der Betriebsgröße infolge der Existenz asymmetrischer Information möglichen positiven Effekten stärker entgegenwirkt als bei männlichen Geringverdienern. In Kombination mit den unterschiedlichen Effekten der industriellen Beziehungen lässt dies darauf schließen, dass asymmetrische Informationen hinsichtlich der wahren Produktivität für Frauen ein relevanteres Aufstiegshemmnis darstellen als für Männer.

Should low-wage workers care about where they work? Assessing the impact of employer characteristics on low-wage mobility

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April 2010

Abstract

This paper studies the importance of employer-specific determinants in escaping low earnings in Germany. To address the initial conditions problem and the endogeneity of employer retention, we model (intra-firm) low-pay transitions using a multivariate Probit model that accounts for selection into low-wage employment and non-random employer drop-out. Using data from the LIAB Linked Employer–Employee panel, our results indicate that for male workers from the service sector the probability of escaping low-pay increases with employer size. This contrasts with female workers from the service sector, who rather benefit from collective bargaining coverage and local works councils. These findings are consistent with internal labour markets being an important ingredient of male within-firm wage growth, whereas the removal of asymmetric information appears to be more relevant in explaining female workers' wage transitions.

Keywords: Wage Mobility, Trivariate Probit, Linked Employer-Employee Data

JEL Code: C23, J31, J51, L13

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1 Introduction

Numerous papers have documented a widening in the wage and earnings distribution especially in the U.S. and the U.K. over the last three decades (e.g. Acemoglu 2003, Gosling et al. 2000, Levy and Murnane 1992). Yet, the degree of concern about wage inequality generally depends on whether individual inequality is likely to persist over the life-cycle. Therefore, in response to this evidence a literature has developed that investigates the extent of individuals' mobility through the wage distribution (e.g. Buchinsky and Hunt 1999, Burkhauser et al. 1997, Dickens 2000). In this literature, low-wage workers typically are of major interest to researchers. The reason is that a high degree of low-pay persistence raises particular concerns about inequality as it tends to marginalise low-wage workers in the long run. However, the degree of wage mobility is not only relevant from a welfare perspective, but is also central to the question of appropriate policy interventions. Wage subsidies, for example, intended to complement low earnings are the more likely to succeed in rendering low-pay jobs a stepping-stone into regular employment, the more mobile workers are in the wage distribution.

The high degree of persistence in low-wage employment that is generally documented by raw descriptive statistics has led some researchers to inquire into the sources of low-pay persistence (see e.g. Cappellari 2002, 2007, Stewart and Swaffield 1999). Their overall aim is to distinguish persistence in low pay due to observed and unobserved heterogeneity from true state dependence. The latter is also referred to as "genuine state dependence" and may occur if low-wage employment today causes low-wage employment in the future for reasons of stigmatization or human capital depreciation. A central result that emerges from this literature is that the extent of genuine state dependence is considerably reduced once observable characteristics and selection into low-wage employment are accounted for. While much of this literature has focused on individual characteristics, the role of employer characteristics has received considerably less attention. Addressing the role of employer characteristics is crucial to an understanding of low-wage dynamics for several reasons. First, neglecting employer characteristics may equally well result in a biased estimation of genuine state dependence if persistence in low pay is systematically

associated with the characteristics of low-wage firms. Second, quantifying the role of employer characteristics in promoting wage mobility is of vital importance for policy recommendations aiming at reducing low-pay persistence. To the extent that employer characteristics matter, active labour market policies, such as hiring subsidies or activating programs for the unemployed, might be directly targeted to those employers who have been identified as being conducive to mobility out of low-wage employment.

The purpose of this paper is to fill in this gap by examining the importance of employer-specific determinants in escaping low earnings in Germany. While the German wage structure has long been considered relatively stable at lower percentiles (Prasad 2004), the past two decades have seen a clear tendency towards more wage inequality at the bottom end of the wage distribution (Dustmann et al. 2009, Kohn 2006). As a consequence, the low-wage sector has increasingly grown in importance. In order to address the importance of employer characteristics, the evidence presented in this paper is based on a large-scale Linked Employer-Employee data set, the Linked Employer-Employee Panel from the German Institute for Employment Research (LIAB). The data provide a useful basis for exploring wage mobility for several reasons. First, the data combine establishment-level data with administrative information on individual wage records and characteristics for the entire population of workers in the establishment sample. The establishment-level data offer a great deal of information on establishment characteristics, such as establishment size, sector affiliation and the nature of industrial relations. Second, the individual data provide information on workers' employment (and earnings) status five years later, enabling us to analyse the extent of wage mobility over this time span. A particular strength of the individual data set is that it mitigates problems of panel attrition that typically arise with survey data. In our data set, the problem of panel attrition is considerably reduced as the data track individuals over time as long as they are either employed or, alternatively, unemployed with transfer payments.[1] Even though our data feature less panel attrition than survey data, we still face the problem of non-random employer retention if individuals leave their employer and/or fall

[1]Note that this holds irrespective of whether the initially observed employer attrited in the *IAB Establishment Panel*.

out of the earnings distribution. Because this drop out is likely to be non-random, we follow the approach of Cappellari and Jenkins (2006) and Cappellari (2007) by estimating a trivariate probit model, which accounts for the selection into low-wage employment and non-random employer retention.

The remainder of the paper proceeds as follows. Section 2 gives an overview of related empirical work. Section 3 contains a discussion of the employer-specific characteristics that may be expected to affect low-wage mobility. Section 4 presents the empirical analysis. While Section 4.1 to 4.4 provide a description of the data set and the estimation strategy, Section 4.5 present the empirical results. The final Section 5 concludes.

2 Previous Research

Earlier studies seek to measure wage mobility by analysing transition matrices between different quantiles of the wage distribution. Studies of this sort include e.g. Buchinsky and Hunt (1999) for the U.S., Cardoso (2006) for Portugal and the U.K., Dickens (2000) for the U.K. and Hofer and Weber (2002) for Austria. A principal finding that emerges from this literature is that, while most of these countries witnessed an increase in inequality, mobility tended to fall over the past three decades. A further well documented empirical pattern is that there appears to be a great deal of persistence particularly at the top and the bottom of the wage distribution. However, even though these studies often provide transitions that are broken down by several observable characteristics, this strand of literature generally remains silent about the mechanisms that lie behind the observed state dependence.

While the notion of genuine state dependence reflects the true causal effect of low pay, a high degree of low-pay persistence need not necessarily indicate genuine state dependence. Persistence in low pay may also result from adverse employer and individual characteristics that may be either observed or unobserved in nature. As a result, the central econometric challenge researchers are facing is that of unobserved heterogeneity and initial conditions. A number of studies have addressed this issue by adopting multi-variate probit models that account for several endogenous

selection mechanisms. For example, Stewart and Swaffield (1999) and Cappellari (2002) estimate bivariate probit models, in order to assess the endogeneity of the initial earnings status. Cappellari (2007) takes this approach further by estimating a four-variate probit model that additionally accounts for the endogeneity of schooling choices and earnings retention. The latter takes into account that unobservables affecting the probability of dropping out of the earnings distribution are typically correlated with factors that determine the initial earnings status. Taken together, the findings of these studies indicate that the impact of personal attributes on remaining low paid are generally overstated if one ignores the endogeneity of the initial low-wage status. Moreover, the results suggest that the extent of "true" state dependence is reduced by up to 50 percent once observable characteristics and the selection mechanisms are accounted for.

While much of this literature has focused on the role of individual characteristics in determining wage mobility, the role of employer characteristics has received somewhat less attention. An exception is the study Holzer et al. (2004). Using matched employer-employee data from Illinois, the authors find employer-specific fixed-effects to be an important determinant of earnings mobility. As to employer observables, this study and most of the analyses reviewed above control for sector affiliation and firm size. By contrast, there are virtually no studies that address the role of employer-specific labour market institutions, such as the existence of a works council and a collective bargaining contract. As will be set out later, the nature of industrial relations may be considered a relevant factor in determining workers' chances of escaping low pay.

Further, there are very studies based on German data that address the issue of wage mobility. An early study is that by Burkhauser et al. (1997), who compare earnings mobility in the U.S. and Western Germany. Despite fundamentally different labour market institutions, the authors find similar mobility rates among German and U.S. workers.[2] Using data from the German Socioeconomic Panel (SOEP), Uhlendorff (2006) analyses the relationship between low pay, high pay and non-employment. Similar to other studies, the author finds the extent of genuine

[2]Some further studies look at (net) income mobility, which is not the focus of interest here, see e.g. Hauser and Fabig (1999) and Jenkins and van Kerm (2006).

state dependence to be considerably reduced once unobservable and observable heterogeneity is accounted for. While Uhlendorff (2006) finds individual characteristics, such as age and education, to have an significant impact on low-pay persistence, his study does not address the role of employer characteristics. The same is true for the study by Gernandt (2009), who also uses data from the German SOEP and focuses on the individual determinants of wage mobility. Using individual panel data from the *Employment Statistics* in Germany, a recent study by Schank et al. (2009) explores low-wage mobility by estimating various probit models that account for some employer characteristics. While these authors find that employer characteristics, such as firm size significantly affect the probability of escaping low pay, they do not address the question of whether their results are robust to the selection into low-wage employment and non-random earnings retention. As noted before, this is an issue of particular concern as the impact of observable attributes is generally considerably reduced once these selection mechanisms are accounted for.

