Wages and Mobility of Young Workers: a Comparative Analysis between Italy and Germany

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Abstract

Using longitudinal administrative data for the period between mid 1980s to mid 1990s this paper analyzes and compares mobility and wage growth of young male workers in two European countries: Italy and Germany. We find that both in Italy and in Germany the average number of job changes for young workers over their first ten years in the labor market is low, compared to the US. While in Germany mean wage growth between jobs is higher than within job wage growth, in Italy between job wage growth is lower than within wage growth. The descriptive evidence therefore suggests that job changing in Italy contributes to the early career wage growth less than in Germany. We then investigate the unobserved components of wages by computing the covariance structure of residuals of within job wage growth equations, and imposing various structural processes. A structure where wage residuals consist of a permanent and a temporary component, with the permanent component following an AR(1) process with unit coefficient, fits both the Italian, and the German data, though in Germany only for skilled workers. We conclude that the evolution of wages within job follows a random walk with drift. Finally, we explore the implications of job search for the relationship between experience, tenure, and wages, and the probability that a worker leaves the firm. We find that the empirical evidence for Italy does not support a simple search model, while the evidence for Germany is largely consistent with a job search model.

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1. Introduction

We analyze and compare mobility and wage growth of young male workers in two European countries: Italy and Germany. Germany is the largest European economy with a labor market characterized by an institutionalized training scheme for young workers, and Italy has a labor market with a rigid earnings structure.

In the US, workers over their first 10 years hold on average about 7 jobs (Topel and Ward, 1992). In contrast both in Italy and in Germany the average number of job changes for young workers over their first 10 years in the labor market is around 3. Mobility and wage growth are strongly related. In the US the high dynamism of young workers in terms of job changes at the beginning of the career is reflected in consistent wage growth. In this paper, having observed low job turnover in Italy and Germany among young workers, we ask how mobility and wage growth are related in these two countries.

We use longitudinal administrative data covering the period between 1986 and 1996 for Italy, and between 1980 and 1995 for Germany. From this data we select a sample of young workers (younger than 17 in 1986 in Italy, and not older than 15 in 1980 in Germany[1]). This allows us to construct complete work histories for young workers, from the moment they enter the labor market onwards. We follow Italian workers for 10 years and German workers for 15 years. Our analysis is limited to the regular labor market of the private sector in the two countries. Furthermore, we exclude self-employment from the analysis. As a benchmark for the analysis on young workers` mobility in Italy and Germany, we use NLSY data on the US[2].

A number of theoretical models have attempted to answer the question whether young workers benefit from job mobility. Different theories have suggested different predictions about which workers move, why workers move, and how mobility affects wage. The simplest models, and those that have the longest history, are the *"non behavioral"* model, also referred to as the *"mover-stayer"* models (Blumen et al., 1955; Singer and Spilerman, 1976). The idea is that individuals differ, for unobservable reasons, in their propensity to stay or to leave a job. In this framework, stayers experience a lower number of job changes than movers, and tenure is negatively related to the probability to quit the job. According to the existing US literature on job mobility, this model alone does not seem to fit the observed empirical evidence[3].
An alternative approach to the analysis of job and wage mobility is that proposed by s*earch theory*. These models suggest that workers do not know the locations of their optimal match upon entering the labor market (Jovanovic, 1979a). In the simplest models, workers

[1] The German schooling system has three different tracks of secondary school. The first one lasts 9 years, the second one 10 years, and the last one 13 years. The students that go through the first track enter the labor market at the age of 15, and usually go into apprenticeship.
[2] We do not intend, however, to conduct a comparative in depth analysis between job and wage mobility of Italian and German workers with the US. Our analysis is limited to the comparison between Germany and Italy.
[3] Light and McGarry (1998), for instance, using NLSY data, find that job mobility and wages are negatively related also when taking account of the correlation between mobility and unobserved time-invariant personal and job characteristics. This finding is contrary to the prediction of the mover-stayer model of job mobility. According to this model, in fact, the negative relationship between job mobility and wages should disappear when controlling for time-invariant factors.

receive a job offer every period. Upon receiving an offer, the quality of the new match is immediately known to the workers. Workers change jobs if the offer is better than the value of the job they are currently holding. Such simple models have straightforward implications for mobility and wage growth: As workers will be better matched with the time in the labor market, their mobility declines. At the same time, they climb up the wage offer distribution, which should increase their wages. Furthermore, as good matches are likely to survive longer, tenure and mobility should be negatively associated. This would also imply a positive relationship between job tenure and wages. Simple job search models are therefore able to explain both wage growth, and mobility[4].

Another explanation for mobility is that match quality is not known ex ante, but is learned over time as the match is "experienced" and productivity-related information is revealed. These are the *"experience good"* models of job matching (Johnson, 1978 and Jovanovic, 1979b). At the time of the match there is imperfect information about job productivity, which can only be disclosed through experience. Job mobility occurs when a match proves to be worse than was initially believed. Good matches survive, and therefore the probability of moving declines with tenure. True match quality does not vary in time, but what drives mobility is the perception of the quality of the job, and this does change in time. The empirical implication is that mobility is correlated with wages even when controlling for individual and job specific time invariant characteristics[5].

The *human capital model* represents an alternative theoretical framework to analyze mobility wage gains. It focuses on the importance of specific human capital (SHC) as a mechanism to explain wage mobility. SHC increases with tenure at decreasing rate and is supposed to be non transferable from one firm to another. Among the empirical implication of these models is that the relative value of current employment (and therefore productivity and wages) increases with tenure, but at decreasing rates. This positive relationship is due to the accumulation of specific human capital. Moreover, the rate of accumulation of SHC decreases with tenure, and wage growth will decline accordingly. Both the "experience good" models of job matching and the human capital approach allow for a dynamic analysis of the mobility wage gains (including both short term and long term changes in the wage dynamics). On the other hand, while job mobility can be analyzed in a search context, it can not be explained by human capital models. In the labor mobility literature, to analyze job separations and unemployment, specific capital and search models have often been combined (e.g. Jovanovic, 1979, and more recently Dustmann and Meghir, 2004).

We attempt to distinguish among these models of job mobility using data for Italy and Germany for a sample of young men. In particular we use the Italian Social Security Archive (INPS data) and the German Social Security Records (IAB data) to examine job mobility and wage dynamics of young workers. First on the light of the theories of job mobility outlined above we interpret the evidence on job and wage mobility that we observe for Italy and Germany. Then, on the basis of the results of the descriptive

[4] Mortensen (1988) develops this model further, allowing for an increasing and concave wage profile, induced by the decreasing returns to investment into specific human capital. This allows establishing a relationship not only between the reservation wage and the current wage but also with tenure. In particular, for a given current wage, reservation wage decreases when tenure increases, and, therefore, the probability to exit increases with tenure. The longer a worker has been employed within a firm, the higher the external wage offers will be relatively to the current wage. In this framework, we will observe an increasing propensity to accept external offers as tenure increases.

