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Job Satisfaction and Quits: Theory and Evidence from the German Socioeconomic Panel

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Job Satisfaction and Quits: Theory and Evidence from the German Socioeconomic Panel *

Louis Lévy-Garboua[†], Claude Montmarquette[‡], Véronique Simonnet[§]

Résumé / Abstract

Dans cette étude, en utilisant les données du Panel Socio-économique Allemand (1985-1993), nous soumettons à réfutation un modèle simple de maximisation de la richesse pour expliquer le fait de quitter une entreprise. À l'aide de questions subjectives sur la satisfaction dans l'emploi et dans d'autres domaines (loisir, santé...), nous développons une méthodologie permettant de comparer la valeur présente attendue de son emploi (incluant une composante non-pécuniaire) aux opportunités d'emplois extérieures. L'approche retenue est basée sur l'idée que la satisfaction exprime une préférence expérimentée de l'emploi actuel contre les alternatives d'emplois disponibles. La propension à garder l'emploi occupé dans ce contexte dépend simplement du résidu de l'équation de satisfaction dans l'emploi. Nos tests confirment cette théorie de la satisfaction et le modèle classique de mobilité volontaire. Finalement, nous observons que le résidu de l'équation de satisfaction dans l'emploi offre une meilleure prédiction du départ volontaire que le niveau général de la satisfaction.

We test the simple wealth maximization theory of quitting behavior on the German Socioeconomic Panel (1985-1993). We develop a new methodology to extract a consistent estimate of how the expected present value of one's job (including the non-pecuniary component) compares with outside opportunities in the future from subjective questions about job and job-related satisfaction. It is based on the interpretation of job satisfaction as an expression of the experienced preference for the present job against available alternatives. With this interpretation, the propensity to stay in the present job is simply related to the residual of a job satisfaction equation. Our tests validate this theory of job satisfaction and the economic theory of quits. We also find that the residual of a job satisfaction equation is a better predictor of quits than the overall level of satisfaction.

Mots Clés : Mobilité volontaire, satisfaction à l'emploi, modèle de maximisation de la richesse

Keywords: Voluntary quit, job satisfaction, wealth maximization model

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1 Introduction

The decision to quit offers the ideal illustration of a simple microeconomic story that becomes very difficult to test as it relates observed behavior to unobservable motives. The simple story is that workers optimally search and learn about their outside job opportunities or their productivity on their present job. As they acquire new information, they decide to quit their current employer as soon as their expected present value becomes lower in their present job than in an alternative job or nonemployment. The difference between these two expected present values of future pecuniary and non-pecuniary income indicates the worker's *propensity to stay* and it determines his or her decision to quit when it turns negative. However, economists have so far been unable to provide an exhaustive ordinal measure of individuals' propensity to stay or, conversely, their *propensity to quit*, and have sought salvation either in very crude and partial proxies for the latter or in other testable implications of the theory¹.

Mortensen (1988) has presented an unsurpassed synthesis of models of job search while employed (Burdett, 1978) and matching (Jovanovic, 1979a, 1979b). He allows for a positive serial correlation of the wage process in a specific job with the assumption that wage increments diminish with tenure in a stochastic sense. This enables him to account for job-specific training in the optimal wage search. In the case of the matching model, he assumes that the current wage is an unbiased estimate of the worker's productivity given current information, which becomes more precise with tenure as it is updated in response to new information. It turns out that both the job training and the job matching hypotheses have identical qualitative implications for the optimal separation strategy. In particular, the value of continued employment, given the current wage, falls with tenure in both models, which means that the quit rate should increase with tenure if the wage is held constant. Unfortunately, this prediction is strongly rejected by the data (Topel and Ward 1992, Galizzi and Lang 1998). Given the number of economic and technical critical assumptions made by Mortensen (1988), as he lucidly points out on several occasions, it is impossible to decide whether this negative test offers a rejection of the basic microeconomic story or of some auxiliary assumption. Galizzi and Lang (1998) motivate their study by essentially the same argument and therefore go on to test a broader prediction of the microeconomic theory, namely that, given the current wage, quits are declining in the level of expected future wage growth in the present firm and increasing in the value of outside opportunities. They use an interesting Italian data set combining information on establishments and workers and approximate expected future wage growth in the present firm by the average wage paid to similar workers in the establishment (they check that wages grow faster in establishments where average wages are higher). Further, they approach outside opportunities at the industry level. In this paper, we wish to take Galizzi and Lang's (1998) argument one step further by suggesting a precise measure of each worker's propensity to quit and then making a direct test of microeconomic models of turnover.

¹ Parsons (1991) approximated the value of current job by the present wage. Bartel and Borjas (1981) used the individual wage growth observed in the past. While these two studies ignored outside opportunities, Viscusi (1980) and Lynch (1991) compared the value of current job to that of an alternative job by introducing the current wage gap as the residual of an earnings equation. Other studies (e.g. Bartel 1982, Akerlof et al. 1988, Van Ophen 1991) emphasized the value of job amenities as an important determinant of job satisfaction and quits.

Our estimation of the worker's propensity to stay (quit) derives from his or her reported job satisfaction. We exploit the new interpretation of satisfaction judgments provided in a companion paper by Levy-Garboua and Montmarquette (2001, henceforth LGM). Instead of viewing reported satisfaction of job (or any other personal experience) as some direct measure of the individual's utility, they take it as an indication of preference for that job conditional on experience. This new interpretation has the virtue of reconciling observed behavior with microeconomic theory because it dispenses from the need to rely on a so-called "psychological" notion of utility which would be determined by how objective conditions of life fare relative to a subjective reference. Indeed, the worker's experienced preference for his job (i.e. conditional on experience of that job) is ordinal and, above all, relative to outside opportunities. Moreover, it captures both the non-pecuniary and the pecuniary aspects of jobs and provides a comparison of the present value of past experience and future prospects in the job with outside opportunities which were experienced in the past and are expected in the future. Since the past can be observed with appropriate data, it is possible to subtract that part of job satisfaction associated with past experience from the overall measure to impute an expected present value to how the present job fares relative to outside opportunities in the future. The residual term recovers the individual propensity to stay with the current employer which is directly unobservable and constitutes a primary cause of the decision to either stay or quit. In addition, this measure allows us to isolate the personal economic incentives for leaving a job from family or other reasons, and to validate the wealth maximization model of separation. It is no more the level of job satisfaction itself which represents the desire to stay, as some have maintained by lack of a better interpretation (Freeman 1978, Akerlof, Rose and Yellen 1988, Clark, Georgellis and Sanfey 1998) but rather its future component. We thus establish a new link between job satisfaction and job mobility and a measure of the individual's propensity to quit.

We apply this methodology to the German Socioeconomic Panel (GSOEP) over nine years (1985-1993). This survey is especially interesting for our purposes because of its length, broad coverage of adult population, and the comprehensive description of jobs including opinions held about the latter. Since Germany is one of the economic powerhouses of Europe, and has the lowest rate of separation², knowledge of the determinants of mobility in Germany is of particular pertinence. Moreover, the opening of the German labor market that followed reunification constitutes a natural experiment visible on the panel data, which can be particularly helpful to simulate the deep consequences that the potential emergence of a wide European labor market would have on job mobility.

In section 2 of this article we propose a theoretical framework for our econometric model of job satisfaction and quits. We present the German Socioeconomic panel data in section 3. In section 4, we discuss our strategy for estimating equations of our model with panel data, and we present methods for estimating wage functions, satisfaction and mobility equations. We report the results in section 5 and conclude in section 6.

² Report to the European Commission in 1989.

2 The Theoretical Framework

2.1 Quits

The wealth maximization model of separation provides a simple expression for the propensity to quit: the individual will consider quitting if the expected benefits outside of the firm are greater than those inside the firm plus mobility costs.