3 The Role of Employers for Low Pay Transitions

3.1 Theoretical Background

The theoretical literature on wage dynamics within firms has identified several features that are considered important determinants of wage mobility inside firms: Job assignment, on-the-job human capital acquisition and learning about workers' unobserved productivity (Gibbons and Waldman 1999). Central to the idea of job assignment is the notion that the assignment to different job levels takes place within a hierarchical job structure based upon comparative advantage. The concept of hierarchical job structures is closely related to the theory of internal labour markets (Doeringer and Piore 1971). At the heart of this approach is the view that workers are hired into entry-level jobs and that jobs at higher levels are filled by the promotion of workers within the firm. In terms of intra-firm low-wage mobility, low-wage jobs might therefore be viewed as representing lower hierarchy jobs. Thus, the extent of low-wage mobility should strongly depend on whether within-firm career paths are also available for low-wage workers. However, even if such internal career paths exit, only those workers who fulfill certain skill requirements may be expected to

move-up the job ladder. This is captured by human capital theory which emphasises the importance of on-the-job human capital accumulation for the extent of intra-firm wage dynamics. The implications for earnings profiles have been extensively analysed in the literature and generally predict wages to increase with experience and tenure, but at decreasing rates (e.g. Topel 1991). According to these profiles, the extent of mobility out of low-wage employment may therefore be expected to decrease with tenure and age.

Finally, the concept of employer learning captures the notion that firms have ex-ante incomplete information about a worker's (unobserved) productivity. This argument is particularly relevant in the context of low-wage employment relationships, which are typically associated with low tenure.[3] Employers only gradually learn about a worker's true ability with the accumulation of tenure, which may possibly translate into intra-firm wage mobility. In this context it is worth noting that incomplete information about a worker's true productivity should be particularly relevant if low-wage employment is systematically associated with earlier career interruptions, which makes it difficult to value a worker's quality based upon previous work performance.

3.2 Relevant Employer Characteristics

How can these considerations be operationalised in terms of measurable characteristics at the employer level? Our empirical analysis will account for the following observables: Firm size, the nature of industrial relations such as the existence of a works council and a collective bargaining contract as well as information on the firm's skill composition. In what follows, we will spell out in more detail why we consider these characteristics central to the study of wage dynamics:

Employer Size: In the literature on internal labour markets, firm size is typically viewed a good proxy for the presence of internal job ladders (e.g., Siebert and Addison 1991). Thus, larger firms may provide low-wage workers with better career opportunities and may positively affect the probability of escaping low pay provided

[3]For example, in our sample the fraction of low-wage earners with less than 60 months (5 years) tenure is 61 (45) per cent among women in the service sector (manufacturing). For low-paid men in the service sector (manufacturing) the corresponding fraction is 75 (61) per cent.

such career paths do exist for the typical low-wage occupations. However, in terms of the learning argument larger employers may also face a larger degree of information asymmetries, which should render learning about a worker's true productive ability more difficult. While some authors have noted that greater difficulties in determining the ability of workers may cause large employers to offer steeper wage profiles (Lazear 1981), others have argued that larger employers have incentives to adopt more extensive screening procedures prior to hiring. This, in turn, might lead to significantly smaller wage growth at larger employers as, e.g., evidenced by Barron et al. (1987). As a result, firm size is likely to be associated with countervailing effects on wage mobility so that the overall impact is ambiguous a-priori.

Industrial Relations: In Germany, employers may be subject to centralised collective wage agreements, firm-specific collective agreements or, alternatively, to no agreement at all. Centralised agreements are typically negotiated between an industry-specific trade union and an employers' association. Such contracts generally stipulate wage increases based upon well-defined tenure profiles and may therefore be envisaged as considerably facilitating intra-firm wage mobility.

A further reason for why industrial relations may be central to intra-firm wage dynamics is that worker representations are often closely related to internal labour markets. This is not only because worker representations may help establish administered wage rules inherent to internal labour markets, but also because of their potential role in monitoring promotions in internal labour markets (Siebert and Addison 1991).

While there is a clear role for German trade unions in establishing administered wage setting rules, they are unlikely to be involved in monitoring the wage setting process and promotions at the firm level. The reason is that German trade unions are generally organised along sectoral dimensions. In the German institutional environment, the monitoring role is rather taken by works councils, which provide workers with the opportunity of employee representation at the establishment level.[4] Their participation rights are laid down under the German *Works Constitution Act*

[4]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.

("*Betriebsverfassungsgesetz*") and include consultation, co-determination and information rights, which generally increase with establishment size. These rights refer to issues such as working hours regulations, health and safety matters and, most importantly, the implementation of measures that aim at monitoring employee performance (see e.g. Addison et al. 1997). Even though works councils are formally prohibited from negotiating over wages which are typically stipulated by collective bargaining agreements, they are widely recognised to have a substantial impact on workers' remunerations for several reasons. First, works councils are traditionally involved in the implementation of collective bargaining agreements at the establishment level and have a consent right with respect to the placement of workers in certain wage groups. Second, works councils may also be expected to play a crucial role in locally negotiating bonus rates and other forms of performance-related pay. Consistent with these ideas, previous empirical studies have documented a significant impact of works councils on wages (see e.g. Hübler and Jirjahn 2003). Along with their codetermination rights with respect to the monitoring process this leads us to expect works councils being actively involved in monitoring promotions and reducing information asymmetries concerning workers' productivity levels.

Skill Composition: Finally, the employer-specific skill composition is meant to capture different opportunities for on-the-job human capital acquisition. A larger share of high-skilled workers is likely to impact positively upon wage mobility if, for example, a larger fraction of skilled workers is associated with more intensive training measures as well as positive spillover effects on low-wage workers' productivity levels.[5] To capture the employer-specific skill composition, we calculate the share of high-skilled workers, the mean age of co-workers as well as the share of workers who participate in on-the-job training measures.

[5]Another reason why co-worker characteristics may exert an impact on wages and wage growth is the reduction of measurement error. To the extent that skills are measured with error and firms tend to employ workers with similar levels of education, then an individual's skill level might be systematically related to its co-workers' skills (see Card and de la Rica 2006).

4 Empirical Analysis

4.1 Data and Variable Description

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* (see e.g. Alda et al. 2005). The *IAB-Establishment Panel* is based on an annual survey of German establishments, whose sampling frame encompasses all German establishments that employ at least one employee paying social security contributions. The individual data stem from 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. 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 contain information on individuals' occupation, occupational status, qualification, sex, age, nationality and, most importantly, on individual gross daily wages. Since there is an upper contribution limit to the social security system, wages are top-coded. However, for our analysis top-coding is of minor relevance as the information on wages is used only to classify individuals according to their low-pay status (see the next section). In addition, the current available version of the LIAB data offer information on daily wages rate and individuals' employment status with a lead of five years. Furthermore, the data provide information on individuals' employment histories, such as the individuals' employment status prior to their current employment relationship.

Both data sets contain a unique establishment identifier which allows us to merge the establishment data with information on all employees subject to social security contributions. To construct the linked employer-employee data set, we first select establishments from the *IAB-Establishment Panel* from the manufacturing and service sector in western Germany for the year 1999. As the individual data contain information on individuals' employment status five years later, this enables us to analyse low-pay transitions between 1999 and 2004. The establishment data give

detailed information on a great deal of establishment characteristics, e.g. establishment size, turnover, the nature of industrial relations, such as collective bargaining coverage and the existence of a works council. As to collective bargaining coverage, establishments are asked to report whether they are bound to an industry-wide collective wage agreement or, alternatively, to a firm-specific wage agreement. Tables A3 and A4 provide a more detailed description of the individual and establishment covariates.

In a second step, we merge the establishment data with notifications for all employees who are employed by the selected establishments on June 30^{th}. Because the *Employment Statistics Register* lacks explicit information on hours worked, we drop information for apprentices, part-time workers and home workers and confine our attention to full-time workers. To avoid modeling human capital formation and retirement decisions, we focus on individuals aged between 20 and 55 years. Moreover, for those workers who have multiple employers we include only the employment relationship with the dominant employer, where the latter is inferred from the maximum amount of daily earnings.

The final sample for male employees in the service sector (manufacturing sector) contains 71,037 (362,420) individuals in 684 (943) establishments. The sample for female employees in the service sector (manufacturing sector) comprises 35,773 (77,726) individuals in 734 (878) establishments. The descriptive statistics are shown in Table A1 and A2 in the appendix.