[5] See for instance Light and McGarry, 1998 for an empirical evidence.

paragraphs, following Topel and Ward (1992), we propose a simple search framework that explains why workers change firm.

We first investigate mobility of workers. Over the period examined, Italy ran a particular scheme to help transitions of young workers from the school into the labor market (the so called Cfl system, *Contratto di Formazione e Lavoro*). This system granted tax benefits to firms, and allowed employing workers on temporary schemes. We compare workers who entered via this system, and workers who entered on permanent contracts. In the German data, we distinguish between two levels of qualification: workers who go through an apprentice training scheme, and workers who leave secondary school without further training. We refer to the first group as the skilled and to the second group as the unskilled workers.

We then investigate wages and wage growth, both within firms and between firms. First, we look at wage growth within jobs, and study the time series properties of wage innovations. Then, we look at the gains workers get from changing job, observing wage changes at job transitions.

Our results are remarkable in many respects. First, young workers both in Italy and in Germany are extremely immobile. While for the US, young workers are on their 7^{th} job after 10 years of potential labor market experience, in Italy and in Germany they have experienced around three jobs. This result holds regardless of the entry mode in the labor market. Second, in the US wage increases within jobs are substantial at the start of a worker's career: about 14 percent for new entrants, and about 7 percent on average (Topel and Ward 1992). While in Italy, if we include in the analysis all young workers that enter the labor market for the first time regardless of the entry mode, we observe a considerable wage growth (around 7 percent on average), within wage growth in Germany is considerably lower (around 4 percent on average). Third, and most remarkably, while job shopping is a very important factor for wage growth in the US - between job wage growth for young workers is on average about 11 percent - such between job wage growth is lower than within wage growth for Italy[6]. On the other hand, in Germany, similarly to that we have observed for the US, mean wage growth between jobs is higher than wage growth for workers that don't change firm. Between wage growth in Germany, as in the US, at the beginning of the worker's career is around 10 percent, and after 10 years of experience drops to around 4 percent. The difference between within and between wage growth seems more pronounced in Germany than in the US.

After examining the 'unconditional' patterns in the data, we investigate the unobserved components of wages and within job wage growth. This part of the analysis focuses on young workers that entered the market either with a typical or a Cfl contract in Italy, and on skilled and unskilled workers in Germany. We compute the covariance structure of residuals of within job wage growth equations and impose various structural processes. A simple measurement error structure of the error term in differences (implying that wage innovations are independent over time and random) is rejected for both Italy and Germany. Following Topel and Ward, we then consider a structure where wage residuals consist of a permanent and a temporary component, with the permanent component following an AR(1) process. This structure fits both the Italian data, for workers that enter the labor

[6] This holds regardless of the entry mode of the young worker.

market with a typical contract and for workers that experience their first employment spell with a training contract, and the German data, for skilled workers. Our results in this respect are therefore similar to those of Topel and Ward: we likewise conclude that the evolution of wages within a job follows a random walk with drift.

In the last section, we follow Topel and Ward (1992) and explore the implications of job search for the relationship between experience, tenure, and wages, and the probability that a worker leaves the firm. We provide a formal analysis of mobility, on the basis of the evidence obtained in the previous sections about between wage growth and about the evolution of wages within jobs.
The main findings of this section can be summarized as follows: first, in line with the empirical implications of the search model, the unconditional probability of changing job decreases with experience both in Italy and in Germany; second, conditioning on tenure and wages, the probability of changing job does not increase with experience as the theory would imply. In Italy it continues to decline, while in Germany it is basically flat. This is different to results by Topel and Ward (1992) for US data. Third, we find evidence of an inverse relationship between exit probabilities and wages for Germany, while this relationship is reversed for Italy. This is clearly in contrast to implications of a simple search model. This evidence supports the hypothesis that young workers in Italy do not change jobs for wage reasons only, but that reasons other than the official job wage are more relevant in determining mobility of these workers. Workers do not move, regardless of higher external offers, if the quality of their present working environment is good or anyway familiar to them. On the other hand, they may change job, regardless of a lower external wage offer, if the new job offers a better working and living environment. While the empirical evidence for Italy is not in favor of a search model of job changing, our evidence for Germany is more similar to what found by the existing literature on the US, where the job changing activity of young workers is consistent with job-matching models of search.

The paper is organized as follows. Section two briefly surveys the existing evidence on young workers' mobility. Section three describes the three datasets used for the empirical analysis: the Italian INPS archive, the German IAB dataset and the NLSY for the US. This last dataset is going to be used only as a benchmark for the descriptive analysis on job mobility. Section four describes the job mobility patters of young workers. Section five relates the evidence on job mobility to young workers' wage growth. Finally, Section six uses a simple search model for interpreting the observed German and Italian evidence. Section seven concludes.

2. Previous Evidence on Young Workers Mobility

The existing literature on wage and mobility is based almost entirely on US data. US literature on young workers mobility documents that average rates of job changing decline with experience and with current job tenure (Farber, 1998; Mincer and Jovanovich, 1981; Parsons, 1991) and that mobility is strongly positively related to the frequency of job change prior to the start of the job. Furthermore, wages of young workers increase when changing jobs, but these gains decline with age (Bartel and Borjas, 1981; Mincer, 1986). Murphy and Welch (1990) find strong evidence of rapid wage growth at the early stages of worker's careers. Topel and Ward (1992) find that a substantial part of the wage growth with age can be attributed to job change.

Evidence on countries other than the US is scarce. Using Italian Inps data, Contini and Villosio (2000) examine the relation between job mobility and wages. In particular, they explore the determinants of wage growth. By comparing full time male employees of all industries of the private sector, at work both in 1986 and in 1991, they observe that those workers that in 1991 work in a different firm than in 1986 experience the same wage growth than those that are still employed by the same firm. Only for young workers, aged 20-30 years, wage growth is slightly higher for movers than for stayers. Moreover, the wage growth between jobs is smaller if workers experience unemployment between both jobs and, the longer the unemployment experience, the less profitable is job mobility. Finally, they find that although job mobility pays, an excessive job turnover may cancel the initially positive result of mobility on wages.

Dustmann and Meghir (2004) analyze the sources of wage growth using German data, and find that there is evidence of a positive return to experience and firm tenure for skilled workers. Always using German data, Von Wachter (2002) focuses on young workers that go through the apprenticeship training and finds that wage losses due to leaving the training firm, though initially strong, fade within the first five years in the labor market.

Labor mobility of young workers

An important contribution in the analysis of the processes of job mobility among young workers is the study by Topel and Ward (1992). Using the Longitudinal Employee-Employer Data (LEED), a longitudinal employee-employer data, for the US (1957-1972), they find evidence of very high turnover in the early phases of the career of young workers. As experience in the labor market increases they find that turnover declines. Using more recent waves of the NLSY, Light and McGarry (1998) find, in line with the evidence reported by Topel and Ward (1992), that young workers change jobs several times during the initial phase of the career and that they move to increasingly more durable jobs.