Let $E_{ia}V_{ia}$ be the present value of future wages and job amenities expected by worker i at time a if he stays with his employer, $E_{ia}V_{ia}^*$ the corresponding value if he quits, and C_{ia} the cost of mobility. E_{ia} is the expectation operator conditional on all information available to individual i before time a . The worker will consider leaving his employer if

$$E_{ia}V_{ia} - E_{ia}V_{ia}^* + C_{ia} < 0. \quad (1)$$

The total value of a job in the future is the sum of its productive value, or human capital, $E_{ia}H_{ia}$ and the value of non-pecuniary job amenities $E_{ia}U_{ia}$

$$E_{ia}V_{ia} = E_{ia}H_{ia} + E_{ia}U_{ia}. \quad (2)$$

We neglect any cost of search and learning because workers search while employed and learn by doing. Other costs of job mobility can be seen as the foregone value of job amenities after switching from one job to another. For instance, if an individual incurs moving costs when accepting a new job, we may say that he must sacrifice the proximity of his working place with his former residence. Thus we include mobility costs in the foregone value of job amenities and rewrite equation (1) more concisely

$$-Q_{ia}^{**} \equiv E_{ia}V_{ia} - E_{ia}V_{ia}^* < 0. \quad (3)$$

The propensity to quit Q_{ia}^{**} is a primary cause of the individual's decision to quit his employer at time a . It is not the sole cause, however, for two kinds of reasons. First of all, family ties and family events like the breakup of marriage and the birth of a child should also be considered if individual members of a family are concerned with the welfare of other members. Lastly, since the decision to quit is empirically observed at discrete intervals, the occurrence of unexpected surprises in the meantime may reorient the decision to quit in contradiction with the once experienced propensity to quit. Consequently, the decision to quit in the time interval $(a, a + t)$ can be described by the following model

$$\begin{aligned} Q_{ia,a+t} &= 1 & \text{if } Q_{ia}^{**} + X_{ia,a+t}\beta + z_{ia,a+t} > 0 \\ Q_{ia,a+t} &= 0 & \text{if } Q_{ia}^{**} + X_{ia,a+t}\beta + z_{ia,a+t} \leq 0 \end{aligned} \quad (4)$$

where $X_{ia,a+t}$ is a vector of deterministic variables which may affect the individual's decision to quit between a and $a + t$ in addition to the propensity to quit, β is a vector of constant coefficients, and $z_{ia,a+t}$ is a random disturbance including the relevant surprises which occurred in the same time interval. Equation (4) seems difficult to test because the propensity to quit compares two expected present values of future outcomes which are both unobservable. But the

latter can easily be recovered from an index of self-reported job satisfaction, which is observable indeed, if we adopt LGM's interpretation.

2.2 Job Satisfaction

LGM define job satisfaction as an index of preference for own job against outside opportunities conditional on information available at time a . Thus, letting J_{ia} be an ordinal index of job satisfaction at time a

$$\begin{aligned} J_{ia} &= 1 & \text{if } E_{ia}V_{io} - E_{ia}V_{io}^* > 0 \\ J_{ia} &= 0 & \text{if } E_{ia}V_{io} - E_{ia}V_{io}^* \leq 0 \end{aligned} \quad (5)$$

where $E_{ia}V_{io}$ ($E_{ia}V_{io}^*$) represents the present value of jobs (outside opportunities) since the individual left school (denoted by time 0) as *experienced in the past and forecast in the future conditional on experience at time a*. Therefore job satisfaction is meant to indicate a preference for the experienced sequence of jobs relative to their contemporaneous outside opportunities. This interpretation implies that, under perfect foresight, rational individuals would always be satisfied with a freely chosen sequence of jobs. Dissatisfaction can only arise from the experience of bad surprises with the current job, good surprises with current opportunities, or unexpected binding constraints like becoming involuntarily laid off and unemployed. Equation (5) also implies that a uniform increase in market wages would have absolutely no effect on reported job satisfaction, which is consistent with Duncan (1975) and Easterlin (1973, 1975)'s seminal observation that satisfaction and happiness judgments are essentially *relative*. LGM derive many other implications of their suggested interpretation for satisfaction judgments but we are here only concerned with those relating to job mobility decisions. They also brought some evidence that workers reporting satisfaction with their job account for their whole career so that all values should be discounted from the school-leaving age instead of when the current job begins. This stems from the fact that the utility of a given job is not time-separable if individuals maximize the total lifetime value of jobs. Hence, although the past is irrelevant for future *decisions* like the decision to quit, it does condition the experienced *utility* of a time-consistent decision-maker.

Let J_{ia}^{**} denote the latent variable underlying job satisfaction. We derive from (5) and the above interpretation

$$J_{ia}^{**} = E_{ia}V_{io} - E_{ia}V_{io}^* \equiv \sum_{t=1}^a \frac{y_{it} - y_{it}^*}{(1+r_t)^{t-1}} + \sum_{t=1}^a \frac{u_{it} - u_{it}^*}{(1+r_t)^{t-1}} + \frac{-Q_{ia}^{**}}{(1+r_a)^a} \quad (6)$$

where y_{it} (y_{it}^*) designate wages earned on the job (wages offered outside or in unemployment), u_{it} (u_{it}^*) stand for the non pecuniary value of jobs (alternatives), and r_t is the interest rate on period t .

As shown by equation (6), the latent variable underlying job satisfaction has three components. The first is the discounted sum of wage gaps experienced by the individual since he started

working. It describes how the actual income profile has ranked high relative to the best-known alternative profile. Such wage gaps can be computed with panel data as the residuals from earnings equations (see subsection 4.1). The second term represents the corresponding discounted sum of non-wage gaps. Although it is probably very difficult to evaluate, it can be approximated with panel data, as will be seen in subsection 4.2, as long as we observe a number of job-related satisfactions (e.g. leisure, health). Both terms reflect past and present values which are supposedly known by the individual with certainty and no more subject to change. The last component captures the propensity to stay with one's employer in the future times a discount factor. Equation (6) shows that it can be recovered as the residual of a regression where job satisfaction is the explained variable and the regressors approximate the latter's past components.

2.3 *A New Link Between Satisfaction and Quits*

It is worth noting that reported job satisfaction, while frequently used by sociologists and psychologists, had received little attention from economists [Borjas (1979), Freeman (1978), and Hamermesh (1977) are a few notable exceptions] until recently Clark and Oswald (1996) started reviving the issue. The primary reason for this traditional neglect has been, we think, a lack of sound economic interpretation of satisfaction judgments which has led the economics profession to a suspicious attitude towards subjective variables of this kind.

Nonetheless, Freeman (1978) had observed more than twenty years ago that reported job satisfaction is a good predictor for job mobility over and above the effect of lagged wages. The more satisfied with their job people proclaim themselves, the less likely they are to quit. Recently, Clark, Georgellis and Sanfey (1998) expanded Freeman's model, using subjective evaluations of job satisfaction from German workers, to predict their mobility. In these studies, satisfaction is implicitly assumed to reflect individuals' expectations about future wages and working conditions. We make two clear additions to previous analyses of the link between job satisfaction and quits. First, we relate job satisfaction to the total value of a sequence of jobs relative to outside opportunities; and second, we relate it to past or present comparisons as much as to future comparisons. This perspective enables us to extract the component of satisfaction pertaining to the past and isolate that part which truly predicts mobility. It is the future component of job satisfaction which must show a negative and significant correlation with the probability of quitting. Furthermore, since pecuniary and non-pecuniary benefits combine to give its value to a job, future and past components mix these two aspects. Finally, note that previous authors, who regressed the decision of mobility on reported job satisfaction, have implicitly included the future component of job satisfaction. This might explain why they found job satisfaction to be a good predictor of mobility. However, our model predicts that the future component of job satisfaction is a better predictor of quits than the overall level of job satisfaction. In the empirical part of the paper, a decisive test of this hypothesis will be performed.

It follows from the interpretation of job satisfaction retained here that there is no causal link between job satisfaction and quits. These two behaviors merely have an important factor in common, which we denominated the individual's propensity to quit. It has been found that dissatisfied workers have a higher quit rate than satisfied workers because the former on average

give a lower expected present value to their job than to outside opportunities in the future. But it is exactly for the same reasons that quitters report more satisfaction in their new job than in their old one (Akerlof, Rose, and Yellen 1988) or that mobile workers experience greater increases in satisfaction if they were willing to leave than if they were not (Bartel and Borjas 1981, Gottschalk and Maloney 1985).

3 The German Socioeconomic Panel

Since job satisfaction is deeply rooted in one's past experience while quits will be taking place in the future, our study requires individual panel data over an extended period of time. We use the German Socioeconomic Panel (GSOEP) data set between 1985 and 1993 as it contains rich information on individual wages, occupation, education and employment, as well as a number of job-related satisfaction variables. We restrict our sample to Germans or foreigners residing in the former Federal Republic and answering the survey since 1985 because we need to observe individuals over a long period of time and East German residents were only included in the sample since 1990. Furthermore, we limit our data to the population of men and women aged 25 to 40 at the time the observations on satisfaction were made.

The restriction to the 25 to 40 age group is motivated by the following observations. Our theory of job satisfaction predicts a stronger relationship between satisfaction and wage gaps in the intermediate age groups (LGM found the regression coefficient insignificant in both the 15-24 and the 44 and over age groups of their sample), since investments in human capital are largely completed by this time and the discount factor affecting wage gaps is getting smaller with age. Job mobility being greatly reduced after age 40, we truncated the 25 to 44 group to 25 to 40. Furthermore, since our data includes individuals starting at age 25, we can be confident that most of the sample is in the work force.

3.1 The Explanatory Variables

The panel contains a great deal of interesting data on the participants. Of special interest to our study is the large amount of information about individuals' occupations. If the respondents were still in grade school, high school or university, their specialization and number of years of study are reported. If they were unemployed, the date at which the last employment spell ended is provided along with the status of the job search. If they were employed, information is provided on the number of hours worked per week, professional classification, and firm's size. Furthermore, mention is made of whether, during the last year, the individual:

- Received a promotion at work,
- Changed employers, and why,
- Received a job after a period of training, unemployment or non-participation,
- Left a job and is currently unemployed or out of the labor force,
- Has experienced no change in his situation.