4.2 Definition of Low-Pay Status

Previous studies have used different definitions of the low-pay threshold, such as the first quintile or third decile of the wage distribution (e.g. Cappellari 2002, 2007) or, alternatively, some fixed proportions of the median wage (e.g. OECD 1998, Stewart and Swaffield 1999 and European Commission 2004). Similar to Cappellari (2002, 2007), we define the low-pay threshold as the third decile of the wage distribution.[6] In order to compute this threshold for the two years of interest (1999 and 2004),

[6]Robustness checks with respect to this definition are provided in Section 4.6.

we need representative data at the individual level. Because our linked employer-employee data are representative only at the establishment level, we complement our analysis with information from the *BA Employment Panel.* This data set is an 1.92% random sample drawn from the quarterly *Employment Statistics* of the Federal Employment Agency and is representative for employees who are covered by the German social security system. To compute the threshold, we keep individuals whose employers are located in western Germany and exclude apprentices, part-time and home workers as in our LIAB sample. To match the threshold definition with the individual notifications from the LIAB data, we use gross monthly earnings for the set date 30th June 1999 and 2004, respectively, and convert these values into gross daily wages. The resulting low-pay thresholds are 67.66 € for 1999 and 71.88 € for 2004. According to this definition, the fraction of low paid workers in the LIAB data was 28.21 per cent among females in the service sector in 1999 and 11.18 per cent among male service workers. In the manufacturing sector, the shares are smaller and amount to 23.89 per cent among female and only 4.90 per cent among male workers, respectively.

4.3 Pattern of Intra-Firm Low-Pay Transitions

Table 1 reports the conditional probabilities of being low paid in 2004 given a worker's low-pay status in 1999. The figures show that the probability of being low paid in 2004 at the same employer is considerably higher for those who were already low paid in 1999 than for those who were highly paid. Low-pay persistence and inflow rates from high pay into low pay tend to be smaller among male workers compared with their female counterparts (Rows (1) and (6)).

Table 1 further reports the probabilities of being low or highly paid after having changed the employer. A comparison of the transition rates across formerly low and highly paid workers shows that for the initially low paid an employer change is much more frequently associated with low-pay persistence (Rows (3) and (8)). Table 1 also reports the probabilities of falling out of the (full-time) earnings distribution. Individuals leaving full-time employment can be either unemployed and receive transfers, non-employed, may enter occupational training or, alternatively,

Table 1: Low-pay transition probabilities

	Males		Females	
State in 1999	Low pay	High pay	Low pay	High pay
State in 2004				
Services				
(1) Low pay in initial establishment	19.94	0.78	30.14	1.99
(2) High pay in initial establishment	14.81	60.67	11.58	46.63
(3) Low pay after employer change	16.94	1.14	10.72	1.66
(4) High pay after employer change	17.04	22.15	8.60	18.37
(5) Out of full-time employment	31.28	15.26	38.96	31.36
ASD	34.96		37.21	
Manufacturing				
(6) Low pay in initial establishment	17.01	0.37	27.39	1.74
(7) High pay in initial establishment	27.29	62.77	17.74	49.18
(8) Low pay after employer change	13.25	1.40	9.91	2.06
(9) High pay after employer change	16.26	21.81	7.17	18.26
(10) Out of full-time employment	26.20	13.65	37.79	28.76
ASD	28.48		33.5	

Source: LIAB 1999.

may work part-time (either at the same or a different employer). The figures show that the probabilities of leaving full-time employment are considerably larger for those who were in the low-wage sector in 1999 as compared with higher paid employees. As expected, in both sectors the differences are much more pronounced among male workers than among their female counterparts (Rows (5) and (10)).

Defining aggregate state dependence (ASD) as the difference between the probabilities $\Pr(L_{2004} = 1|L_{1999} = 1)$ and $\Pr(L_{2004} = 1|L_{1999} = 0)$, with $L_t = 1$ and $L_t = 0$ denoting low and high pay in year t, Table 1 shows that ASD amounts to 34.96 percentage points for men and 37.21 percentage points for women in the service sector. In manufacturing, ASD turns out to be somewhat smaller and amounts to 28.48 percentage points for male and 33.5 percentage points for female employees. Conditional on staying with the same employer, the figures become larger. The corresponding values are 57.37 percentage points for males and 72.2 percentage points for females in the service sector, as well as 37.8 percentage points for males and 57.7 percentage points for females in manufacturing.

To assess the importance of some selected employer characteristics for low-pay

transitions, Table 2 displays transitions rates into low pay cross-tabulated by size classes, the existence of a works council and collective bargaining (industry-wide contract, firm-specific contract and no coverage). Due to the focus on the employer attributes, we restrict the sample to those individuals who stay (full-time) employed with their current employer. The first noteworthy fact that emerges from Table 2 is that persistence rates nearly monotonically decline with employer size (an exception are the rates for females in the service sector, see Column (3) in Panel A). A similar pattern of results holds for entry rates even though in some groups individuals in the largest size class (establishments with at least 5,000 employees) exhibit somewhat higher transition rates than those in the adjacent class (1,000 $<$ Size $<$ 5,000). As to collective bargaining coverage, workers employed by non-covered establishments generally have higher persistence and entry probabilities as compared with those working at covered employers. The only exception that stands out here are women in manufacturing, who exhibit larger persistence probabilities when their employer is covered by a firm–specific contract (Panel B, Column (3)).

Finally, the figures displayed in the last two rows in each panel show that persistence as well as entry probabilities are consistently smaller when the employer has a works council. Even though these figures reveal some striking patterns of low-pay transitions, it needs to be emphasised that on the one hand, the employer attributes displayed in Table 2 are strongly positively correlated, and, on the other hand, there may be a large amount of selection upon unobservables into establishments. This raises the question as to how the established relationships between low-pay transitions and employer characteristics hold if one accounts for these correlations and unobserved individual heterogeneity. We will address these questions in turn in our multivariate econometric framework.

4.4 Econometric Analysis of Low-Pay Transitions

As noted at the outset, the high degree of aggregate state dependence observed in the data does not control for heterogeneity - either observed or unobserved. The aim of the multivariate analysis is to characterise the determinants of low-pay persistence and exit rates by explicitly distinguishing between observed and unobserved

Table 2: Low-pay transition probabilities across different employers

	Males		Females	
State in 1999	Low pay	High pay	Low pay	High pay
Low pay in 2004	*(1)*	*(2)*	*(3)*	*(4)*
	A. Services			
Size < 100	68.33	4.41	81.11	9.19
100 ≤ Size < 500	65.55	2.76	81.81	5.76
500 ≤ Size < 1,000	54.92	1.73	62.77	5.46
1,000 ≤ Size < 5,000	41.80	0.53	65.32	2.70
Size ≥ 5,000	9.09	0.66	64.13	3.30
Industry-wide contract	56.44	1.37	72.10	3.88
Firm-specific contract	50.15	0.84	55.16	3.47
No contract	67.53	1.16	80.23	6.53
Works council	53.83	1.09	70.15	3.90
No works council	69.10	4.54	82.95	8.19
	B. Manufacturing			
Size < 100	60.72	4.60	87.59	6.75
100 ≤ Size < 500	46.67	1.50	72.74	4.69
500 ≤ Size < 1,000	36.60	0.57	64.89	4.57
1,000 ≤ Size < 5,000	25.31	0.49	45.14	3.31
Size ≥ 5,000	9.84	0.17	22.73	1.31
Industry-wide contract	33.44	0.45	57.12	3.02
Firm-specific contract	49.41	1.20	73.05	4.16
No contract	56.31	2.30	70.32	9.23
Works council	35.25	0.55	57.91	3.35
No works council	60.70	3.14	83.41	6.83

Source: LIAB 1999. The sample is restricted to employees who stay with their employer in 2004.

heterogeneity and true state dependence.

4.4.1 Model Specification

To analyse low-pay transitions, we estimate the probability of being low paid in period t, conditional on the lagged pay status in $t-5$. An endogeneity issue which is commonly referred to as the 'initial conditions problem' (Heckman 1981) arises if the starting point of the earnings process cannot be observed in the data and the unobservables affecting these processes are correlated. A solution is to augment the model of interest with an equation for the initial condition and to allow for a correlation between the error terms of both equations. To provide our employer attributes of interest with a meaningful interpretation, we model the transition process for those who stay with their employer. This gives rise to a second endogeneity issue since intra-firm pay transitions are only observable for employees who stay full-time employed with their employer. If unobservables affecting the probability of drop out and the initial low-pay status are correlated, the resulting attrition will be endogenous to the pay transition process.[7]

In order to account for these selections mechanisms, we estimate a trivariate probit model. Multivariate probit models have been adopted in a number of recent studies analysing labour market dynamics (e.g. Cappellari 2007, Cappellari and Jenkins 2008). Our model includes the determination of low-pay status in period $t-5$ (to account for the initial conditions problem), the determination of whether full-time earnings at the same employer are observed at both points in time, $t-5$ and t (employer retention), the determination of pay status in period t, and finally the correlation of unobservables affecting theses processes.

We start by specifying the initial low-pay status. Let l^*_{it-5} denote a latent low-pay propensity for individual i at the start of the observation period and x_{it-5} represents a set of individual and employer-specific characteristics. x_{it-5} includes age, age

[7]Non-retention therefore comprises either a (full-time) employer change, becoming part-time employed at the same or a different employer or becoming unemployed or non-employed. Strictly speaking, as we do have information on these different employment states, we could model these processes by estimating a four-variate or even higher dimensional Probit model. However, due to our large sample size we refrain from estimating such models due to the computational burden involved by higher-dimension Probit models.

squared, tenure, tenure squared as well as dummies on educational attainment (five categories) and occupational status to capture labour market experience and human capital endowment. We also include information on the employment history, such as the employment status prior to entry into the current establishment as well as the number of previous unemployment spells with transfer receipt. We further include employer characteristics such as establishment size, the nature of industrial relations, two-digit sectoral affiliation, the share of fixed-term contracts as well as information on the employer-specific skill composition (the share of high-skilled workers, the share of workers who participated in training measures and the mean age). u_{it-5} is the sum of an individual-specific effect, μ_i, and an orthogonal white-noise error, λ_{it-5}, and is assumed to follow a standard normal distribution.

$$l^*_{it-5} = \beta' x_{it-5} + u_{it-5}, \quad u_{it-5} = \mu_i + \lambda_{it-5} \sim N(0,1) \tag{1}$$

If l^*_{it-5} exceeds some unobservable value (normalised to zero), individual i is observed to be low paid. We define a binary indicator $L_{it-5} = 1$ if $l^*_{it-5} > 0$ and zero otherwise.