The fact that average rates of job changing decline with tenure is linked to the evidence that most new jobs are short. Farber (1998) using data on job durations from the National Longitudinal Survey of Youth (NLSY) for the US, finds that about 1/3 of all new full time jobs end in the first six months, one half within the first year and 2/3 within two years. Burgess (1998) analyses the fraction of workers who had been in their jobs for one year or less in the 1990's for ten countries (France, Germany, Holland, Italy, Japan, Poland, Spain, Sweden, the UK, and the US). He finds that this fraction is large in the US, but substantially

smaller in European countries.

This different evidence for the US and other developed countries can be interpreted in the light of the different degree of institutional restrictions on hiring and firing that characterizes the different countries. This could partially explain the higher level of labor mobility in the US. Farber (1998) has also pointed out that another reason for the above mentioned differences between the US and other developed countries may lay in the different investment in on-the-job training, which is lower in the US than in many European countries. A good example is Germany, where the investment in on-the-job training is substantial and we observe lower mobility than in the US.

As we mentioned earlier, the fact that the probability of job change declines with tenure is closely linked to the observed evidence of early termination of jobs. Among the studies that find evidence of the relation between job change and tenure there is the early work by Parsons (1973). Based on data from the *Employment and Earnings* series of the Bureau of Labor Statistics (BLS), he shows that workers with less than six months tenure were more likely to end their job than workers with tenure longer than six months. These findings are on line with the evidence for young men both of the study by Blau and Kahn (1981), using NLS data, and that by Mincer and Jovanovic (1981) using both NLS and PSID data. Among more recent works, not specific on young workers though, that find evidence of the inverse relationship between job change and tenure, there is that of McLaughlin (1991) on PSID data, and that by Farber (1993) using DWS data.

Wage mobility of young workers

Job mobility and wage dynamics are clearly interactive processes. Flinn (1986) develops a discrete time version of Jovanovic's (1978) job-match model, and stresses the importance of considering simultaneously job turnover and wage growth when analyzing the careers of young workers. The descriptive evidence he presents shows that for young workers the unobserved matching heterogeneity is an important component of the intertemporal structure of wages. He provides a formal test of whether the covariance structure of the error term significantly departs from the restricted matrices implied by the theory. He does not reject the restrictions imposed by the job-matching theory.

Topel and Ward (1992) investigate the relationship between job and wage mobility. They look both at the effect of past job mobility on current wages and past wages growth on current decisions of job mobility. They find that controlling for unobserved heterogeneity, wage is the key determinant for the durability of the job among young workers. They conclude that wage growth is largely a result of a search process, and that experiencing new jobs is the way in which young workers improve their condition.
Using more recent waves of the NLSY dataset (1979-1993), Light and McGarry (1998) select a sample of young white men to examine the patterns of mobility and wage growth. They find that young workers who move firm more often are characterized by a lower wage path than those who move less frequently. This negative relationship between mobility and wages is found both by estimating a simple wage model via OLS, but also by controlling for unobserved time-invariant characteristics. They conclude that what they observe is consistent with models where mobility is driven by time-varying unobservables (e.g. experience good job matching models).

Bartel and Borjas (1978) develop a human capital model with infinite lived agents in order to analyze the wage gains that workers obtain by moving. In their model, they assume that workers have an expectation about the total duration of the current job, which they revise each period. According to their perception of the expected job duration, workers decide how much to invest in specific training. Their model suggests that labor turnover is inversely related to the amount of specific training obtained in the job. They distinguish between young, adult and older workers, and conclude that between wage growth is higher at the beginning of a worker's career. Moreover, according to the same authors more intense mobility (when voluntary) and lower initial wage for young workers can entail a higher gain when moving job. The initial possible wage drop, due to a loss of specific human capital, will be subsequently compensated by a higher wage growth. On the contrary, when qualified high wage older workers move firm, they are likely not to be able to compensate the short-term drop in earnings, because elderly workers are not far from retirement.
In a later paper, Bartel and Borjas[7] documented the relationship between wage growth and turnover. They found evidence that quits and wage growth on the job are negatively correlated. This result is supported in later contributions by Topel and Ward (1992) and Munasinghe (2000). Topel and Ward (1992) find a role for job specific wage growth in affecting workers' mobility decisions. In particular, they observe that a 5 percent increase in annual job-specific wage growth leads to a reduction of about 0.8 points of the quarterly probability of changing jobs. Munasinghe (2000) proposes a model that draws on key elements of search and human capital theory, and explains why jobs with high wage growth are less likely to end in separations. The theory of turnover presented in his paper rests on the hypothesis that jobs differ systematically in the rates of wage growth.

Evidence for Italy and Germany

The majority of the empirical studies that analyze the mobility patterns in the Italian labor market use the social security archives (INPS dataset). A recent contribution by the LABORatorio R. Revelli, edited by Contini (2002), provides extensive evidence on the mobility and earning's dynamics of workers in Italy. The analysis covers the period 1986-1996. They find that young workers, busy looking for a satisfying occupation, have higher than average engagement and separation rates. In particular, they observe that during expansions, the separation rate of workers younger than 25 is about 56-59%. The same figure for older workers (aged between 35 and 44) is of about 18%. Engagement rates follow a similar pattern: 75% for the younger workers and less than half of that for older workers. Similarly, during downturns (e.g. years from 1991 and 1993 in Italy) both engagements and separations decrease particularly for younger workers. Moreover, they observe higher than average earnings mobility for young workers at the beginning of their working career.
Contini and Villosio (2000), using the same INPS dataset, analyze job changes and wage dynamics of Italian workers. In particular, they explore the determinants of wage growth. They look at the role of firm's characteristics in determining wages, and decompose the total wage growth in two parts: one due to mean wage growth between the firm of origin and that they move to, the other is a wage premium that movers get for their observable characteristics. By comparing full time male employees of all industries of the private sector, at work both in 1986 and in 1991, they observe that those workers that in 1991 work in a different firm than in 1986 experience the same wage growth than those that are still

[7] Bartel and Borjas (1981).

employed by the same firm. Only for young workers, aged 20-30 years, wage growth is slightly higher for movers than for stayers. Moreover, the wage growth between jobs is smaller if workers experience unemployment between both jobs and, the longer the unemployment experience, the less profitable is job mobility.

A recent contribution on the analysis of the sources of wage growth among young workers in Germany is that by Dustmann and Meghir (2004). Using the German Social Security records, they consider the time span from 1975 to 1995 and select young male workers. They distinguish between skilled and unskilled workers, and analyze the contribution to wage growth due to general, sector specific and firm specific human capital. Among their main conclusions, they find positive returns to experience and firm tenure for skilled workers. On the other hand, unskilled workers are characterized by small returns to experience but by substantial returns to firm tenure.