Since participants were asked to specify the beginning and end of all their completed employment spells, we are able to reconstruct the spells of employment, unemployment, training and non-participation. For each of these states, information on the remuneration is also supplied (monthly wage, monthly unemployment benefits, amount of student scholarships and/or support from parents, etc.).

The survey further reports several satisfaction judgments. Workers were asked to estimate their level of satisfaction with their job on a 0-10 scale, 0 denoting complete dissatisfaction and 10 utter satisfaction. Since the observed scores tend to concentrate in the upper levels, in conformity with the theoretical prediction of section 2, we only retain two values: zero for individuals reporting a level below eight, and one for those with ratings between eight and ten (this choice will receive more justification in subsection 4.3, note 8). We also have similar data about the respondents' satisfaction with job-related concerns like health and leisure time.

Job mobility is estimated annually using information concerning the aforementioned changes. For the employed population, we can estimate the respective shares of those experiencing either internal or external mobility and, among the latter, the proportion of those who chose to quit. This yields the probability of quits between two successive years.

3.2 *Job Mobility in Germany*

The low frequency of job mobility in Germany has attracted a great deal of attention. Statistics prepared for the European Community Commission in 1989 and computed from the European Labor Force Survey put Germany in the last place for the workers' risk of being laid off. In fact, the *Beschäftigungsförderungsgesetz*³, which opened the door to short-term contracts in 1985, has had a very limited incidence over the period under study. 92% of the German labor force was still bound by open-ended contracts in 1988. Nonetheless, while the rate of job loss due to layoffs or the expiration of short-term contracts remains low in Germany, it should be noted that the rate of quits is one of the highest in Europe. The prominence of quits among all separations in Germany is confirmed by a study by Büchtermann and Höland (1989). According to this study, the annual rate of separation between 1985 and 1987 was about 13% with the following breakdown: 27% were attributable to layoffs, 24% to contract termination or the end of apprenticeships, 39% to quits, and 10% to mutual consent or retirement.

Statistics calculated from the Socioeconomic panel confirms the predominance of quits. The annual rate of separation, computed as the ratio of the number of workers leaving the firm, voluntarily or not, to the total number of workers, is reported in table 1 from 1988 to 1991. These rates and the following estimations are only computed until 1991 because job mobility and particularly quits reduce quite substantially after that year, both for men and women residing in the former Federal Republic. The fall of quits can partly be explained by the arrival of competing workers from the former Democratic Republic. Table 1 shows that, over a year, less than 5% of individuals normally experience quit; but we need to observe at least 5% of quitters in the

³ Employment Promotion Act.

working population in order to provide the robustness of our results. Thus we estimate the probability of quitting over the two years following the statement of job satisfaction. Moreover, since the probability of quitting over two years fell under 5% in 1992 and 1993, we decide to end the econometric analysis of quits in Germany in 1991.

Insert Table 1, about here

We observe that job mobility among workers of 25-40 years of age is mostly voluntary in Germany. Quits are also higher in years in which the unemployment rate is low. Thus, there is a negative correlation between the rate of quits and the unemployment rate. We observe that the evolution of the rate of layoffs and separations due to plant closures and redundancy parallels that of the unemployment rate. The layoff rate is lowest in 1990, when the unemployment rate is at its lowest point for the period. This appears to confirm the works of Akerlof, Rose, and Yellen (1988) and Anderson and Meyer (1994), who show that voluntary departures are cyclical in contrast with involuntary departures which are counter-cyclical.

Table 1 also presents statistics on job, leisure, and health satisfactions and on the monthly wage. Respondents are more satisfied with their job and health than they are with leisure. The real monthly wage of German workers fluctuates within a two- percent band over the period of study.

Insert table 2, about here

Table 2 shows the average quit rates between years a and $a + 2$ found on our sample for workers reporting their job satisfaction level on year a . We obtain the usual systematic negative relation between job satisfaction and quits, since the less satisfied workers (reporting a level smaller than 8) are about twice as mobile as the more satisfied ones (reporting a level of 8 and more). We also verified, after Akerlof et al. (1988), that quitters between years a and $a + 2$ tend to be more satisfied with their new job than with their old one. The average proportion of quitters reporting a satisfaction level of 8 and more in any year of the four-year interval 1988-1991 was 34.98% on year a (when they were in their old job) versus 57.95% on year $a + 2$ (when they were in their new job). This contrasts with the small decline of the share of stable workers between years a and $a + 2$ reporting the same level of satisfaction with their job: 57.70% on year a versus 52.70% on year $a + 2$.

3.3 Panel attrition

One disadvantage of the data is the high rate of attrition. While new individuals are added to the database every year, these cannot be used in the estimates because we need to observe the sample over the entire duration of the panel. Attrition (withdrawal, non-response to surveys) has three consequences for our study. First, it limits the size of our sample, since we need to observe the individual wages and employment status over an extended period of time. Second, it forces us to limit the study's timeframe in order to retain a large sample size. For example, it is difficult to estimate job satisfaction in 1994 as a function of all wage gaps observed since 1984 since many participants did not remain in the study for the whole period and, among those who did, some did not supply their income or status every year. Consequently, we choose to relate the job satisfaction reported in a given year to the wage gaps experienced in the same year and the three preceding years. Third, it is likely that a large proportion of the respondents who dropped out of

the panel as they moved to a new residence took another job as well. This cause of attrition is especially unfortunate since our primary interest is in workers' quit. This problem is somehow mitigated by the considerable efforts made by the researchers to track down participants having moved.

4 Econometric Specification

The high rate of attrition in the database makes it impossible for us to retain the same individuals in the sample for more than six years. On the other hand, the quality of estimation requires that individuals be present in the panel for the maximal length of time. Thus we chose to observe individuals over six consecutive years. This period is divided in two intervals. The first four years are being used to estimate the past and present components (pecuniary and non pecuniary) of job satisfaction as reported in the fourth year, and the probability of quitting is being determined over the two remaining years. According to equation (6), the pecuniary part of the job satisfaction's past component is a discounted sum of wage gaps, which are estimated by the residuals of earnings equations in the first four years. We regress the reported satisfaction in the fourth year on the discounted sum of these residuals, on variables representing non-pecuniary benefits (the other satisfaction variables), and on other individual characteristics. After controlling for the main observable past variables which determine the past component of job satisfaction, the residual must essentially capture the latter's future component. This provides us with a precise estimate of the future component of satisfaction, or each individual's propensity to stay, as experienced in the fourth year. We determine the probability of quitting for the two following years from this component. If a negative and statistically significant coefficient is associated with this variable, we can validate the simple assumption that workers maximize the expected present value of their job.

The implementation of this empirical strategy imposes specific requirements on the data. In addition to being present in the sample during six consecutive years, selected individuals must report an income from work or unemployment insurance for the first three years of this period, be employed in the fourth year and report their wage and job satisfaction, and, during the fifth and sixth years, they must have been questioned to establish whether they quit the job mentioned in the fourth year. Before performing the estimations, we account for the probability of being selected—i.e. having answered all the questions used as explanatory variables—among individuals present six years and working in the fourth year. This allows us to correct for a potential selectivity bias⁴.

In order to circumvent somewhat the problem of finding a large sample of individuals with consecutive entries covering more than six years, we repeat our estimates of job satisfaction and the probability of quitting on four consecutive years: 1988, 1989, 1990 and 1991. Therefore, we observe four overlapping panels of workers between 1985 and 1993. This allows us to verify the

⁴ The results of the probit estimates associated with selectivity bias are not presented, but they are available on request.

robustness of the results and examine business cycle effects and consequences of the fall of Berlin's wall in 1989.

Our estimates of the wage equations, of job satisfaction and of mobility are performed in three stages. We first estimate the wage equations from which the residuals are extracted. In the next step, the latter serve as explanatory variables in the satisfaction equations. Finally, the residuals of the satisfaction equations are used to explain observed quits in the two following periods. This procedure of estimation by stages is not necessarily the most efficient, and corrective measures need to be implemented. A joint estimation of all the equations would probably be very difficult with panel data, and traditional estimation methods for such data would no longer be the most appropriate. However, the implicit assumption of a sequential choice of job and separation is natural here, and it should also be clear from the theoretical section that the causal link goes from wages to job satisfaction and mobility, but not the other way round. Mobile workers have no guarantee that they will receive greater wages or greater satisfaction simply by virtue of their mobility.

4.1 Estimation of the Wage Equations

The econometric specification is the following:

$$y_{it} = X_{it}\beta + Z_i\gamma + d_t\theta + a_i + \varepsilon_{it}, \quad (7)$$

where y_{it} designates the monthly earnings accruing to individual i at year t , X_{it} is a set of explanatory variables which vary between individuals and over time, Z_i is a set of explanatory variables which are constant over time, d_t is a set of time dummy variables, a_i represents the individual-specific effect, ε_{it} is an error term with the usual properties. Notice that the explained variable is expressed in levels, not in logarithms, because the model of human wealth presented in section 2 is additive in wages. Relevant characteristics include hours of work, education and training, experience, gender, marital status, nationality, occupation, sector, etc. Seniority is not included in this list because it is irrelevant to workers leaving their job for unemployment or a new job.