The next process to be specified is the employer retention. We assume that the propensity to observe full-time earnings of individual i in period $t-5$ and t at the same employer can be described by a latent retention index r^*_{it},

$$r^*_{it} = \delta' y_{it-5} + \varepsilon_{it}, \quad \varepsilon_{it} = \eta_i + \xi_{it} \sim N(0,1), \tag{2}$$

where the error term ε_{it} is standard normally distributed and specified as the sum of an individual-specific effect, η_i, and an orthogonal white-noise error, ξ_{it}. y_{it-5} includes factors affecting both earnings and the attachment to paid employment. y_{it-5} contains x_{it-5}, i.e. we assume that all factors affecting earnings levels are also relevant in determining employer retention. y_{it-5} additionally includes expected employer-specific employment growth as an explanatory factor for employer retention. If the latent retention propensity of individual i is lower than some critical unobserved value (again normalised to zero), earnings and low-pay status cannot be observed in period t. Let R_{it} be a binary variable of the employer retention outcome of each individual, whereas $R_{it} = 1$ if $r^*_{it} > 0$ and zero otherwise.

The third component of the model is the specification of the low-pay status in period t. We assume that the latent propensity of low pay can be characterised by

$$l_{it}^{*} = \left[\left(L_{it-5}\right)\gamma_1' + \left(1 - L_{it-5}\right)\gamma_2'\right] z_{it-5} + \upsilon_{it}, \quad \upsilon_{it} = \tau_i + \zeta_{it} \sim N\left(0,1\right), \tag{3}$$

with υ_{it} denoting the sum of an individual-specific effect, τ_i, and an orthogonal white-noise error, ζ_{it}.The column vector z_{it-5} comprises individual and employer-specific attributes affecting the pay status in t. In order to deal with simultaneous changes in covariates and pay status, the employer and individual characteristics pertain to period $t-5$. The switching specification in (3) allows the impact of the explanatory variables to differ according to the low-pay status in the initial period. Again, L_{it} denotes a binary variable $L_{it} = 1$ if $l_{it}^{*} > 0$ and zero otherwise, where L_{it} is only observable if $R_{it} = 1$. As a consequence, the sample likelihood will be endogenously truncated.

We assume that the error terms in each of the three equations are jointly distributed as trivariate normal with unrestricted correlations, which can be written as

$$\rho_1 \equiv corr\left(u_{it-5}, \varepsilon_{it}\right) \tag{4}$$

$$\rho_2 \equiv corr\left(u_{it-5}, \upsilon_{it}\right) \tag{5}$$

$$\rho_3 \equiv corr\left(\upsilon_{it}, \varepsilon_{it}\right). \tag{6}$$

The cross-equation correlations provide a parameterisation of unobserved heterogeneity. The correlation ρ_1 describes the relationship between unobservable factors affecting the initial low-pay status and employer retention. A negative sign suggests that individuals who were more likely to be low paid in the initial period are more likely to drop out of full-time employment at the same employer compared with highly paid individuals. The correlation ρ_2 summarises the association between unobservable factors determining the initial and the current low-pay status. Here a positive sign would imply that individuals earning low pay in t are more likely to remain in the low-pay status. Finally, the correlation ρ_3 characterises the relationship between unobservables affecting the retention propensity and the current low-pay status. A negative sign would indicate that individuals employed at both points in

time are more likely to escape low pay in t as compared to individuals dropping out of full-time employment at the same employer. Estimation of unconstrained cross-correlation coefficients provides a test of whether initial conditions and the employer retention process may be treated as exogenous. In particular, $\rho_1 = \rho_3 = 0$ would imply that the employer retention process is exogenous and would give rise to a bivariate probit model. Similarly, testing the exogeneity of initial conditions amounts to testing $\rho_1 = \rho_2 = 0$. Finally, if all cross-equation correlations are zero, then γ_1 and γ_2 can be consistently estimated using univariate probit models on sub-samples depending on individuals' initial pay status ($L_{it-5} = 0$ or $L_{it-5} = 1$).

Estimating the model with unrestricted cross-equation correlations requires identifying restrictions, i.e. variables entering x_{it-5} or y_{it-5} but not z_{it-5} in the transition equation. We exclude expected employment growth and the share of fixed-term contracts from the equation for low-pay transitions and test the validity of these restrictions using functional form as the identifying restriction.

4.4.2 Measures of State Dependence

One important issue in the dynamic analysis of low pay is the investigation of state dependence. Following Cappellari (2007), we distinguish between aggregate state dependence (ASD) and genuine state dependence (GSD). ASD is obtained by computing the difference in average predicted transition probabilities for those who were low paid in $t-5$ and for those who were initially highly paid:

$$\begin{aligned} ASD &= \frac{\sum_{i\in(L_{it-5}=1,R_{it}=1)} \Pr\left(L_{it}=1|L_{it-5}=1\right)}{\sum_i L_{it-5}\cdot R_{it}} - \frac{\sum_{i\in(L_{it-5}=0,R_{it}=1)} \Pr\left(L_{it}=1|L_{it-5}=0\right)}{\sum_i (1-L_{it-5})\cdot R_{it}} \\ &= \frac{\sum_{i\in(L_{it-5}=1,R_{it}=1)} \frac{\Phi_2\left(z_{it-5}\widehat{\gamma}_1, x_{it-5}\widehat{\beta}; \rho_2\right)}{\Phi\left(x_{it-5}\widehat{\beta}\right)}}{\sum_i L_{it-5}\cdot R_{it}} - \frac{\sum_{i\in(L_{it-5}=0,R_{it}=1)} \frac{\Phi_2\left(z_{it-5}\widehat{\gamma}_2, -x_{it-5}\widehat{\beta}; -\rho_2\right)}{\Phi\left(-x_{it-5}\widehat{\beta}\right)}}{\sum_i (1-L_{it-5})\cdot R_{it}}, \end{aligned} \tag{7}$$

where $\Phi(\cdot)$ and $\Phi_2(\cdot)$ are cumulative density functions of the univariate and bivariate standard normal distributions. This measure does not take into account individual observed or unobserved heterogeneity.

Genuine state dependence arises if initial low pay causes low-pay employment in the future for reasons of stigmatization or human capital depreciation. The absence of GSD can be directly tested by using the endogenous switching structure in (3) and amounts to testing the null hypothesis $H_0 : \gamma_1 = \gamma_2$. To account for individual-specific heterogeneity the GSD measure is based upon individual-specific probability differences. In particular, GSD is derived by computing for each individual the difference between the predicted transition probability conditional on being initially low paid and the predicted transition probability conditional on being initially highly paid, and then averaging the difference over the sample of those with observed earnings in t and $t-5$:

$$\begin{aligned} GSD &= \frac{1}{\sum_i R_{it}} \sum_{i \in R_{it}=1} \left[\Pr\left(L_{it}=1 | L_{it-5}=1\right) - \Pr\left(L_{it}=1 | L_{it-5}=0\right) \right] = \\ & \frac{1}{\sum_i R_{it}} \sum_{i \in R_{it}=1} \left[\frac{\Phi_2\left(z_{it-5}\widehat{\gamma}_1, x_{it-5}\widehat{\beta}; \rho_2\right)}{\Phi\left(x_{it-5}\widehat{\beta}\right)} - \frac{\Phi_2\left(z_{it-5}\widehat{\gamma}_2, -x_{it-5}\widehat{\beta}; -\rho_2\right)}{\Phi\left(-x_{it-5}\widehat{\beta}\right)} \right] \end{aligned} \quad (8)$$

4.4.3 Log-Likelihood Function and Marginal Effects

The log-likelihood contribution for each individual i with earnings information observed in period $t-5$ is:

$$\begin{aligned} \log \pounds_i &= L_{it-5} R_{it} \log\left[\Phi_3\left(g_i \gamma_1' z_{it-5}, h_i \delta' y_{it-5}, d_i \beta' x_{it-5}; g_i h_i \rho_3, g_i d_i \rho_2, h_i d_i \rho_1\right)\right] \\ &+ \left(1 - L_{it-5}\right) R_{it} \log\left[\Phi_3\left(g_i \gamma_2' z_{it-5}, h_i \delta' y_{it-5}, d_i \beta' x_{it-5}; g_i h_i \rho_3, g_i d_i \rho_2, h_i d_i \rho_1\right)\right] \\ &+ \left(1 - R_{it}\right) \log\left[\Phi_2\left(h_i \delta' y_{it-5}, d_i \beta' x_{it-5}; h_i d_i \rho_1\right)\right] \end{aligned} \quad (9)$$

where Φ_3 is the cumulative density function of the trivariate standard normal distribution and $g_i \equiv 2L_{it} - 1$, $h_i \equiv 2R_{it} - 1$, $d_i \equiv 2L_{it-5} - 1$. We compute the trivariate standard normal distribution by applying the Geweke-Hajivassiliou-Keane (GHK) simulator, yielding a maximum simulated likelihood (MSL) estimator (see