3. Data and Sample Restrictions

For the empirical analysis we have used the Italian and the German Social Security Archives. As a benchmark for the analysis we have used the US National Longitudinal Survey of Youth (NLSY).

Italy

The Italian data originate from the archive of the Italian National Security Institute (Instituto Nazionale di Previdenza Sociale, INPS) and refer to the 1986-1996 period. For its institutional purposes, INPS collects data both on employers (firms) and on individual employees. The entire private sector is covered (about 10 million employees and 1.2 million employers per year). Agriculture, self-employment and part of the Public Administration are also covered by INPS, but they are excluded from this study. The administrative nature of the INPS archive implies a good reliability of the earnings and working time data, the coverage and accuracy of administrative archives cannot be reached by any survey, but, on the other hand, individual characteristics such as education or family background are not recorded.

The sample is a random draw from the entire INPS archive of employees of private firms. People born on the 10th of March, of June, of September and of December have been selected from the INPS employee archive and observed during the period 1986-1996. The resulting 1:90 random sample has been organized into a longitudinal dataset, where the unit of observation is the work-history of the selected employees. There is one record for each employment spell in the year: two firms will be recorded if during year t the worker moves to a new firm. Each worker may be connected at any point in time with his/her firm; it is therefore possible to assign employer's attributes to the employee. Each record contains (among other things) worker and employer codes, year of birth of the worker, place of work, gross annual wage, kind of contracts (e.g. full-time, part-time, training contracts) and occupation. Each longitudinal record has been complemented by information on the relevant employer (e.g. dates of opening and closure, total number of employees, industry). This database allows, therefore, observing for each worker the monthly mobility.

For this study, workers younger than 17 in 1986 are selected. This selection allows us to

observe the first labor spell of the workers. We confine the analysis to men workers. Moreover, we exclude from the analysis workers who have experienced only one employment spell, and who then exited the panel. The reason being that we are interested in analyzing the careers of young workers and information on only their initial spell is of no interest to us.

In addition to considering the whole sample of young workers at their first labor market experience, we consider two sub-samples where we distinguish between workers that entered the labor market either straight with a typical contract, and workers that experienced first a period of employment as Cfl and subsequently were transformed into typical.[8] This is for comparison reasons with the German labor market for young workers. In the German data we distinguish between young workers that entered the market with or without a training scheme. In the second half of the paper (sections five and six) we will confine the analysis to these two sub-groups of workers.

The INPS dataset allows us to observe job-specific wages, providing therefore important information for distinguishing among models of job mobility and earnings growth. According to the selection criteria outlined above, in the dataset used for this study there are around 10,000 workers. These, in the time window considered (1986-1996), experienced around 65,000 job spells. Given the selection criteria used, we observe the careers of the workers from their inception, and do not have therefore to deal with the problem of left censoring of labor market histories. Moreover, the administrative nature of the dataset allows us to track jobs' turnover and the evolution of wages with a much greater degree of precision than that allowed by self-reported longitudinal samples[9].

Germany

The data we use for Germany is a one percent sample from the German Social Security records (IAB data[10]). This dataset has been supplemented by information from the official unemployment records. This data is available for the years 1975-1995. Over this period, it records for each worker the exact date of state changes (change of employer, change into or out of unemployment, or non employment). It further provides information about whether a worker has been on an apprenticeship training scheme. All records are updated at the end of each calendar year. For each employment record, it reports the average daily wage over the last employment spell. In addition, despite being drawn from administrative records, it

[8] We, therefore, exclude from the Cfl subsample all the other possible career profiles (e.g. workers that enter the market with a typical contract and then are hired with a Cfl, or workers that experience one spell of Cfl after the other, repeatedly changing firm after the maximum time allowed by a Cfl contract has elapsed). Given that the Cfl program is meant to last on average between 6 months and one year, we furthermore exclude from the sample those workers that experienced a Cfl spell either shorter than six months or longer than two years.

[9] The administrative nature of the datasets we use does not allow distinguishing between voluntary quits and separations due to firing. We only observe the incidence of a separation. Thus, separations are a mixture of the two. When comparing the wage growth between movers and stayers, movers include therefore at a mixture of workers that quit voluntarily and workers that separated from the firm where they were previously employed because they were fired. In a strict search context, all separations are voluntary, and any separation is interpreted as resulting from a wage offer, which is inferior to another firm's offer, or unemployment.
To check robustness of our results, we will at times distinguish between workers who experienced a non-employment spell after separation, and workers who experienced job-to-job transitions (as defined below).

[10] A thorough description of the dataset is in Bender et al (2000).

includes an unusually large array of background information. We observe age, gender, educational status, marital status, occupation and industry.

Compared to data sets used in other studies, this dataset has several advantages. On the one hand, the administrative nature of the data ensures that the information on wages and employment spells is very accurate. On the other hand, we can exactly match wages to employment spells with a particular employer[11]. Furthermore, the data set is large and covers a long period.

The German dataset, as the Italian INPS archive, does not cover the entire labor force. In particular, self employed and civil servants are excluded from the German archive. However, when estimating the effects of tenure and experience, civil servants (who do in practice not change employer) are not an interesting group to consider anyway. Moreover, as with many administrative data sets, the data is top coded. In our analysis, we consider only young individuals who went through apprenticeship training, and individuals who did not receive any further training after school. Wages of workers in these two groups are barely affected by top coding. In particular, less than one percent of our sample population experiences a right censoring later in their career.

From the database described in the previous paragraph, we have constructed a sample of young male workers, whom we observe from the entry to the labor force onwards. We restrict our sample to workers who have been not older than 15 years in 1980[12], in order not miss out early employment spells.

We distinguish between two levels of qualification: workers who go through an apprenticeship training scheme early on in their careers, and workers who do not acquire any further training after school (which could be a high school degree (13 years of schooling), or a lower secondary degree (9-10 years of schooling)), or who drop out of the training scheme. The first group of workers is referred to as the skilled and the second group as the unskilled. Apprenticeship status and other forms of training (like stageships) are not distinguishable in our data. We, therefore, refer to a skilled worker as an individual who has gone through the apprenticeship training scheme, and has stayed at least 450 days on the scheme. Unskilled workers are workers who have either joined the labor market after secondary school, or have enrolled on some type of training scheme, but have not successfully completed training.
In our analysis we exclude university graduates. This for two reasons. First we would like to concentrate on workers who are either unskilled, or are comparable to the sample that we selected for Italy. Second, and more importantly, among university graduates, the fraction of censored wage spells is very large, especially at higher years of labor market experience. Notice that the fraction of each cohort, which in Germany goes through the university system, is comparatively small (about 19 percent), as many jobs for which college education qualifies in many other countries in Germany are trained for within the apprenticeship system. On the other hand, about 65 percent of the workforce in Germany has been trained within the apprenticeship scheme. Finally, we exclude all part time workers (which is a very small fraction).