Our objective in estimating the wage equations is to recover the wage residuals ε_{it} . However, by regressing equation (7) for each year separately, we obtain residuals η_{it} including individual-specific effects ($\eta_{it} = a_i + \varepsilon_{it}$). The individual fixed effect captures the returns to individual characteristics, which are being observed by all firms and workers but remain unknown by the econometrician. Since these returns are not job-specific, they cannot be deemed to contribute to the individual's reasons for staying with the present employer. Thus, we must distinguish between the individual fixed effect and the residual effect in order to ensure that we only retain the latter as an explanatory variable for job satisfaction.

Traditional techniques for estimating panel data provide methods for eliminating the fixed effect from the estimated residual. With T annual observations for each individual, and N individuals, we can redefine equation (7) by expressing wages and individual characteristics as deviations from their means, i.e. estimate the *within* equation:

$$y_{it} - y_i = (X_{it} - X_i)\beta + (d_t - d)\theta + (\varepsilon_{it} - \varepsilon_i) \quad (8)$$

The residual of this equation ($\varepsilon_{it} - \varepsilon_i$) is corrected for the specific effect, and is very close to the residual sought (ε_{it}). In theory, $\varepsilon_i \rightarrow 0$ as $T \rightarrow \infty$. However, since we never observe more than four consecutive years, the last assumption may be exaggerated. But, even if we could rely on it, equation (8) would be an unsuitable way of estimating the wage gap for our purposes because it imposes:

$$\sum_{t=1}^T (\varepsilon_{it} - \varepsilon_i) = 0, \forall i \in \{1, \dots, N\} \quad (9)$$

The within estimation implies the nullity of the individual-specific mean residual over the entire period. This assumption is inappropriate here since the satisfaction model is consistent with workers receiving positive or negative rents on their job over an extended period of time. A more appropriate assumption is that the mean residual be zero over the entire population for each specific year:

$$\sum_{i=1}^N \varepsilon_{it} = 0 \quad \forall t \in \{1, \dots, T\} \quad (10)$$

Consequently, we cannot use the standard panel data techniques in the present application and choose to estimate the wage functions (7) on four successive years simultaneously by Zellner's (1962) seemingly unrelated regression method. The latter assumes that the four annually determined residuals will have zero mean and allows for a correlation between them without requiring any specific form for this correlation. Thus we can account for the autocorrelation of individual residuals over time and compute the best linear unbiased estimator. The estimated residuals ($\hat{\varepsilon}_{it}$) define the wage gaps which will be used, in the second stage, to explain job satisfaction. However, since this method does not eradicate the individual-specific effect, we need to control for it through additional variables. Farber and Gibbons (1996) adopted the same strategy by first estimating the probability of reading specialized journals as a function of observable characteristics like education, then taking the residual of their Probit equation as an additional determinant of wage. In the present paper, we add variables describing the individual's personality to the wage function. These include the worker's participation to cultural associations, political activities or charity work, his satisfaction with health and command of the German language by foreign citizens.

The simultaneous estimations of wage equations on four consecutive years for the selected sample of workers of 25-40 years of age are presented in tables of the appendix 1. These results are comparable to those generally obtained using single wage equations.

4.2 Estimation of Job Satisfaction

The output of the previous subsection was to recover, through simultaneous estimation, four-year sequences of wage residuals. These measure the wage gaps experienced by each individual in the

last four years before reporting his own job satisfaction. Ideally, as shown by (6), the coefficients of regression of job satisfaction on each of the four wage gaps should measure the corresponding discount factors⁵. Unfortunately, this direct method does not yield a consistent set of estimates because the four explanatory variables are highly correlated. Instead, we simply compute the discounted sum of the four wage gaps with the values of the real interest rate observed in Germany between 1985 and 1991⁶. We interpret this sum as a proxy for the past pecuniary component of satisfaction. Then we substitute this single variable for the four-year sequence of wage gaps in the regression of job satisfaction.

On our panel data, we have a direct measure of past wage gaps but do not have the same for the non-pecuniary components of a job. Fortunately, this is not a problem because GSOEP provides several indicators of job-related reported satisfactions like satisfaction with respect to leisure time and health. Under LGM's interpretation, the latter indicates the preference for the sequence of experienced leisure or health occurrences relative to their contemporaneous alternatives. They are thus directly related to the discounted sum of non-wage gaps between experienced jobs and outside opportunities since the beginning of work which appears in equation (6), and so capture the past non-pecuniary component of job satisfaction better than the measure of a few specific benefits would⁷. However, according to the same interpretation, reported satisfactions with respect to leisure or health, for instance, also incorporate a future component. On regressing job satisfaction on a discounted sum of past and present wage gaps and on other job-related satisfactions, we account only for (the most recent part of) the *past pecuniary component* of job satisfaction on one hand, but both for its *past and future non-pecuniary components* on the other hand:

$$J_{ia} = \lambda_a + \mu_a \sum_{t=a-3}^a \frac{\hat{\varepsilon}_{it}}{(1+r_t)^{t-1}} + \sum_{j=1}^2 v_{ja} \text{satis}_{ja} + X'_{ia} \beta'_a + v_{ia} \quad (11)$$

⁵ One may question as an empirical issue whether wage gaps experienced in previous jobs enter in job satisfaction in the same way as wage gaps experienced in the current job. We gave a positive answer to this question in the theoretical section. Simonnet (1997) shows that both wage gaps explain job satisfaction. In reporting their job satisfaction, workers do seem to consider all employment spells which led them to their current job.

⁶ The choice of the real interest rate is not an easy matter. Since the past is known with certainty, it is legitimate to choose the risk-free rate. Mehra and Prescott (1985) for the U.S. had a low average estimate of 0.8% for the period 1931-1978. As interest rates increased dramatically after that period, we first used a constant higher value of 1.5% for the period 1985-1991. As the assumption of a constant interest rate during a period of considerable change may be too strong, we then allowed for the real interest rate to change. Observing the evolution of real interest rates for the period 1988-1991, we see that they closely follow the business cycle of the German economy, though with a small lag (in 1991, the unemployment rate increased while the interest rate continued to climb). We also tried various constant discount rates. Our results were not much affected in a relatively wide range of variation of interest rates, so we simply kept in the final estimation the variable real interest rates which were observed in Germany between 1985 and 1991. All results are available upon request.

⁷ Job-related satisfactions are not only more precise measures of the non-pecuniary benefits of a job, but more consistent as well. A rational individual will consistently refer all of his job-related satisfactions to a unique sequence of outside opportunities while the separate estimation of these references by econometric techniques cannot achieve this task.

Notice that, if higher earnings compensate for lower value of the non-pecuniary components of the job, the omission of job-related satisfactions in this equation might lead to a downwardly biased estimate of the coefficient of the observable part of discounted wage gaps.

However, what we ultimately want to predict is not job satisfaction but job mobility. This task requires that we disentangle the future pecuniary and non-pecuniary components of jobs from their past and current counterparts. Obviously, the job satisfaction equation mentioned above does not quite accomplish this task since the estimated residual will not account for the future value of non-wage gaps. In order to leave the latter in our measure of the individual's propensity to quit, we reestimate the job satisfaction equation by first-differencing job-related satisfaction equation terms:

$$J_{ia} = \lambda'_a + \mu'_a \sum_{t=a-3}^a \frac{\hat{\epsilon}_{it}}{(1+r_t)^{t-1}} + \sum_{j=1}^2 v'_{ja} [\text{satis}_{ja} - \text{satis}_{j,a-1}] + X''_{ia} \beta''_a + v'_{ia} \quad (12)$$

The new residual incorporates the expected present value of future non-wage gaps and should thus be a better predictor of quits than the residual of equation (11). The coefficients of the first-differenced non-pecuniary satisfactions obviously capture current non-wage gaps which exert a positive effect on the overall job satisfaction. However, the first differenced variables retain the ordinality of job-related satisfaction by only taking three values:

- 1 if $\text{satis}(a) < \text{satis}(a-1)$
- 0 if $\text{satis}(a) = \text{satis}(a-1)$
- 1 if $\text{satis}(a) > \text{satis}(a-1)$

Hence, the first-differenced non-pecuniary satisfactions merely tell us whether they have decreased, increased or remained stable rather than measuring the magnitude of change. Since the satisfaction variables themselves were ordinal and could only take two values, the first-differences equal

- 1 if $\text{satis}(a-1) = 1$ and a negative surprise occurs
- 0 if $\text{satis}(a-1) = 0$ or 1 and no decisive surprise occurs
- 1 if $\text{satis}(a-1) = 0$ and a positive surprise occurs

Thus the first-differences of job-related satisfactions actually describe the worker's satisfaction one period back as much as the sign of the currently experienced surprise. Moreover, these two events are strongly negatively correlated. Since the worker's satisfaction one period back follows the sum of past non-wage gaps discounted from the beginning of work, it will be less heavily discounted than the current surprise; and our model of job satisfaction predicts that effects of the past should outweigh the current effect. Hence, the coefficients of the first-differenced job-related satisfactions capture both the past and current components of the job, and they are expected to be *negative*.