Cappellari and Jenkins 2006).[8]

Our estimation sample is based on those individuals for whom we observe full-time earnings in our matched employer-employee data set. In this data set, we observe for each establishment the initial pay status for all employees.[9] As the repeated observation of employer-specific characteristics violates the i.i.d. assumption of the maximum likelihood estimation approach, we adjust the standard errors using a robust variance estimator based on clusters at the establishment level.[10]

In order to simplify the interpretation of the estimation results, we report the marginal effects (ME) showing the impact on the relevant probabilities of a change in the chosen covariate. For a dummy variable, the ME is calculated as a change in the probability resulting from a change in the indicator's value from zero to one, holding all other covariates fixed at their sample median values. ME for continuous variables are usually estimated by evaluating the partial derivative, which is equal to the corresponding coefficient multiplied by an evaluation of the normal density function. However, here the computation is not straightforward because the transition probabilities are conditional in nature (e.g. the probability of low pay in t conditional of being low paid in $t-5$). To clarify this point, the conditional probabilities are given by:

$$e_{it} \equiv \Pr\left(L_{it}=1|L_{it-5}=1\right) = \frac{\Phi_2\left(z_{it-5}\widehat{\gamma}_1, x_{it-5}\widehat{\beta}; \rho_2\right)}{\Phi\left(x_{it-5}\widehat{\beta}\right)} \tag{10}$$

and

$$f_{it} \equiv \Pr\left(L_{it}=1|L_{it-5}=0\right) = \frac{\Phi_2\left(z_{it-5}\widehat{\gamma}_2, -x_{it-5}\widehat{\beta}; -\rho_2\right)}{\Phi\left(-x_{it-5}\widehat{\beta}\right)} \tag{11}$$

As is evident from eqs. (10) and (11), a change in the value of a covariate may affect both the numerator and denominator of the conditional probabilities. In order

[8]More precisely, we use the GHK simulator with 100 Halton draws and antithetic draws for three dimensions.

[9]More specifically, we observe all employees who are covered by the social security system.

[10]See for further explanations Wooldrige (2002, Chapter 13, p. 404).

to deal with this issue, we adopt the procedure suggested by Stewart and Swaffield (1999) (see also Cappellari (2007) and Cappellari and Jenkins (2008)) by keeping the elements of x_{it-5} fixed. To do so, we first predict the low-pay probability in $t-5$ for all low paid individuals and take the average over these values - denoted as q. By inserting $w = \Phi^{-1}(q)$ into eq. (10) we obtain $\Phi_2(z_{it-5}\widehat{\gamma}_1, w; \rho_2)/w$. This expression is used to calculate ME as deviations between the conditional probabilities for a reference person and hypothetical probabilities induced by changing each covariate by an unit. For the reference person, we set continuous covariates to the sample median values and dummy variables to zero. The same procedure is applied to f_{it}.

4.5 Results

In this section, we report the results from estimating our specified model separately by gender. For females, we provide separate estimates for the manufacturing and service sector, whereas for male workers our estimates are confined to the service sector. The underlying reason for this restriction is the very low proportion of male low-wage workers in manufacturing (below 5 per cent), which makes it difficult to obtain a well-behaved specification for this group of workers.[11]

Table 3: Diagnostic tests

	Females				Males	
	Services		Manufacturing		Services	
	χ^2	p-value	χ^2	p-value	χ^2	p-value
A. Exclusion of Instruments						
Instrument I from transition eq.	0.98	0.614	0.02	0.990	0.41	0.816
Instrument II from transition eq.	3.82	0.148	3.79	0.150	3.40	0.182
Instruments I and II from transition eq.	5.44	0.245	6.31	0.177	3.52	0.474
B. Inclusion of Instruments						
Instrument I in retention eq.	8.77	0.003	10.14	0.002	11.12	0.001
Instrument II in initial condition eq.	5.21	0.023	6.57	0.010	12.10	0.001

Note: Instrument I denotes expected positive employment growth and instrument II refers to the share of fixed-term contracts in all subsamples.

[11] In the appendix, we also present the results from estimating the model for male workers in manufacturing for the sake of completeness. However, as can be seen from Table A6 in the appendix, our instruments fail to provide valid exclusion restrictions for this subgroup of workers.

Table 3 reports the tests for the validity of the exclusion restrictions for our four estimation samples. Referring to Panel A of Table 3, the figures show that the specifications pass the exclusion tests for our imposed restrictions (with sufficiently large $p-$values). In Panel B, the test statistics also reveal that the exclusion of the imposed restrictions from the initial conditions and retention equation can be rejected at conventional significance levels.

Table 4 reports the estimates of the correlation coefficients across the three equations. For males in the service sector, the figures provide evidence of the endogeneity of the initial conditions equation. This contrasts with females, for whom the hypothesis of exogeneity and no unobserved heterogeneity cannot be rejected (with a $p-$value of 0.193). This finding suggests that much of the heterogeneity governing the selection and transition processes of females is already accounted for by our observed individual and employer-specific attributes. In manufacturing, in contrast, endogeneity of the retention and initial condition process is of much larger concern for females, as the null of the exogeneity of the underlying process has to be rejected for both equations. As expected, the correlation between unobservables affecting retention and initial conditions is estimated to be negative, which suggests that individuals with unobserved factors fostering low-wage employment are less likely to stay full-time employed with their employer. The negative correlation between the retention and initial condition indicates that those who were initially low paid are less likely to be employed at both points in time. Note that there is no significant correlation between the initial condition and the transition equation for males and females in the service sector, suggesting that any bias due to the selection into low-wage employment influences the transition process through its impact on employer retention.

Tables 5 and 6 report the results from estimating the transition equation (3) separately by gender (for females both for the service and manufacturing sector). The tables display the marginal effects of our individual and employer-specific explanatory variables on the low-pay transition probabilities. In line with the switching regression specification, the marginal effects are reported for those who where initially low paid and for those initially highly paid. For the former group the effects

Table 4: Cross equation correlation structure

	Females				Males	
	Services		Manufacturing		Services	
Correlation Structure	Estimate	p-value	Estimate	p-value	Estimate	p-value
ρ_1 (Initial conditions - retention)	-.043	0.060	-.170	0.000	-.111	0.000
ρ_2 (Initial conditions - transition)	-.415	0.186	-.500	0.040	-.012	0.975
ρ_3 (Retention - transition)	0.092	0.502	-.006	0.978	-.190	0.368
Hypothesis Tests	χ^2	p-value	χ^2	p-value	χ^2	p-value
Exogeneity of initial conditions						
$H_0 : \rho_1 = \rho_2 = 0$	4.09	0.130	36.05	0.000	13.61	0.001
Exogeneity of retention						
$H_0 : \rho_1 = \rho_3 = 0$	4.29	0.117	38.24	0.000	13.48	0.001
Unobserved heterogeneity						
$H_0 : \rho_1 = \rho_2 = \rho_3 = 0$	4.73	0.193	38.71	0.000	13.61	0.004

are to be interpreted in terms of persistence effects, whereas for the latter group the marginal effects refer to the probability of entering low pay. Marginal effects are calculated as described in Section 4.4.3 and are to be interpreted as deviations from a reference person. The reference individual has all dummies set to zero[12]and is defined by setting the continuous covariates equal to their sample median values. In Table 5, the first two rows report the average transition probabilities and those for the reference individual - which is referred to as the baseline probability. For females in the service sector, the baseline persistence probability of 0.90 is considerably larger than the average transition probability, whereas the opposite is true for entry probabilities. In manufacturing, transition probabilities of the reference individual both for the initially low and highly paid tend to be larger as compared with the average. The bottom row of Table 5 shows both the ASD and GSD measure as described in Section 4.4.2. The figures show that there is still considerable state dependence even after controlling for observed and unobserved heterogeneity. In the service sector, GSD amounts to 0.583, which is still about 82 per cent of ASD. In manufacturing, accounting for heterogeneity leads to a larger reduction in

[12]I.e., the reference individual has a vocational degree, a simple blue-collar occupation and had no regular employment-relationship prior to entry into the current establishment. As to the employer characteristics, the reference worker is employed by an establishment that belongs to the financial intermediation sector (in manufacturing: to the raw materials sector), has no works council and no collective agreement and employs at least 5,000 workers.

state dependence, as ASD is reduced by about 40 per cent.