[11] There is no overlapping wage information across firms as in many data sets such as the PSID.
[12] 15 years of age is minimum compulsory full time schooling age in Germany.

For apprentices, we can construct tenure and experience variables including, or excluding the apprenticeship period. As wages during apprenticeship time are regulated we will not consider wage spells during this period in our analysis. However, for mobility analysis, we will sometimes include apprenticeship time. We also restrict the observation period to 1980-1995, and the sample to individuals born 1965 and after. These individuals are at most 15 years old in 1980, the minimum age for labor market entry. This ensures that we do not miss out labor market spells before our observation window commences. Finally, we restrict our analysis to West Germany only.

US

For comparison purposes, we use US data drawn from a random sample of 3,005 male individuals from the National Longitudinal Survey of Youth (NLSY), covering the years between 1979 and 1996 (a period similar to that covered both by the Italian and the German data). A major advantage of the NLSY as compared to other US data sets is that it allows to follow a cohort of the same individuals over time, and to construct complete labor market histories of young workers, up to the date of the most recent interview. Detailed work history information contains weekly work records for all individuals in the sample, and records all state changes within the worker's observation window.

Form the data base we construct a sample of young workers with complete work histories. Individuals in the NLSY are between 14 and 21 years old on January 1, 1979. These cohorts are similar to those used for Italy and for Germany. We construct labor market histories from the Work-history Data File, which contains week-by-week longitudinal work records from January 1, 1978 onwards. For multiple jobholders, we only consider the main job the worker worked for, defined as the job for which the worker worked most hours. Since reconstruction of work histories is not possible for individuals who entered the labor market before that date, we drop these individuals. We match to this data educational and other information from the NLSY main files. A problem with the NLSY is a clear definition of employment. While the Italian and the German data only cover regular employment relations that are subject to social security contributions, the NLSY reports all employment relations. To count all these jobs would clearly overstate mobility in the US. To solve this problem, we combine the definitions of the first real transition into the labor market, as used by Lynch (1997) and Farber and Gibbons (1996). This implies that we include in our working sample all full-time jobs for individuals who are not enrolled in school, and who do not return to school within the next 2 years. If the individual is enrolled in school, we consider this spell if he is classified as "working". Using this definition, our final sample consists of 4073 individuals.

We distinguish between 3 educational categories: Individuals who are high school dropouts (549), individuals who have a high school degree only, or who are college dropouts (2619), and individuals who have a college degree (911).
According to Lynch, the transition from school to work is the year in which the respondent is enrolled in school, followed by two years of non-school enrollment. According to Farber and Gibbons, a transition from school to work takes place when the worker is classified as non-working for at least one year, followed by two consecutive years classified as working.

Construction of work history variables

For the purpose of our analysis, from the datasets described in the previous paragraph, we

construct a number of key variables. For each worker we observe the exact length of each employment spell within calendar years, as described above, and also an identifier for the firm where the individual works. We construct the variable "tenure" as the sum of all employment spell length in a particular firm for a particular wage spell. Moreover, we construct the variable "experience" as the sum of all employment spells in the labor market up to a particular wage spell. Both tenure and experience have been aggregated in years.

As wages are contracted before a wages spell starts, they are based on experience and tenure observed before the wage spell commences. We, therefore, lag experience and tenure variables, so that each wage spell has corresponding experience and tenure entries as of the start of the respective spell.

Sometimes we use also potential experience. This variable is simply the time that has passed after the first entry of an individual into the labor market up to the observed employment spell.

Although the German data set allows in addition to describing precisely the characteristics of an employment spell for distinguishing between different states in non-employment, this information does not exist in the Italian data. To ensure comparability, we consider here only non-employment spells that may comprise periods of unemployment, non-employment or, in the case of Germany, military service. These spells are simply the time that has elapsed between tow valid employment spells.

4. Job Mobility Patterns

In this section we intend to provide a picture of job mobility patterns, and of the link between wages, wage growth and job mobility in Italy and in Germany. The nature of the Italian and German datasets as well as that of the NLSY allows us to construct complete work histories for young workers over almost the same period[13].

With regard to Italy, we consider separately workers that entered the market with a Training-and-Work contract (Cfl) and that at the end of the training period are hired with typical contracts, and workers that entered the labor market directly with a typical open-end contract. In Germany, we distinguish workers that went through formal apprenticeship training (skilled workers) from those workers that did not. Though the Italian Cfl scheme and the German apprentice system are substantially different in their nature, they share a number of characteristics. Both are a way offered to employers to hire young workers, very often at their first work experience, for a fixed term. During this period employers can get to know the quality of the worker and, once the training period elapses, decide whether to keep the worker or not. Given that the training contract is fixed term, the employer have a higher degree of flexibility to lay off these workers with respect to typical workers hired with open end contracts. Moreover, both in Italy and in Germany labor cost associated to workers in training is lower that average labor cost. In Italy the

[13] The German dataset and the NLYS cover a slightly longer period of time with respect to the Italian one. In particular, we have waves for the US and for Germany that, in addition to the period from mid '80 to mid'90, cover also the first half of the '80s.

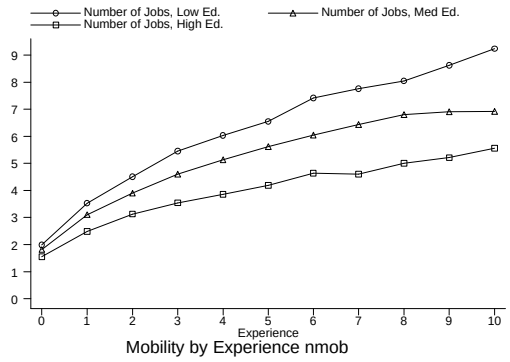
number of workers entering the labor market with a Cfl contract is always lower than the number of worker entering the market with a typical contract right from the start of their working career. In Germany, on the other hand, the number of workers that went through the formal apprenticeship training is substantially higher than that of workers that either did not go through training or that did not complete it.

4.1 Job Mobility Among Young Men

In figure 6.7 we present the average number of jobs accumulated by years of experience in the US (panel a) and in Germany (panel b), where we brake down our sample into different educational categories.

Fig. 6.7 – Number of Jobs by experience

Panel a – US (high, medium and low education)



Panel b – Germany (skilled and unskilled workers)

Source: NLSY 1979-1996 and IAB dataset 1980-1995, own calculations

On average, in the US the first full year of actual experience is divided among almost three jobs. Moreover, in the US from the second year of experience onward, the average pace of sampling jobs declines fairly smoothly as experience accumulates (fig. 6.7).