In conclusion, we estimate both equation (11) and equation (12), because equation (11) is a better predictor of job satisfaction than (12) but the residual from (12) is a better predictor of job mobility than the residual from (11). The results of equation (11)'s estimation and the estimated

coefficients associated with the first-differenced job-related satisfactions in equation (12) will be discussed in the next section

Other control variables which may contribute to the participants' level of job satisfaction are present in equations (11) and (12). Individuals are differentiated according to religion, education, marital status, family income or their participation to cultural associations, political activities or charity work. Our primary hope in introducing these variables is to capture the propensity of workers to be satisfied whatever happens, and account for one part of the individual fixed effect.

Under LGM's interpretation, job satisfaction eventually increases with experience because the discounted sum of wage and non-wage gaps is very likely to become permanently positive in the past after a sufficient number of years at work, if individuals have rational expectations, while it gets smaller in the future. Therefore, we allow for job satisfaction residuals being negatively correlated with workers' experience by estimating a heteroskedastic Probit model⁸ and by expressing that heteroskedasticity is caused by experience.

4.3 Estimation of Quits

We classify any job separation as quit when the worker designates this separation as such or as *other reasons*. We assume that this last category corresponds to separations initiated by the worker, perhaps for family reasons, since all motives of separation initiated by the firm such as layoff, redundancy, firm closure, contract termination or retirement were explicitly listed in the questionnaire.

The residual of the job satisfaction equation (12), estimated for a given year a , is our measure of individuals' propensity to stay with their current employer at this point in time. It is now used to explain quits between a and $a + 2$. According to equation (4), the coefficient associated with this variable should be negative and equal, in absolute value, to the average discount factor. But the probability of quitting is also affected by family ties and family changes and unexpected events which occurred to him after reporting his job satisfaction and were susceptible to make him change his mind. In our estimation, we mention family changes occurring between a and $a + 1$, some of which being unexpected, like getting married or beginning to share residence, separating from a spouse or becoming widowed, and having a new birth or a child moving out. Personal instability, for whatever reasons there may be, is simply measured by the number of previous

⁸ A probit estimation was preferred to the more traditional ordered probit found in the job satisfaction literature (eg. Clark and Oswald 1996, LGM). This choice does not entail a great loss of valuable information here because prior analysis of the data showed that the histogram of satisfaction variables on a 10-point scale is unimodal and concentrated in the upper scores. It allows an equal treatment of all satisfaction variables (leisure and health) appearing in the wage and job satisfaction equations. It also helps to capture the past non-pecuniary component of job satisfaction in equation (9) so as to have a more precise measure of the propensity to quit (see the discussion above in the same subsection). We tried different ordered probit models and obtained comparable results. We also estimated linear probability models with a correction for the variance of the estimators by Murphy and Topel's (1985) method. The results were similar to those presented here, and are available on request. The same remark applies to the mobility equations.

employers holding experience constant. We also control for gender, family income, years of education, apprenticeship, firm size, experience and tenure.

The reason why tenure is included in the regression needs further explanation. Tenure is commonly used as a predictor for quits because it serves as a good indicator of the individual's propensity to stay when the latter is deemed unobservable. But this is not the case here. Nor can tenure serve to capture the effect of unobserved heterogeneity on quits when the number of previous firms and experience are controlled for (Farber 1994). However, the propensity to quit Q_{ia}^{**} is estimated with systematic error. Its estimate \hat{Q}_{ia} unduly contains an important part of the past pecuniary component of job satisfaction since wage gaps were not measured from the beginning of work until the third year preceding the current period:

$$\frac{-Q_{ia}^{**}}{(1+r_a)^a} = \sum_{t=1}^{a-4} \frac{y_{it} - y_{it}^*}{(1+r_t)^{t-1}} + \frac{-\hat{Q}_{ia}}{(1+r_a)^a} \quad (13)$$

The unobservable component of the propensity to quit is negatively correlated with the number of firms in which the worker previously held a job, and with years of tenure in his current job. We further suspect that these two proxy variables will play a substantial role in explaining quits, holding Q_{ia}^{**} constant, since discounting from the beginning of work puts a heavy weight on early experiences. Hence, we regress the probability to quit in the time interval $(a, a+2)$ on the estimated job satisfaction residual (drawn from equation (12)), tenure, number of firms, experience, family events that occurred in the time interval $(a, a+1)$, and a few additional controls.

$$Q_{ia,a+2} = x_a + \psi_a \hat{Q}_{ia} + \eta_a \text{tenure}_{ia} + \eta'_a \text{experience}_{ia} + \eta''_a \text{number of firms}_{ia} + \Phi_{ia} \phi_a + \zeta_{ia} \quad (14)$$

As we suppose that marital status influences the decision to quit because a married or cohabiting person has a greater cost of mobility than a single person, we allow for the residual being correlated with marital status by estimating a heteroskedastic Probit model and by expressing that the marital status creates heteroskedasticity.

In order to test our job mobility model, we decide to estimate a modified version of the quit equation (14), where the job satisfaction variable is added:

$$Q_{ia,a+2} = x'_a + \psi'_a \hat{Q}_{ia} + \eta_a \text{tenure}_{ia} + \eta'_a \text{experience}_{ia} + \eta''_a \text{number of firms}_{ia} + \psi''_a J_{ia} + \Phi_{ia} \phi'_{ia} + \zeta'_{ia} \quad (15)$$

Having entered overall satisfaction in the regression alongside with the satisfaction residual, it is possible to test whether the latter is a better predictor of quits than the former. Our interpretation will prevail if the coefficient of the overall job satisfaction variable is not significant and the coefficient of the residual (i.e. the estimated propensity to stay) is significant and negative.

5 Results

The estimations of job satisfaction equations are reported in tables 3 and 3bis. Finally, the estimations of quit equations and the test which depends on these estimations are presented in tables 4 and 4 bis. Since wage residuals enter the job satisfaction equation and job satisfaction residuals enter the quit equation, we must pay attention to issues of identification. The table reproduced in appendix 2 summarizes the assumed causalities on wages, job satisfaction, and quits that permit identification. Attention is also paid to the robustness of our results on four consecutive years although systematic variation may sometimes be imputed to business cycle effects or, as we shall see, to the exogenous shock caused by the fall of Berlin's wall in 1989.

Insert Table 3A, about here

Let us first mention that education and gender, which are major determinants of wages, do not exhibit stable and significant effects on job satisfaction and quits, when wage and non-wage gaps and the satisfaction residual are held constant in the relevant equation. The fact of being, or having been, married exerts a positive influence on job satisfaction but the latter is significant at the 5% level only one year (in 1988). Reporting a religion (catholic or protestant) also makes one feel more satisfied with one's job and the latter effect is significant in 1990 and 1991, perhaps because former West German residents were able to compare their own condition with that of East Germans after the fall of Berlin's wall in 1989 and the more religious among them felt compassion for their poorer brothers⁹.

The results about effects of education, gender and religion on job satisfaction corroborate those of LGM on Canadian data¹⁰.

5.1 Determinants of job satisfaction

Table 3A shows that the discounted sum of wage gaps (restricted to the recent past by lack of better data) and the reported satisfactions with respect to health and leisure are definitely the major determinants of job satisfaction. The two satisfaction variables always have positive and highly significant coefficients which, furthermore, remain fairly constant. The last statement is literally true for leisure satisfaction but not quite for health satisfaction whose coefficient nearly doubles between 1988-1989 and 1990-1991. This parallels what happened to the religion coefficient in the same periods (see the discussion in the previous paragraph) and we give the same explanation to both phenomena. The fall of Berlin's wall in 1989 enabled the former West German residents to compare their superior health status with that of East Germans, but their leisure status was probably no better. The positive relationship between job satisfaction and the discounted sum of wage gaps in the last four years is only significant for 1988 and 1989. For 1990 and 1991 these coefficients, while having the expected positive sign, are not significantly

⁹ Since the reference wages have been computed on a sample of formerly West Germans, they are likely to be overestimated, after 1989, for the religious persons who «compare» themselves with their East German «brothers». Thus, for given estimates of the wage and non-wage gaps, religious persons will be more satisfied with their job.

¹⁰ In their study, LGM substituted satisfaction with marriage for marital status and found a positive and significant effect of the former on job satisfaction.

different from zero. In Germany, wages rose and the unemployment rate fell sharply among West German residents in 1990-1991 relative to 1988-1989 (see table 1). This observation suggests that, during periods of low (high) unemployment, individuals impute less (more) value to wages relative to non-pecuniary benefits associated with a job. This may be so because wage movements during the business cycle are likely to be more uniform than changes of working conditions which are attached to specific jobs. Consequently, jobs offering good working conditions are rationed in periods of high unemployment and workers have to wait that unemployment should fall in order to catch up by looking for these jobs in priority. Flanagan, Strauss and Ulman (1974), and Akerlof, Rose and Yellen (1988) had already noted from U.S. data that economic expansion creates an incentive for workers to change jobs, primarily in quest of better non-pecuniary benefits.