Referring to the upper part of Table 5, our estimates for females in the service sector indicate that observable individual attributes significantly affect the probability of both staying and becoming low paid. As to the persistence effects (see Columns (1) and (2)), older women and those without any educational degree exhibit significant higher persistence probabilities as compared to the reference woman in the service sector. Also, working in a service or qualified blue-collar occupation appears to significantly worsen the probability of escaping low pay. The result for qualified blue-collars is somewhat surprising and may hint to the fact that low paid women with a qualified blue-collar occupation are particularly negatively selected and have already reached the top of the job ladder. This may give rise to less promotion and therefore transition possibilities as compared with those with a unqualified occupation. On the contrary, there are less observed individual characteristics that serve to keep initially highly paid women out of low pay: for this group only the lower education and technical-college dummies turn out to be significant (see Columns (3) and (4)). The corresponding results for female manufacturing workers are shown in Columns (5) to (8). Compared with the estimates for the service sector, the pattern of results is reversed as observables appear to be more relevant for entry probabilities. Moreover, the results from Columns (5) and (7) indicate that some occupational categories, such as technicians, clerical workers and the category "professional, managers and others" significantly reduce persistence as well as entry probabilities. Particularly for persistence probabilities, these effects are not only significant but also economically sizeable, as belonging to these occupational groups reduces persistence probabilities between 12.7 and 27.7 percentage points.

We next turn to the employer characteristics, which are reported in the lower part of Table 5. Our considerations from Section 3 suggested that if internal labour markets were an important ingredient of within-firm wage growth, the marginal effects on persistence of the employer size dummies should be positive (relative to the reference individual working in an establishment with at least 5,000 employees). For females in the service sector, the estimates reported in column (1) provide no evidence of this effect, as the marginal effects are consistently estimated to be negative

and are statistically insignificant. As to the entry effects, only in small establishments the probability of entering low pay is significantly larger as compared with the reference group of establishments with at least 5,000 employees. In manufacturing, persistence probabilities are significantly larger only in small plants, the same is true for entry probabilities. For the remaining size classes, however, the marginal effects on persistence are estimated to be negative and are not statistically significant at conventional levels.

Turning next to the industrial relations effects (comprising the effects of works councils as well as firm and industry-level contracts), the estimates indicate that industrial relations are important both for persistence as well as entry probabilities. In the service sector, industrial relations appear to be an effective means in helping women either to escape or to keep them out of low pay. The estimates reported in column (1) indicate that initially low paid women significantly benefit from firm-specific contracts and works councils, even though the estimate for firm-specific contracts is significant only at the 10 per cent level. However, the marginal effect from this institution is economically non-negligible: Initially low paid females subject to a firm-level contract experience a probability of remaining low paid that is 8.4 percentage points lower as compared with the reference worker. This amounts to a reduction of the baseline probability by about 10 per cent. In contrast, the effect of works councils is estimated with more precision, leading to a reduction of the persistence probability by about 6.6 percentage points. Moreover, the marginal effects displayed in column (3) show that industry as well as firm-specific contracts also have a significant impact on the probability of entering low pay, by almost halving the baseline probability of 0.061.

For manufacturing, the results are somewhat less pronounced. While collective contracts significantly reduce entry probabilities, there are no significant marginal effects on persistence probabilities. The marginal effect for works councils on low-pay persistence is also negative and large (-10 percentage points), but is very imprecisely estimated, only bordering significance with a $p-$value of 0.13.

From the skill composition covariates, a larger share of high-skilled workers helps female workers to escape low pay in the manufacturing sector. The marginal effect

Table 5: Estimation results for low-pay transitions of female workers

Females	Services				Manufacturing			
Wage in t-5	Low		High		Low		High	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Average prediction	0.681		0.131		0.554		0.112	
Baseline	0.903		0.061		0.736		0.161	
Explanatory variable in t-5	ME	*z*-ratio	ME	*z*-ratio	ME	*z*-ratio	ME	*z*-ratio
Individual Characteristics								
Age	0.018**	2.52	-.009	-.75	0.000	0.01	-.027	-1.11
Age squared	-.000***	-2.72	0.000	0.78	0.000	0.37	0.000	1.12
Lower education	0.049***	4.41	0.067***	3.21	0.022	0.97	0.032**	2.22
Higher sec. education	-.057	-.99	0.031	1.53	-.036	-.39	0.042	1.12
Voc. training + high	-.133***	-2.68	-.014	-1.46	-.093	-1.32	0.070**	2.22
Technical college	-.084	-1.26	-.046***	-4.42	-.027	-.22	-.029	-1.01
University	-.030	-.44	-.019	-1.36	-.095	-.39	0.006	0.17
Job tenure	-.001	-.64	-.000	-.69	0.000	0.84	-.000	-.90
Job tenure squared	0.000	0.64	0.000	0.74	-.000	-.93	0.000	0.77
Qualified blue-collar	0.060***	4.13	0.057	1.13	0.067	1.59	-.005	-.13
Technician and engineer	0.020	0.49	0.050	1.06	-.218**	-2.56	-.059***	-3.17
Service occupation	0.042**	2.52	0.072	1.58	-.005	-.11	0.026	0.45
Clerical, administrative	-.021	-.65	0.012	0.44	-.127**	-2.05	-.067***	-4.46
Professional, managers	0.004	0.10	0.025	0.73	-.277*	-1.70	-.060**	-2.08
# Previous benefit spells	0.006	0.83	0.005	0.60	-.001	-.19	0.004	1.04
Regular employment history	-.007	-.47	-.009	-1.44	-.020	-.92	-.016	-1.48
Employer Characteristics								
Size $<$ *100*	-.021	-.24	0.155***	2.59	0.160**	2.00	0.129*	1.70
100 $\leq$ *Size* $<$ *500*	-.049	-.51	0.048	1.37	-.036	-.25	0.068	1.29
500 $\leq$ *Size* $<$ *1000*	-.157	-1.10	0.042	1.36	-.087	-.61	0.063	1.35
1000 $\leq$ *Size* $<$ *5000*	-.142	-1.04	0.012	0.46	-.208	-1.56	0.043	1.01
Industry-wide contract	-.029	-1.14	-.027***	-3.04	-.033	-.67	-.090***	-3.35
Firm-specific contract	-.084*	-1.74	-.033***	-2.82	-.058	-.64	-.111***	-4.32
Works council	-.066**	-2.00	0.020	0.89	-.102	-1.50	0.025	0.61
Mean Age	0.002	0.71	0.001	0.38	0.004	0.56	-.005	-1.34
Share of high-skilled	-.010	-1.09	-.002	-.58	-.012***	-2.89	-.001	-.57
Training share	-.000	-.43	0.000	0.43	-.002**	-2.27	-.000	-.62
ASD (GSD)	0.713		(0.583)		0.584		(0.336)	
Number of observations	35,773				77,726			

Note: See main text for description of the estimation method and the definition of marginal effects. All specifications additionally include regional dummies and further sectoral dummies according to the classification shown in Tables A2 and A4 in the appendix. ***;** ;* significant at 1, 5, 10 per cent level.

has an equal magnitude in the service sector, but is not significant. The share of workers experiencing training measures significantly decreases persistence probabilities in manufacturing. In contrast, entry probabilities of initially highly paid females are not greatly affected by these co-worker characteristics.

Table 6 reports the results from estimating our model for male workers in the service sector. The results for the individual covariates are again shown in the upper panel of Table 6. Similar to female workers, older employees experience significantly larger persistence probabilities. For male workers, having a university degree significantly lowers the probability of remaining in the low-wage sector (Columns (1) and (2)). While a university degree is also relevant in sheltering initially highly paid men from entering low pay (see Columns (3) and (4)), the marginal effect is lower as compared with its effect on the persistence probability. A university degree reduces the probability of staying low paid by about 19 percentage points, whereas it reduces the entry probability by 0.9 percentage points. Note, however, that given the small baseline probability of 1 per cent this is a sizeable effect. Marginal effects of similar magnitude can be found for some professional groups, such as technicians and engineers as well as clerical and administrative employees and professionals/managers.

We next turn to the employer attributes for which the marginal effects are shown in the lower panel of Table 6. While there appears to be no role of employer size in helping women to escape low pay, the opposite is true for male employees. The marginal effects of the employer size dummies are all estimated to be positive and - with the exception of establishments between 1,000 and 5,000 employees - statistically significant at conventional levels (Column (1)).

Further, the effects are not only significant, but also economically sizeable and much larger in magnitude than the marginal effects of the individual characteristics. For instance, working in a small establishment with less than 100 employees increases the probability of staying low paid by almost 27 percentage point, which amounts to almost half of the baseline probability. Comparing employer size effects across gender in the service sector, it is worth noting that - except for the largest size class - the differences in the marginal effects are statistically significant at conventional levels.