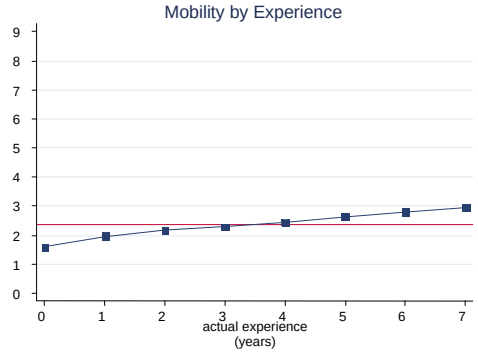
The differences between the US and Germany are striking. As we can observe from figure 6.7, mobility in Germany is much lower than in the US. After 10 years in the labor market, workers in Germany are still on their third job. Furthermore, the number of jobs held by German workers increases only during the first few years, and flattens out afterwards. In the US, workers keep being mobile for longer. On average, workers hold their seventh job after 10 years of labor market experience. In Germany, unskilled workers experience on average a larger number of jobs than workers that went through formal training. After the first year of experience, the difference between the propensity to move of the two groups of workers stays substantially constant for the entire labor market career. This lower mobility of better educated workers is a feature that Germany shares with the US. In the US, the average unskilled worker is on his 8.8^{th} job after 10 years in the labor marker, while the average college graduate holds his 5.6^{th} job only. In Germany, an unskilled worker is on his 3.4^{th} job, while a skilled worker is on his 2.8^{th} job.

The US trend has been interpreted (Topel and Ward, 1992) as evidence on the sorting

process (search); as experience accumulates, the frequency of job changing declines. This is the trend we observe also in the German labor market (for skilled workers we shall look at the trend after the third year in the labor market, when they finish the apprenticeship period and look for a job). The German evidence is, on the other hand, inconsistent with a pure mover-stayer model, as well as with the pure "experience goods" version of job matching, in which new jobs within careers, would form a renewal process. If all jobs were identical ex ante, then new jobs would not be systematically more stable than past ones.

In Italy the picture is less clear-cut. Figure 6.8 plots the number of jobs experienced by young workers in Italy by years of actual experience[14].

Fig. 6.8 - Number of Jobs by experience – Italy



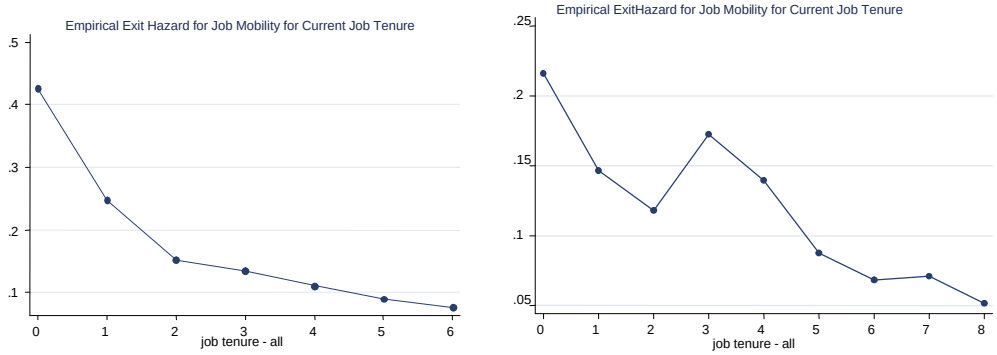
Source: Inps archive 1986-1996, own calculations

From an average of 1.6 jobs within the first year of experience, after 4 years the average number is 2.2, and after 10 years of experience the average number of jobs is 2.9.

Underlying many of these results is a prime feature of mobility data: the average frequency of job mobility is a declining function of current job tenure. The strength of this association is illustrated by figure 6.9 (pane (a) for Italy, and panel (b) for Germany). These two figures show the conditional relative frequency of job terminations given current tenure.

[14] No noticeable difference exists between the whole sample of young workers, considered in Fig.6.8, and the sub-sample of Cfl entrants and that of typical workers. Graphs relative to the sub-samples not reported.

Fig. 6.9 – Exit probability by tenure, Italy and Germany
Panel (a) – Italy Panel (b) Germany



Source: INPS archive 1986-1996, and IAB dataset 1980-1995, own calculations.

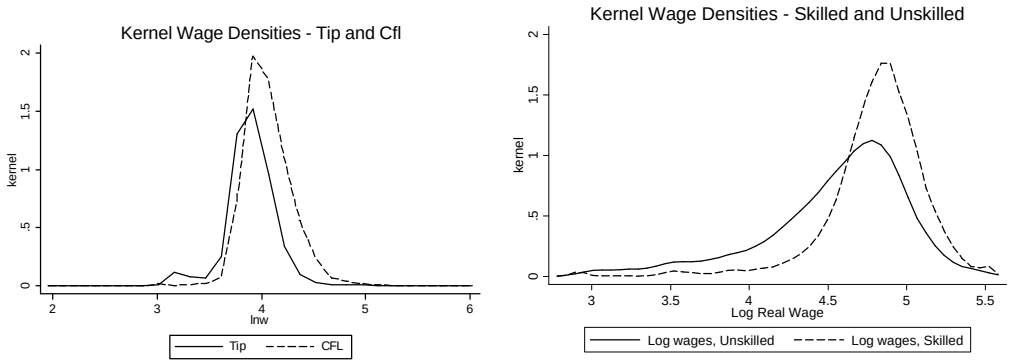
In Italy, the probability of moving declines dramatically over the first two years of tenure. From a 40% average probability to move within the first year of tenure, after two years of tenure the annualized probability of job terminations stabilizes at less than 10% (Fig. 6.9, panel a). In Germany we observe a peak in the exit probability after two years of job tenure (Fig. 6.9, panel b). This is related to the high mobility experienced at the end of the apprenticeship period. This is also the moment in which workers that went through the apprentice go for the compulsory military service. The peak is clearly more pronounced when we consider only skilled workers, and not present when looking at unskilled workers.

The evidence that job ending declines with tenure is clear, both in Italy and in Germany. However, it is absolutely not straightforward to attribute this evidence to one theoretical framework or another. It suffices to say that the specific capital model might be a parsimonious explanation for these facts, but that there is extensive evidence as well for a role of heterogeneity among workers.

5. Wages, Wage growth and Job Mobility

We turn now our attention to the evolution of wages for young workers. Figure 7.1 graphs the unconditional densities of the logarithm of wages for Italy (panel a) and for Germany (panel b).

Fig. 7.1 – Unconditional Kernel Wage Densities
Panel (a) - Italy Panel (b) - Germany



Source: INPS archive 1986-1996 and IAB dataset 1980-1995, own calculations

In Italy, workers that went through a period of formal training earn higher wages than workers that did not[15]. Similarly, in Germany, workers that went through the formal apprenticeship training earn higher wages than those that entered the labor market without having done, or completed, the apprenticeship training. Wages in Germany are, however, higher than in Italy for all groups of workers, and show a slightly higher dispersion.

Wages and wage growth with respect to experience

Figure 7.2 plots wages against experience (panel a, refers to Italy; panel b, refers to Germany[16]).