Insert Table 3B, about here

Table 3B substitutes first-differenced forms of the job-related satisfactions (with respect to leisure and health) for levels in order to eliminate the past component of non-pecuniary benefits from the residual of the overall job satisfaction variable. As expected, the coefficients of the non-pecuniary components become negative after this transformation (see the thorough discussion of subsection 4.2). Hence, these variables really capture both the past and current value of non-pecuniary components of the job and the results corroborate the prediction of our job satisfaction model, that is effects of the past outweigh the current effect.

5.2 Determinants of quits

Insert Table 4A, about here

Table 4A shows the results of the Probit regressions of quits over four consecutive years. The main prediction of the model of job satisfaction and quits which is being tested in this paper is that the overall job satisfaction residual, if properly measured, summarizes the economic reasons for wishing to stay in one's job. Firm size has been added to the regressions because it captures the scale of the internal market, which offers the opportunity of changing job without having to leave the firm. We find, indeed, that larger firms are able to retain their workers having insufficient prospects in their present job better than small firms. The probability of staying in one firm is a monotone function of firm's size. However, this relation is steadily losing strength between 1988 and 1991, and the expansion of the labor market caused by the reunification of Germany is an obvious explanation for this change. Family changes do not appear to be an important determinant of mobility. We do not rule out the possibility, however, that, if quits were regressed separately for men and women, these variables have an impact for women. But, since the aim of our study is to test the economic theory of quits, we use mainly indicators of family change as controls for non economic reasons.

Therefore, when men and women are considered together, the economic reasons for quitting prevail. The latter are described here by the job satisfaction residual (drawn from equation (12)), tenure, experience and number of firms, with the proviso that the last three variables were included as proxies for the unobservable part of the discounted sum of wage gaps. As expected, we find that the probability of quitting is related negatively and significantly to the residual of satisfaction in the initial job, and to experience and tenure, and positively and significantly to the

number of firms. All the results have the expected sign and most of the coefficients are significant at the 5% level. The significance of tenure and the number of firms (holding experience constant) is consistent with the weight attached to early experiences in job satisfaction judgments and feelings. The coefficients of these two variables remain remarkably constant in the time intervals 1988-1989 and 1990-1991 but the coefficient of tenure roughly doubles between the two periods while the coefficient of number of firms (holding experience constant) becomes non-significant. Farber (1994) indicated that the number of firms and experience are sufficient statistics for describing the unobserved individual heterogeneity relevant for quitting behavior, so that tenure should exert no effect on quits for this reason after controlling for those two variables. Thus the last result suggests that the effect of tenure is not due to unobserved heterogeneity, at least during the first two years. It may also testify that the opening of the German labor market after 1989 diminished the unobserved heterogeneity of the former West German residents on the labor market by uniformly reducing their propensity to quit.

The simple wealth maximization hypothesis conditional on the present model of job satisfaction implies that the coefficient of the job satisfaction residual in absolute value exactly measure the average interest factor. It will be assumed that the school-leaving age is 16 and the mid-point in the age interval is 32. Hence, we obtain the following sequence of average implicit real interest rates from table 4:

1988	1989	1990	1991
4.76%	6.83%	7.25%	5.86%

Two comments are in order. First, the magnitude of these estimates is quite plausible. Second, the variation of these implicit interest rates follows the business cycle: interest rates increase when the unemployment rate falls and rise when the unemployment rate diminishes.

The ultimate test for validating our approach is presented in table 4bis. Here, the overall job satisfaction variable is introduced in the Probit regression of the probability of quitting alongside with the job satisfaction residual. The results show unambiguously that the propensity to quit is captured by the residual, not by the level of job satisfaction itself.

All these results lead us to believe that both the LGM's interpretation of job satisfaction and wealth maximization hypothesis are sound for describing quitting behavior. The job satisfaction residual is a reliable indicator of the propensity to stay which can shed light on the determinants of quits ascribable to economic reasons.

6 Conclusion

We have used a new interpretation of job satisfaction as an index of the experienced preference for the present job to construct a good indicator of the individual propensity to stay in the job. The latter is simply the estimated residual of a job satisfaction equation. This new indicator captures a good deal of how the expected present value of one's job (including the non-pecuniary component) compares with outside opportunities in the future. With this indicator, we were able to perform a direct test of the simple wealth maximization model of quitting behavior, and to validate the theory. Our results show that economists can draw a lot of hidden information from

simple subjective questions about job and job-related satisfactions without giving up their traditional tools.

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Table 1

Wages, satisfaction and job mobility

	1988		1989		1990		1991	
	<i>men</i>	<i>women</i>	<i>men</i>	<i>women</i>	<i>men</i>	<i>women</i>	<i>men</i>	<i>women</i>
Monthly wage (1984 inflation-adjusted DM)	2411.23	1625.38	2437.67	1698.76	2645.26	1803.41	2556.37	1756.55
Job Satisfaction (%) <i>satisfied</i>	51.30	51.10	50.60	51.20	49.90	55.85	52.70	56.25
Leisure Satisfaction (%) <i>satisfied</i>	39.30	36.30	39.10	33.80	31.80	33.80	39.10	31.80
Health Satisfaction (%) <i>satisfied</i>	55.55	52.50	54.90	51.20	53.10	51.30	55.65	52.60
Job mobility (%)	4.88	6.13	7.05	8.13	8.15	8.00	6.15	7.6
Quits (%)	2.63	4.24	4.57	5.74	5.98	4.00	4.03	4.9
Quits over 2 years (%)	5.19	8.97	9.06	7.51	8.62	6.49	7.11	6.77

Table 2

Quit rates (%) between years a and $a+2$ of workers reporting (dis)satisfaction on a

a	1988	1989	1990	1991
Satisfaction level 8-10	4.35	5.84	5.90	4.72
Satisfaction level 0-7	8.33	11.48	10.24	9.68

Table 3A
Job Satisfaction

Men and Women 25-40 years old

HETEROSCEDASTIC PROBIT REGRESSIONS	1988 observations : 763	1989 observations : 743	1990 observations : 523	1991 observations : 670
Σ act. Wage differentials*.....	5.48 (2.8)	6.27 (2.57)	2.31 (3.77)	6.12 (3.75)
Satisfaction with:				
leisure.....	41.22 (10.49)	50.07 (11.24)	57.86 (15.15)	50.86 (13.14)
health.....	59.06 (12.22)	43.72 (10.46)	73.93 (16.67)	93.10 (15.43)
<i>personal characteristics :</i>				
married / sharing residence.....	31.41 (12.88)	19.55 (12.07)	27.94 (15.64)	-1.59 (15.02)
separated/widowed.....	40.26 (21.53)	9.03 (18.18)	34.06 (29.09)	47.92 (28.50)
single.....	ref.	ref.	ref.	ref.
cultural association participation.....	-15.44 (10.35)	2.72 (9.67)	-41.52 (16.67)	-4.06 (16.42)
voluntary work.....	2.65 (9.64)	0.88 (8.77)	16.37 (13.44)	-20.67 (12.90)
political activities.....	-8.86 (9.66)	4.44 (8.96)	18.06 (13.24)	19.66 (13.37)
family income*.....	6.59 (4.2)	-2.49 (3.42)	-7.63 (5.62)	5.65 (5.04)
gender (man).....	6.36 (13.30)	-14.45 (11.59)	-37.31 (17.04)	15.71 (17.11)
<i>religion :</i>				
catholic.....	4.94 (11.32)	10.86 (10.43)	36.34 (18.67)	58.44 (15.87)
protestant.....	-6.53 (13.29)	2.60 (12.13)	50.17 (19.71)	48.21 (18.16)
other/no religion.....	ref.	ref.	ref.	ref.
<i>education :</i>				
no degree.....	-23.42 (22.83)	-12.12 (19.25)	97.62 (65.51)	33.68 (33.65)
short course secondary school (Hauptschule)..	-23.72 (20.85)	-50.56 (20.29)	-67.19 (27.63)	-52.24 (26.94)
intermediate secondary school (Realschule)...	4.35 (25.05)	12.22 (22.85)	21.71 (31.44)	-16.04 (29.20)
technical school (Fachochschule).....	-32.04 (23.63)	-29.55 (20.82)	-12.51 (26.80)	-77.00 (32.95)
academical secondary school (Gymnasium)....	-24.06 (48.56)	-78.56 (47.72)	14.36 (50.16)	-19.85 (54.46)
apprenticeship.....	-13.13 (16.55)	-14.31 (14.33)	-6.85 19.39)	5.03 (18.84)
vocational and healthcare school.....	ref.	ref.	ref.	ref.
technical college.....	ref.	ref.	ref.	ref.
college and university.....	-2.69 (23.56)	9.45 (21.85)	21.68 (27.93)	14.47 (28.20)
other.....	-27.59 (20.99)	-15.41 (16.75)	dropped	38.83 (26.54)
inverse of Mills' ratio	7.23 (21.12)	-6.98 (18.14)	-13.67 (22.78)	23.91 (21.78)
constant.....	-57.28 (31.34)	-30.69 (27.21)	-35.89 (41.43)	-133.47 (40.90)
heteroscedastic variable.....	-14.29 (24.31)	-31.76 (24.33)	8.64 (28.66)	33.31 (21.75)
Log likelihood	-480.63	-463.63	-309.95	-397.26

Data : German Socio-economic Panel (GSOEP, 1984-1994).