Table 6: Estimation results for low-pay transitions of male workers

Males	Services			
Wage in t-5	Low		High	
	(1)	*(2)*	*(3)*	*(4)*
Average prediction	0.645		0.011	
Baseline	0.594		0.011	
Explanatory variable in t-5	ME	z-ratio	ME	z-ratio
Individual Characteristics				
Age	0.047**	2.00	0.001	0.24
Age squared	-.001	-1.61	-.000	-.20
Lower education	0.054	1.37	-.001	-.30
Higher sec. education	-.097	-1.11	-.004	-.87
Voc. training + high	-.060	-.91	-.004	-1.54
Technical college	0.148	1.07	-.002	-.56
University	-.193*	-1.94	-.009***	-5.30
Job tenure	0.002	1.30	-.000	-.39
Job tenure squared	-.000	-.96	0.000	0.40
Qualified blue-collar	0.043	0.59	-.005	-1.62
Technician and engineer	0.027	0.24	-.007***	-2.81
Service occupation	0.043	0.62	-.001	-.41
Clerical, administrative	0.003	0.04	-.007***	-4.58
Professional, managers	0.028	0.25	-.008***	-4.04
# Previous benefit spells	0.004	0.53	0.000	0.39
Regular employment history	-.018	-.43	-.004***	-3.36
Employer Characteristics				
Size < 100	0.268***	2.61	0.022	1.02
100 ≤ Size < 500	0.276***	3.26	0.005	0.50
500 ≤ Size < 1000	0.211*	1.75	0.001	0.10
1000 ≤ Size < 5000	0.154	1.29	-.008***	-2.59
Industry-wide contract	-.061	-1.00	0.004	0.66
Firm-specific contract	-.075	-.64	-.004	-.88
Works council	-.033	-.56	0.000	0.00
Mean Age	0.005	0.75	0.001	0.24
Share of high-skilled	-.016***	-3.03	-.001	-.33
Training share	0.002***	3.09	0.000	0.32
ASD (GSD)	0.567		(0.389)	
Number of observations	71,037			

Note: See main text for description of the estimation method and the definition of marginal effects. All specifications additionally include regional dummies and sectoral dummies according to the classification shown in Tables A2 and A4 in the appendix.
***;** ;* significant at 1, 5, 10 per cent level.

From Section 3, recall that our established finding that employer size does not matter for women may be explained by countervailing effects that result from less employer learning about workers' true productivity levels, or alternatively, from more extensive screening procedures prior to hiring. While we are not able to distinguish these approaches, either explanation is related to a larger degree of information asymmetries about female workers' true productivity as compared with their male counterparts. This is consistent with the notion that incomplete information should be particularly relevant for those having more career interruptions, which makes it difficult to value a worker's quality based upon previous work performance.

Turning next to the industrial relations effects, the pattern of results is reversed as compared with our findings for females. While for female workers industrial relations appear to be an effective means in helping them either to escape or enter low pay, our findings provide no evidence of such a significant effect for male workers. In particular, the marginal effect of works councils on low-pay persistence is much smaller in magnitude (-0.033) than that for women. Even though the differences in the marginal effects of works councils on the persistence probabilities across male and female workers are not statistically significant, the results provide some weak evidence for works councils having a more pronounced effect for female low paid workers. In line with our reasoning for employer size effects, this result is consistent with the asymmetric information story as works councils may help to reduce information asymmetries about workers' productivity, which - as we argued above - is likely to be considerably larger for females as compared with their male counterparts.

For males, the share of high-skilled workers is also found to significantly reduce persistence probabilities. Further, the size of the marginal effect is very similar to that obtained for females: a one percentage point increase in the share of high-skilled workers (relative to the reference worker) reduces the probability of staying low paid by roughly one percentage point. Interestingly, the share of workers experiencing training measures significantly increases the probability of initially low paid men of staying in the low-sector. While this finding is clearly at variance with what one might expect, it may reflect that training measures in the service sector are not

targeted towards those who are initially low paid and may point to a particular negative selection of low-wage workers into establishments with a large fraction of workers participating in training. Overall, our estimates indicate, that for males in the service sector employer attributes appear to be more important for persistence rather than for entry probabilities.

4.6 Robustness Checks

To assess the sensitivity of our findings with respect to the low-wage threshold, we re-ran all specifications using the first quintile as the low-pay threshold.[13] For females, the overall pattern of results with respect to the importance of plant size and industrial relations remains unchanged, with employer size (again except for the smallest size class in manufacturing) playing no significant role for low-pay persistence and works councils significantly reducing the probability of staying low-paid. Compared with the results reported in Table 5, the marginal effect of works councils on low-pay persistence in manufacturing becomes even more pronounced, with a point estimate of -0.27 which is now statistically significant at the 1 per cent level. While the estimates for males in the service sector again point to insignificant marginal effects of the industrial relations covariates, the estimates of the employer size marginal effects on low-pay persistence are positive only for the two smallest size classes and are very imprecisely estimated. A possible explanation for the insignificant estimates might relate to the fact that using a lower quantile as the low-pay threshold considerably reduces the incidence of low-pay among males and therefore gives rise to much more imprecise estimates for this group.

5 Conclusions

The purpose of the present paper was to study the importance of employer-specific determinants in escaping low earnings in Germany. In order to address the initial conditions problem and the endogeneity of employer retention, we have modelled low pay transitions using a trivariate Probit model that accounts for selection into

[13]For the sake of expositional brevity, the results are not reported here, but are available on request.

low-wage employment and non-random employer drop out. Using data from a large-scale Linked Employer–Employee panel data set, our findings indicate that while aggregate state dependence is considerably reduced once observed and unobserved characteristics are accounted for, the magnitude of genuine state dependence still remains substantial. For females in services and manufacturing, GSD still accounts for 82 and 58 per cent of ASD and amounts to 0.583 and 0.336, respectively. For males in the service sector, we obtain a GSD measure of 0.389, accounting for 69 per cent of ASD. Overall, our findings indicate that employer characteristics play an important role in helping workers to escape their low pay status. At least for the service sector, our findings allow us to draw some conclusions about gender-specific patterns of the importance of employer covariates. While for male workers from the service sector the probability of escaping low pay tends to increase with employer size, female workers rather benefit from collective bargaining coverage contracts and the presence of local works councils. While these findings support the notion that internal labour markets are an important ingredient of male within-firm wage growth, they do not necessarily contradict the view that internal labour markets also exist for female low-wage workers. The only conclusion that can be inferred from our findings is that for females there are potential countervailing effects of plant size which might arise from a larger degree fo asymmetric information at larger employers. Along with the differences in the industrial relations effects this leads us to conclude that the removal of asymmetric information appears to be more relevant in explaining female workers' wage transitions as compared with their male counterparts.

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6 Appendix

Variable	*Services*				*Manufacturing*			
	Males		Females		Males		Females	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gross daily wage 1999 in €	100.00	26.649	84.681	26.403	103.878	23.750	86.449	25.832
Gross daily wage 2004 in €	113.531	37.363	91.931	37.566	118.318	34.105	94.656	38.085
Low wage in 1999	67.658	0	67.658	0	67.658	0	67.658	0
Low wage in 2004	71.883	0	71.883	0	71.883	0	71.883	0
Employment in 2004	0.829	0.376	0.665	0.472	0.859	0.348	0.691	0.462
Age	39.023	8.572	36.613	9.298	39.068	8.647	37.653	9.208
Low education	0.128	0.334	0.118	0.322	0.170	0.376	0.328	0.470
Higher secondary education	0.015	0.120	0.018	0.133	0.006	0.074	0.012	0.107
Vocational training	0.674	0.469	0.691	0.462	0.683	0.465	0.527	0.499
Vocational training + high	0.051	0.221	0.087	0.283	0.027	0.162	0.069	0.253
Technical college	0.036	0.186	0.020	0.141	0.061	0.239	0.026	0.158
University	0.096	0.295	0.066	0.248	0.054	0.225	0.039	0.193
Job tenure	107.775	87.340	89.971	78.872	140.005	91.621	120.280	88.082
Simple blue-collar occ.	0.046	0.210	0.023	0.151	0.371	0.483	0.372	0.483
Qualified blue-collar occ.	0.113	0.317	0.029	0.168	0.243	0.429	0.063	0.243
Technician and engineer	0.106	0.307	0.065	0.246	0.183	0.387	0.082	0.280
Service occupation	0.331	0.471	0.158	0.365	0.070	0.255	0.038	0.191
Clerical, administrative	0.319	0.466	0.554	0.497	0.104	0.306	0.420	0.493
Professional, manager	0.085	0.280	0.171	0.376	0.029	0.167	0.025	0.155
# Previous benefit spells	0.941	1.767	0.749	1.415	0.803	1.548	0.757	1.407
Regular employment before current employment	0.478	0.500	0.388	0.488	0.377	0.485	0.305	0.461
Number of observations	71,037		35,773		362,420		77,726	