Fig. 7.2 – Wages and Experience
Panel (a) Italy Panel (b) Germany

Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

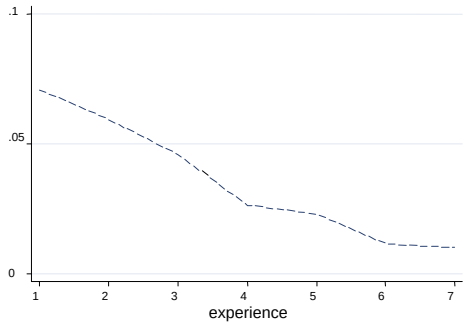
In Italy (figure 7.2) wages are increasing less than in Germany. While in Italy there is no substantial difference between wages of Cfl workers and those of typical workers[17], in Germany wages of unskilled workers are lower than wages of skilled workers at the

[15] The unconditional kernel wage density for the whole population is very similar to that relative to typical workers (graph not reported).
[16] Wages of skilled workers in Germany refer to the period following the termination of the apprenticeship training.
[17] Graph not reported.

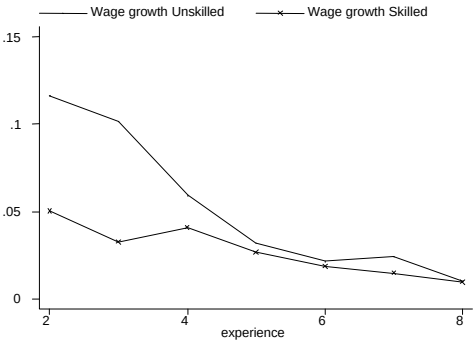
beginning of the career. However, the initial wage differential between the two groups of workers gets smaller the longer the labor market experience of the worker. The benefits of having gone through the apprenticeship program, therefore, seem to fade away after the first three years of the workers' career.
Figure 7.3 plots, for Italy in panel (a) and for Germany in panel (b), the wage growth against experience. In the German data we distinguish between skilled and unskilled workers[18].

Fig. 7.3 – Wages Growth versus Experience

Panel (a) Italy



Panel (b) Germany



Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

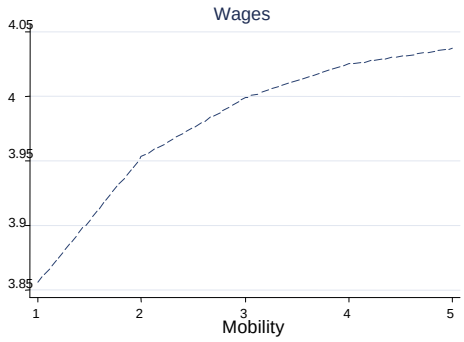
Young workers in Germany experience a more pronounced decrease in the wage growth than in Italy. This is particularly the case for unskilled workers. In Germany, we observe a difference in the wage growth between skilled and unskilled, but only in the first four years of labor market experience.

Wages and wage growth with respect to mobility

If we consider wages against the number of jobs held by the workers (Figure 7.4, panel (a) for Italy, and panel (b) for Germany), we observe a number of interesting features. In Italy, wages of young workers increase with the number of firm changes[19]. This is not the case in Germany, where, as in the US, the level of wages decreases with the number of jobs held. When breaking down these numbers according to skill groups, however, we see that for the US, low skilled workers' wages increases with the number of jobs held (figure not reported). In Germany we observe that wages of skilled workers decrease as the number of jobs grows. Wages of unskilled workers, on the other hand, first increase and then decline.

[18] In the Italian data we do not distinguish between Cfl and typical workers because the trend is not substantially different between groups of workers.
[19] This is true regardless of the entry mode in the labour market (graph distinguishing by entry mode not shown).

Fig. 7.4 – Wages and Number of Jobs
Panel (a) Italy



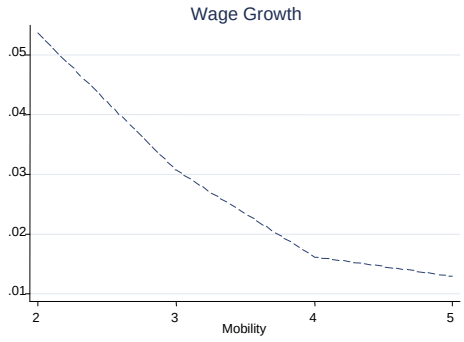
Panel (b) Germany

Wages, Skilled and Unskilled, by number of firms

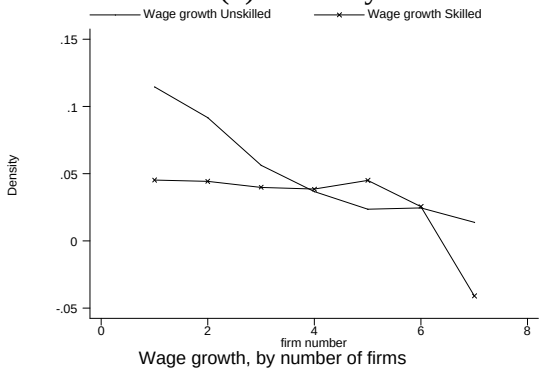
Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

Figure 7.5 plots the wage growth against the number of jobs experienced (Fig. 7.5, panel (a) for Italy, and panel (b) for Germany).

Fig. 7.5 – Wage Growth and Number of Jobs
Panel (a) Italy



Panel (b) Germany



Wage growth, by number of firms

Source: INPS archive 1986-1996 and IAB dataset 1980-1995, own calculations

In Italy wage growth is decreasing with the number of firms[20]. In Germany, wage growth with respect to the number of firm changes experienced by the worker differs by education level: wage growth for unskilled workers is higher than for skilled workers, but only up to three firm changes.

4.1 Wage Mobility Within and Between Jobs

In this paragraph we analyze two important aspects of the evolution of wages for young workers. First, we look at wage growth within jobs, and study the time series properties of wage innovations. Then, we look at the gains workers get from changing job, observing wage changes at job transitions.

What we find is that earnings evolve within jobs approximately as a random walk with drift. In Italy this is the case for both workers that entered the labor market with a Cfl contract

[20] Again there is no substantial difference between Cfl and typical workers (graph not shown).

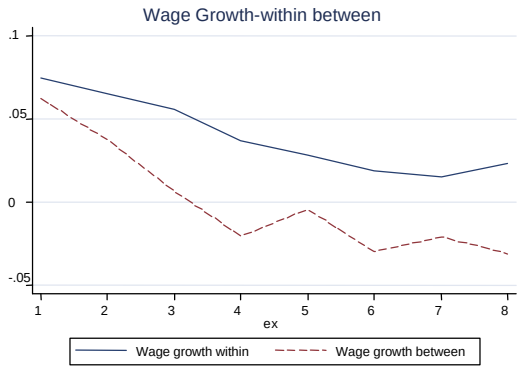
and for those that entered the market right away with a typical contract. In Germany, the random walk with drift structure fits the evolution of earning for skilled workers.