Coefficients and standard errors are multiplied by 10^2 . Standard errors are in parentheses.

* Coefficients and standard errors are multiplied by 10^4 . Standard errors are in parentheses.

Table 3B

Job Satisfaction equation with differenced non pecuniary satisfaction variables^(a)

Men and Women 25-40 years old

HETEROSCEDASTIC PROBIT REGRESSIONS	1988 observations : 763	1989 observations : 743	1990 observations : 523	1991 observations : 670
Satisfaction with:				
leisure.....(sat _t -sat _{t-1} =-1).....	ref.	ref.	ref.	ref.
.....(sat _t -sat _{t-1} =0).....	-27.47 (20.65)	-50.20 (15.40)	-3.14 (6.04)	-27.08 (5.22)
.....(sat _t -sat _{t-1} =1).....	-5.85 (24.50)	-64.41 (19.37)	-2.24 (4.54)	-30.38 (1.21)
health.(sat _t -sat _{t-1} =-1).....	ref.	ref.	ref.	ref.
.....(sat _t -sat _{t-1} =0).....	-20.03 (19.57)	6.04 (5.23)	1.57 (3.54)	-14.16 (6.57)
.....(sat _t -sat _{t-1} =1).....	-72.29 (25.32)	-24.69 (20.39)	0.79 (2.63)	-47.01 (4.58)
Log likelihood	-512.36	-489.69	-333.93	-463.62

Data : German Socio-economic Panel (GSOEP, 1984-1994).

Coefficients and standard errors are multiplied by 100. Standard errors are in parentheses.

(a) extract from a modified version of the job satisfaction equation described in table 3A in which leisure and health satisfactions are replaced by differences in satisfaction from t-1 to t.

Table 4A
Quits

Men and Women 25-40 years old

HETEROSCEDASTIC PROBIT REGRESSIONS	1988 observations : 763	1989 observations : 743	1990 observations : 502	1991 observations : 670
Job Satisfaction residual ¹	-47.46 (20.55)	-34.75 (15.92)	-32.61 (17.80)	-40.19 (18.62)
<i>Familial changes :</i>				
wedding/cohabitation.....	43.82 (34.18)	51.73 (28.07)	-30.30 (52.73)	6.70 (35.45)
separation../child's leaving	33.07 (40.53)	42.51 (33.96)	dropped	58.10 (36.38)
birth	-56.74 (41.82)	-12.93 (29.69)	7.12 (30.66)	-15.85 (29.32)
gender (man).....	-21.88 (24.38)	5.97 (21.37)	24.26 (26.04)	-3.57 (28.28)
years of education.....	0.85 (4.15)	-6.44 (3.76)	-1.92 (3.86)	1.33 (4.11)
apprenticeship.....	2.34 (18.59)	6.63 (15.80)	-34.05 (18.04)	12.83 (17.65)
tenure.....	-0.54 (0.25)	-0.49 (0.21)	-0.81 (0.24)	-1.06 (0.26)
experience.....	-3.36 (2.34)	-4.63 (2.39)	2.30 (2.52)	-4.20 (3.58)
family income*.....	3.01 (7.34)	-2.59 (6.43)	4.45 (7)	6.9 (6.43)
firm size (< 200).....	ref.	ref.	ref.	ref.
firm size (200 to 2000).....	-71.38 (24.09)	-41.20 (18.10)	-2.12 (19.70)	-73.16 (26.98)
firm size (2000 and more).....	-116.79 (30.55)	-83.78 (23.72)	-26.15 (21.22)	-13.18 (19.73)
number of firms.....	13.01 (5.52)	13.34 (4.50)	6.29 (4.62)	6.04 (4.61)
<i>inverse of Mills' ratio</i>	16.59 (36.28)	-7.37 (33.33)	-27.41 (35.26)	-68.53 (64.39)
<i>constant</i>	-67.23 (98.37)	58.81 (98.91)	-85.32(111.43)	42.91(167.15)
<i>heteroscedastic variable</i>	5.68 (15.27)	-3.18 (14.56)	-15.98 (16.93)	-7.20 (14.93)
Log likelihood	-135.89	-165.24	-117.01	-129.30

Data : German Socio-economic Panel (GSOEP, 1984-1994).

Coefficients and standard errors are multiplied by 10². Standard errors are in parentheses.

¹ Residual from the estimation reported table 3B.

* Coefficients and standard errors are multiplied by 10⁴. Standard errors are in parentheses.

Table 4B
Job satisfaction versus job satisfaction residual as predictor of quits^(b)

Men and Women 25-40 years old

HETEROSCEDASTIC PROBIT REGRESSIONS	1988 observations : 763	1989 observations : 743	1990 observations : 502	1991 observations : 670
Job Satisfaction residual.....	-46.55 (20.31)	-35.42 (16.34)	-32.69 (17.81)	-39.60 (18.44)
Job Satisfaction.....	47.07 (79.94)	-85.15 (68.59)	9.58 (58.25)	-97.24 (67.32)
Log likelihood	-135.72	-167.61	-117.00	-128.27

Data : German Socio-economic Panel (GSOEP, 1984-1994).

Coefficients and standard errors are multiplied by 100. Standard errors are in parentheses.

(b) extract from a modified version of the quit equation described in table 3A in which the job satisfaction variable is added.

Appendix 1

Table 1A

Wage Equations^(a) 1985-1988

Simultaneous Equations (SURE estimation)

number of observations : 634

	1985		1986		1987		1988	
	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR
<i>education :</i>								
years of education.....	115.6	24.74	125.9	25.32	159.6	27.01	214.3	27.85
no degree./secondary school.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
specialised vocational school.....	198.7	145.09	139.3	144.85	114.0	153.52	-166.9	165.46
technical college/university.....	441.6	223.21	693.3	230.30	662.4	245.78	289.0	257.08
apprenticeship.....	-18.5	109.45	-29.7	111.77	-62.6	120.39	-231.5	126.86
preparation vocational year	-144.1	139.70	-158.22	144.12	-212.4	151.97	-349.8	160.82
<i>professional characteristics :</i>								
experience.....	25.6	14.97	38.9	15.65	29.8	16.96	39.4	19.69
number of worked hours.....	13.1	5.48	17.4	4.94	19.6	4.77	17.1	6.28
civil servant.....	-84.2	127.37	-272.0	123.63	-375.0	135.70	-110.0	145.43
skilled employee.....	392.9	84.46	353.8	78.73	238.7	81.88	466.3	87.68
skilled worker (+).....	52.2	76.22	49.8	68.03	-54.2	70.73	46.4	78.07
skilled worker (-).....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
unskilled worker or employee....	-187.9	91.67	-44.0	84.76	-109.9	84.92	20.0	104.18
natural resources.....	205.0	104.51	47.5	104.98	12.5	108.08	144.4	116.21
industry.....	407.6	79.32	237.4	79.32	317.8	83.24	386.1	89.39
construction.....	51.2	103.77	-56.0	102.99	-25.5	110.43	198.0	119.85
merchant services	25.3	94.72	2.48	93.63	12.8	99.02	126.2	107.77
non merchant services.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
<i>personal characteristics :</i>								
married / sharing residence.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
separated, widowed.....	111.5	150.26	22.7	142.61	58.6	124.73	-54.7	133.13
single.....	-196.3	64.59	-148.0	66.21	-179.9	71.73	-146.5	79.58
German nationality.....	225.2	115.04	138.7	119.14	181.8	127.82	101.8	139.93
command of German language...	24.4	98.12	111.1	90.02	193.7	102.65	107.9	118.38
health satisfaction.....	52.6	70.63	34.0	57.15	110.2	55.71	56.3	63.02
<i>inverse of Mills' ratio.....</i>	-1121	580.82	-538	614.37	-841.7	664.66	33.2	765.74
<i>constant.....</i>	527.7	423.70	216.1	436.20	-59.5	467.45	-649.3	544.95
R-squared.....	0.388		0.405		0.408		0.418	

(a) wages or compensations in level, 1984 inflation-adjusted Deutsche Mark.
Data : German Socio-economic Panel (GSOEP, 1985-1993).