Table A1: Descriptive statistics of individual characteristics. LIAB 1999

	Services				*Manufacturing*			
Variable	Males		Females		Males		Females	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Size $<$ *100*	0.068	0.252	0.082	0.274	0.019	0.136	0.021	0.142
100 $\leq$ *Size* $<$ *500*	0.213	0.409	0.228	0.419	0.125	0.331	0.153	0.360
500 $\leq$ *Size* $<$ *1000*	0.143	0.350	0.185	0.388	0.144	0.351	0.169	0.374
1000 $\leq$ *Size* $<$ *5000*	0.424	0.494	0.430	0.495	0.464	0.499	0.529	0.499
Size $\geq$ *5000*	0.152	0.359	0.076	0.265	0.248	0.432	0.129	0.335
Industry-wide contract	0.706	0.456	0.707	0.455	0.901	0.299	0.876	0.330
Firm-specific contract	0.200	0.400	0.157	0.364	0.046	0.210	0.050	0.218
Works council	0.904	0.294	0.909	0.288	0.978	0.146	0.965	0.183
Mean Age	39.566	3.113	38.962	2.968	40.010	2.046	39.731	2.289
Share of high-skilled	0.095	0.130	0.105	0.125	0.096	0.087	0.100	0.092
Training share	0.378	0.413	0.337	0.385	0.346	0.280	0.360	0.319
Share of fixed-term contracts	0.053	0.093	0.055	0.078	0.039	0.042	0.042	0.053
Pos. employment growth	0.787	0.410	0.782	0.413	0.648	0.478	0.638	0.481
Manufacturing I	0	0	0	0	0.850	0.357	0.712	0.453
Manufacturing II	0	0	0	0	0.085	0.278	0.146	0.353
Manufacturing III	0	0	0	0	0.043	0.204	0.073	0.259
Construction	0	0	0	0	0.022	0.145	0.069	0.254
Wholesale and retail trade	0.199	0.399	0.263	0.440	0	0	0	0
Transport/communication	0.416	0.493	0.147	0.354	0	0	0	0
Financial intermediation	0.326	0.469	0.546	0.498	0	0	0	0
Other service activities	0.059	0.243	0.044	0.205	0	0	0	0
West Berlin	0.074	0.261	0.131	0.337	0.016	0.124	0.031	0.174
Schleswig Holstein	0.014	0.118	0.029	0.168	0.019	0.137	0.021	0.144
Hamburg	0.113	0.317	0.068	0.252	0.024	0.153	0.033	0.178
Lower Saxony	0.063	0.243	0.081	0.273	0.082	0.274	0.077	0.266
Bremen	0.065	0.247	0.022	0.146	0.012	0.109	0.010	0.100
North Rhine Westphalia	0.231	0.422	0.230	0.421	0.301	0.459	0.249	0.432
Hesse	0.174	0.379	0.109	0.312	0.065	0.246	0.074	0.262
Rhine-Palatinate	0.035	0.184	0.049	0.215	0.070	0.255	0.048	0.213
Baden-Wuerttemberg	0.103	0.304	0.117	0.322	0.178	0.382	0.213	0.410
Bavaria	0.126	0.332	0.164	0.370	0.234	0.423	0.245	0.430
Number of observations	71,037		35,773		362,420		77,726	

Table A2: Descriptive statistics of establishment characteristics. LIAB 1999

Variable	**Definition**
Low wage in 1999	Dummy=1 if gross daily wage $\leq$ third decile 1999 (67.66 €)
Low wage in 2004	Dummy=1 if gross daily wage $\leq$ third decile 2004 (71.88 €)
Employment in 2004	Dummy=1 if full-time employment in 2004
	Dummy=0 if no employment, part-time, marginal work or vocational training
Age	Age in years
Low education	Dummy=1 if lower secondary education without completed vocational training
Higher secondary education	Dummy =1 if Abitur (German university entrance qualification)
	without completed vocational training
Vocational training	Dummy=1 if completed vocational training and lower secondary education
Vocational training + high	Dummy =1 if completed vocational training and higher secondary education
Technical college	Dummy=1 if technical college degree (Fachhochschule)
University	Dummy=1 if university degree
Job tenure	End of spell date minus date of entry into the establishment (measured in months)
Simple blue-collar occupation	Dummy =1 if simple blue-collar occupation
Qualified blue-collar occupation	Dummy =1 if qualified blue-collar occupation
Technician and engineer	Dummy =1 if technician or engineer
Service occupation	Dummy =1 if service occupation
Clerical and administrative occupation	Dummy =1 if clerical or administrative occupation
Professional, manager and others	Dummy =1 if professional, manager or others
Previous benefit receipt (# spells)	Number of spells with benefit transfers (unemployment benefits and assistance,
	subsistence allowance) since entering the labour force, soonest 1.1.1975*)
Regular employment before current employment	Dummy=1 if full-time employed 8 days prior to entry into current establishment

Table A3: Definition of individual characteristics gained from the *Employment Statistics Register*

*) Note: Spells with gaps between periods of transfer receipt that fall short of ten days are treated as one single spell.

Variable	**Definition**
Size $<$ *100*	Dummy=1 if number of employees $<$ 100
100 $\leq$ *Size* $<$ *500*	Dummy=1 if 100 $\leq$ number of employees $<$ 500
500 $\leq$ *Size* $<$ *1000*	Dummy=1 if 500 $\leq$ number of employees $<$ 1000
1000 $\leq$ *Size* $<$ *5000*	Dummy=1 if 1000 $\leq$ number of employees $<$ 5000
Size $\geq$ *5000*	Dummy=1 if number of employees $\geq$ 5000
Industry-wide contract	Dummy=1 if employer is subject to industy-wide wage agreement
Firm-specific contract	Dummy=1 if employer is subject to firm-specific wage agreement
No wage agreement	Dummy=1 if no wage agreement is valid
Works council	Dummy=1 if works council exists
Mean Age	Mean Age of employees
Share of high-skilled employees	Number of employees with technical college (*Technical University* = 1) or university degree (*University* = 1) divided by number of employees
Training share	Number of employees participating in training measures divided by number of employees
Share of fixed-term contracts	Number of employees with fixed-term contracts divided by the number of employees
Positive employment growth	Dummy=1 if positive employment growth is expected in 2000
Manufacturing I	Dummy=1 if raw material manufacture
Manufacturing II	Dummy=1 if capital goods manufacture
Manufacturing III	Dummy=1 if consumer goods manufacture
Construction	Dummy=1 if construction sector
Wholesale and retail trade	Dummy=1 if wholesale and retail trade
Transport and communication	Dummy=1 if transport and communication
Financial intermediation	Dummy=1 if financial intermediation
Other service activities	Dummy=1 if other service activities

Table A4: Definition of establishment characteristics gained from the *IAB Establishment Panel* and the *Employment Statistics Register*

Males	Manufacturing			
Wage in t-5	Low		High	
	(1)	*(2)*	*(3)*	*(4)*
Average prediction	0.439		0.005	
Baseline	0.226		0.005	
Explanatory variable in t-5	ME	z-ratio	ME	z-ratio
Individual Characteristics				
Age	0.022	1.27	0.000	0.23
Age squared	-.000	-.89	0.000	0.46
Lower education	0.076***	2.60	0.005***	4.32
Higher sec. education	-.067	-.85	-.002	-.69
Voc. training + high	-.010	-.16	-.002	-1.13
Technical college	0.171	0.59	-.004***	-4.84
University	0.651***	7.72	-.004***	-6.21
Job tenure	0.002*	1.87	-.000	-0.55
Job tenure squared	-.000	-1.62	0.000	0.41
Qualified blue-collar	0.005	0.18	-.001	-1.37
Technician and engineer	-.030	-.44	-.004***	-9.89
Service occupation	0.013	0.50	0.001	1.15
Clerical, administrative	-.059	-1.59	-.004***	-8.95
Professional, managers	0.048***	4.38	-.004***	-7.35
# Previous benefit spells	-.002	-.36	0.000	0.52
Regular employment before current employment	-.014	-.66	-.002***	-4.74
Employer Characteristics				
Size $<$ 100	0.434***	2.69	0.036**	2.20
100 $\leq$ Size $<$ 500	0.249	1.47	0.010**	2.05
500 $\leq$ Size $<$ 1000	0.187	1.14	0.003	1.14
1000 $\leq$ Size $<$ 5000	0.157	1.01	0.004*	1.93
Industry-wide contract	-.071**	-2.00	-.004***	-5.22
Firm-specific contract	-.033	-.61	-.003**	-2.38
Works council	-.052	-1.25	0.000	0.15
Mean Age	0.017	1.41	0.000	0.42
Share of high-skilled	-.013*	-1.86	-.000	-.51
Training share	-.251**	-2.18	-.001	-.47
Manufacturing II	0.075	1.53	0.010**	2.16
Manufacturing III	0.149***	2.62	0.003	1.52
Construction	0.133	1.61	0.008*	1.66
ASD (GSD)	0.384		(0.209)	
Number of observations	362,420			

Note: See main text for description of the estimation method and the definition of marginal effects. All specifications additionally include regional and sectoral dummies.

Table A5: Estimation results for low pay transitions of male workers in manufacturing

Males		
	Manufacturing	
	χ^2	p-value
A. Exclusion of Instruments		
Instrument I from transition eq.	6.62	0.037
Instrument II from transition eq.	1.95	0.378
Instruments I and II from transition eq.	9.88	0.043
B. Inclusion of Instruments		
Instrument I in retention eq.	8.16	0.004
Instrument II in initial condition eq.	4.71	0.030

Note: Instrument I denotes expected positive employment growth and instrument II refers to the share of fixed-term contracts.

Table A6: Diagnostic tests

Males		
	Manufacturing	
Correlation Structure	Estimate	p-value
ρ_1 (Initial conditions - retention)	-.185	0.000
ρ_2 (Retention - transition)	-.044	0.811
ρ_3 (Initial conditions - transition)	-.207	0.182
Hypothesis Tests	χ^2	p-value
Exogeneity of initial conditions		
$H_0 : \rho_1 = \rho_3 = 0$	62.83	0.000
Exogeneity of retention		
$H_0 : \rho_1 = \rho_2 = 0$	62.01	0.000
Unobserved heterogeneity		
$H_0 : \rho_1 = \rho_2 = \rho_3 = 0$	63.38	0.000

Table A7: Cross equation correlation structure