Table 1B

Wage Equations^(a)
1986-1989

Simultaneous Equations (SURE estimation)

number of observations : 724

	1987		1988		1989		1990	
	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR
<i>education :</i>								
years of education.....	127.9	22.09	166.8	22.11	237.8	23.46	217.8	23.32
no degree./secondary school.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
specialised vocational school.....	66.1	138.44	8.0	138.13	-445.2	147.35	-279.7	150.58
technical college/university.....	330.0	197.05	234.4	198.37	-311.2	208.47	-106.3	206.12
apprenticeship.....	-108.4	95.83	-128.7	97.26	-308.0	133.17	-248.5	102.04
preparation vocational year	-241.5	127.51	-250.4	126.16	-414.3	136.21	-327.2	139.28
<i>professional characteristics :</i>								
experience.....	39.1	13.18	45.2	12.61	66.6	12.99	59.2	15.83
number of worked hours.....	16.4	4.59	22.1	4.21	9.8	4.36	16.2	4.73
civil servant.....	-86.1	114.19	-152.4	113.44	28.8	121.06	54.2	123.80
skilled employee.....	392.3	75.31	229.8	71.30	319.3	72.53	455.5	73.49
skilled worker (+).....	163.9	65.03	64.3	62.67	126.4	61.92	81.0	64.59
skilled worker (-).....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
unskilled worker or employee....	-129.5	82.13	-234.7	74.80	-48.4	83.26	91.9	90.38
natural resources.....	75.9	95.30	161.9	92.43	180.7	99.87	210.6	102.97
industry.....	324.0	73.01	446.6	70.60	430.3	75.43	450.9	76.06
construction.....	33.9	92.74	46.5	93.03	228.2	98.90	223.7	102.35
merchant services	127.4	87.53	212.0	84.89	296.6	91.90	257.6	91.88
non merchant services.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
<i>personal characteristics :</i>								
married / sharing residence.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
separated, widowed.....	-32.2	135.59	-36.1	111.57	-50.4	119.20	-78.2	111.22
single.....	-167.7	62.67	-198.3	64.15	-250.2	69.49	-217.0	81.96
German nationality.....	145.4	94.37	136.9	93.58	150.0	99.82	121.7	103.58
command of German language...	72.1	89.73	41.9	89.06	-52.1	90.12	22.9	88.57
health satisfaction.....	24.4	58.82	120.6	51.12	-1.3	50.43	2.7	50.62
<i>inverse of Mills' ratio.....</i>	-545.9	683.17	-74.6	661.62	1358	690.75	872.7	853.84
<i>constant.....</i>	158.0	371.73	-574.6	360.64	-1056	383.99	-1019	439.37
R-squared.....	0.384		0.409		0.402		0.413	

(a) wages or compensations in level, 1984 inflation-adjusted Deutsche Mark.

Data : German Socio-economic Panel (GSOEP, 1985-1993).

Table 1C

Wage Equations^(a)
1987-1990

Simultaneous Equations (SURE estimation)

number of observations : 807

	1987		1988		1989		1990	
	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR
<i>education :</i>								
years of education.....	147.3	20.83	217.3	21.74	193.6	22.05	230.0	23.30
no degree./secondary school.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
specialised vocational school.....	143.9	119.28	-111.4	124.68	37.6	124.07	-208.7	139.75
technical college/university.....	651.8	206.11	268.9	219.23	457.2	225.13	-91.1	266.64
apprenticeship.....	107.6	88.85	-63.6	94.19	16.0	94.80	-147.5	103.63
preparation vocational year	-56.4	120.75	-298.6	127.24	-189.9	128.06	-363.5	134.89
<i>professional characteristics :</i>								
experience.....	38.9	9.63	35.4	9.92	35.2	10.35	53.9	15.25
number of worked hours.....	14.6	4.48	8.0	3.84	11.5	3.88	14.4	5.35
civil servant.....	-141.2	115.25	32.3	115.62	72.9	115.95	-13.7	132.42
skilled employee.....	158.4	73.73	308.7	66.08	382.0	63.09	292.8	75.83
skilled worker (+).....	-17.7	63.91	136.8	56.01	76.5	54.97	69.1	67.50
skilled worker (-).....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
unskilled worker or employee....	-347.2	74.63	-72.9	74.01	-14.8	73.88	-140.0	87.42
natural resources.....	247.9	84.79	232.1	86.63	249.1	89.66	166.7	97.77
industry.....	419.8	66.60	398.0	68.31	459.9	69.30	442.9	76.63
construction.....	110.0	88.37	297.0	89.82	321.3	92.77	266.2	101.59
merchant services	164.6	81.47	237.0	83.24	225.1	82.41	231.2	90.41
non merchant services.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
<i>personal characteristics :</i>								
married / sharing residence.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
separated, widowed.....	-11.7	111.94	69.8	107.78	-35.5	99.13	-219.9	137.35
single.....	-155.7	65.04	-75.0	65.81	-79.7	73.63	-167.4	113.76
German nationality.....	82.4	83.84	124.9	88.46	116.6	89.62	81.4	98.66
command of German language...	-49.0	93.76	-96.7	84.58	-44.2	85.34	115.3	101.92
health satisfaction.....	69.2	53.81	-8.1	45.78	-47.8	42.40	-41.6	51.02
<i>inverse of Mills' ratio.....</i>	-836.7	632.55	-1033	662.32	-862.8	716.09	648.3	1103.79
<i>constant.....</i>	193.0	340.49	-38.6	337.97	3.1	352.89	-869.5	465.81
R-squared.....	0.405		0.394		0.400		0.390	

(a) wages or compensations in level, 1984 inflation-adjusted Deutsche Mark.

Data : German Socio-economic Panel (GSOEP, 1985-1993).

Table 1D

Wage Equations^(a)
1988-1991

Simultaneous Equations (SURE estimation)

number of observations : 762

	1988		1989		1990		1991	
	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR	COEF.	STAND. ERROR
<i>education :</i>								
years of education.....	219.1	20.44	199.3	20.73	236.7	21.46	201.5	22.53
no degree./secondary school.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
specialised vocational school.....	-340.2	118.15	-268.3	118.71	-320.1	122.47	-184.5	131.77
technical college/university.....	-168.9	190.74	37.7	189.17	-425.4	203.37	-290.6	212.97
apprenticeship.....	-163.3	101.85	-152.6	104.85	-129.8	110.99	-131.5	128.42
preparation vocational year.....	-138.1	128.58	-396.2	128.83	-419.5	130.13	-310.5	142.39
<i>professional characteristics :</i>								
experience.....	62.5	12.47	50.0	13.19	75.5	14.52	60.1	18.49
number of worked hours.....	12.7	4.17	14.5	3.95	19.1	5.32	18.7	5.52
civil servant.....	-31.9	118.13	66.2	115.65	-48.3	124.16	-79.2	130.50
skilled employee.....	306.1	72.47	372.9	66.07	337.5	73.47	389.6	77.85
skilled worker (+).....	139.0	61.08	136.0	56.30	85.6	62.83	-14.7	68.88
skilled worker (-).....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
unskilled worker or employee....	-243.4	75.99	-106.6	74.95	-151.8	80.65	-87.8	91.51
natural resources.....	229.5	92.05	175.4	93.45	122.5	95.82	95.6	104.75
industry.....	360.5	69.07	402.4	68.66	375.7	73.38	438.0	79.43
construction.....	222.2	92.91	198.3	93.85	176.6	100.07	218.0	110.14
merchant services.....	301.9	86.22	254.3	84.02	254.4	88.60	184.8	97.14
non merchant services.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
<i>personal characteristics :</i>								
married / sharing residence.....	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>	<i>ref.</i>
separated, widowed.....	-119.5	122.48	-230.8	107.21	-122.3	107.98	-148.3	116.42
single.....	-206.4	58.38	-212.1	59.09	-184.9	63.24	-187.7	68.81
German nationality.....	52.6	88.84	121.4	89.96	99.4	93.06	178.3	101.19
command of German language...	-93.3	88.83	-96.7	85.39	9.2	93.28	-13.8	104.81
health satisfaction.....	23.6	51.12	-56.2	43.41	0.5	49.76	99.7	56.03
bon vivant.....	26.6	64.39	82.2	66.41	106.2	68.04	60.3	72.20
ambitious.....	-98.3	80.44	-32.4	82.57	-12.8	84.41	54.1	89.54
emotionally expressive.....	-16.0	71.06	-74.2	73.00	-53.4	74.97	-65.1	79.37
altruistic.....	-67.0	63.05	-9.8	64.82	-70.6	66.37	-150.4	70.43
<i>inverse of Mills' ratio.....</i>	541.5	575.52	232.1	615.50	1467.2	671.85	1277.5	853.60
<i>constant.....</i>	-636.0	393.58	-309.2	408.40	-1527.7	467.58	-943.7	581.75
R-squared.....	0.439		0.407		0.429		0.389	

(a) wages or compensations in level, 1984 inflation-adjusted Deutsche Mark.
Data : German Socio-economic Panel (GSOEP, 1985-1993).

Appendix 2

Assumed causalities on wages, job satisfaction, and quits

	Wage	Job satisfaction	Quit
Education	yes	yes	yes*
Gender	yes	yes	yes
Marital status	yes	yes	no
Nationality	yes	no	no
Occupation	yes	no	no
Experience	yes	no	yes
Firm size	yes	no	yes
Health satisfaction	yes	yes	no
Leisure satisfaction	no	yes	no
Personality traits (3)	yes	yes	no
Religion	no	yes	no
Family income	no	yes	yes
Number of firms	no	no	yes
Tenure	no	no	yes
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Wage gap	-	yes	no
Job satisfaction residuals	-	-	yes

* only years of education and apprenticeship

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