Within and between wage growth

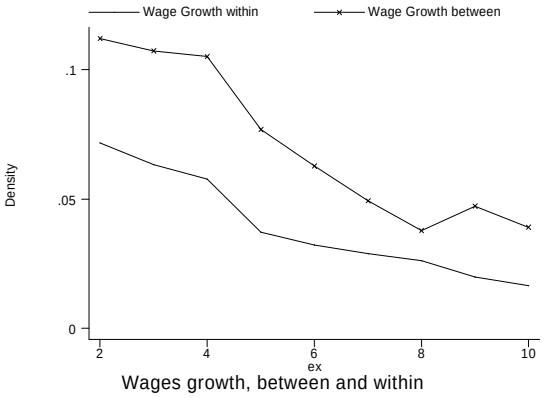
Existing evidence for the US reports consistent wage gains from job mobility for young workers. In particular, among young men, more than a third of early career wage growth is associated with job changing. Moreover, within job average wage growth is lower than between job average wage growth (Topel and Ward, 1992).
Figure 7.7 plots the growth of wages in Italy (panel a) and in Germany (panel b) distinguishing between wage growth for workers that stay within the same firm, and those workers that change firm.

Fig. 7.7 - Within and Between Wage Growth

Panel (a) Italy



Panel (b) Germany



Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

As in the US, also in Italy and in Germany, for both workers that stay within the same firm and those that change firm, wage growth decreases with experience. Moreover, both in Germany and in the US the difference in within and between job wage growth reduces with time in the labor market. This could be interpreted as evidence of a higher variance of job offers early in ones career, when workers have not sorted into their preferred match yet. However, while in Germany, similarly to that we have observed for the US, mean wage growth between jobs is higher than wage growth for workers that don't change firm, in Italy we find that within wage growth is higher than between wage growth. The difference between within and between wage growth seem more pronounced in Germany than in the US.

In Italy, within wage growth is higher than between wage growth regardless of the entry mode in the labour market[21]. Moving across firms does not pay in terms of wage growth, regardless of the entry mode in the labor market. Both workers that started their career with a training contract and those that were employed from the start with a typical open-end contract lose in terms of wage growth if they decide to move firm.
In Germany, on the other hand, alike in the US there are noticeable differences according to the education level of the young workers that enter the market. We find that both within and between job wage growth in the first four year in the labor market is much larger for

[21] Graph not reported.

the highest education group in the US than in Germany (2.8 and 4.2 percent for within and between job wage growth for high school dropouts, and 5.5 and 12.7 percent for college graduates). In Germany, we observe the opposite. In particular, workers who left secondary school without further education or training have a yearly average within and between job wage growth of 5.5 and 8.6 percentage points in their first 4 years in the labor market, respectively. Those that went through a formal apprenticeship program have only 3.8 and 7.1 percent increases.

The evidence of a between wage growth in Germany larger than the within wage growth, obtained despite the fact that in the sample there may be workers that separate involuntarily, tells us that in Germany there is evidence of search. On the other hand, the observed between wage growth smaller than the within wage growth in the Italian data, could of course be due to large losses of those workers that are fired.

The administrative nature of the datasets does not allow distinguishing between voluntary quits and separations due to firing. However, we can distinguish those workers that when separate from the firm join the new firm within one month[22], from those workers that have longer spells of non-employment in between the two jobs[23]. In Italy, between wage growth for those workers that stay only a short time out of the labor market (less than one month) before finding a new employment, is lower than that of workers that stay out of the market for a longer period of time. In particular, we find evidence of a 2.8% between wage growth for workers with shorter non employment spells, compared to a percentage which is close to 5% when we look at the overall population of young workers. However, also considering this sub-sample of the population, which seemingly moves voluntarily from one job to the other, we still observe in Italy a between wage growth which is considerably lower than that experienced for instance by German workers. In Germany we find evidence of a higher wage growth for workers with a non-employment spell between two jobs shorter than a month (around 10% compared to 8.7%). This is true for both skilled and unskilled workers. Moreover, if we look at spells of non employment in between jobs shorter than one month, we find that the wage growth experienced by young workers that change firm within less than five days is not much different from that of workers that stay up to one month without a job before finding a new one.

To summarize our results on wage careers of young workers, we found that:

- While between wage growth is higher than within wage growth in the US and in Germany, in Italy within wage growth is higher than between wage growth. Moreover, the difference between within and between wage growth in Germany is more pronounced than in the US.
- While in the US both within and between wage growth is larger for highly educated workers, the opposite is true for Germany.
- In Italy we observe no substantial difference between Cfl and typical workers with respect to the evolution of their wages.

[22] The nature of the German data, which provide daily information about the starting and ending date of the job, allows us to look also at a shorter interval of time than one month. For German workers, therefore, we look both at unemployment spells between two consecutive jobs of one month and of five days.

[23] This analysis is particularly relevant given the observed evidence in the existing literature on the Italian labor market (Contini, 2002) of the relatively low percentage of job-to-job transitions among young workers (around 30% among workers younger than 25 years).

- In the US as well as in Italy and in Germany, between and within job wage growth decreases with the number of jobs hold.
- While in the US and in Germany the level of wages decreases with the number of jobs hold, in Italy it increases.
- In the US and in Germany, the level of wages increases first with the number of jobs hold and then decreases for the low educated, but decreases throughout for the better educated. In Italy it is always increasing regardless of the type of contract with which the workers entered the labor market (open-ended or training contract).

In the next two paragraphs, we try to understand the reasons of the observed relative immobility of Italian and German young workers with respect to the US. We will first examine wage growth for those workers that stay within the same firm where they were employed as they entered the labor market (paragraph 6.4.1), and then we will look at wage growth for workers that move firm (paragraph 6.4.2). We will examine in parallel the Italian and the German labor market. Following Topel and Ward (1992), we then draw the main empirical implications from a simple on-the-job search model (e.g. Burdett, 1978; Jovanovic, 1979a; Flinn, 1986; Topel, 1986; and Mortensen, 1988) for interpreting both the Italian and the German evidence.

5.2 Within Job Wage Growth

In this section we analyze wage growth of young workers within firms. We commence by estimating wage growth due to experience and tenure for both Italy and Germany. We then investigate in much detail the time series properties of wage innovations (paragraph 7.3). We are interested in two sets of parameters. First, we wish to compare systematic wage growth in Italy and Germany[24]. Second, we will model the time series properties of the unobservable component of wages within firms, conditional on individual specific fixed effects. Our analysis will distinguish between Cfl and typical workers for Italy, and between apprentices and unskilled workers for Germany. Our results suggest that, except for the group of unskilled workers in Germany, wage growth within firms follows a random walk with drift – a result that resembles findings of Topel and Ward for the US.

We express individual earnings as a function of labor market experience (X^j_{it}) and current job tenure (T^j_{it}) for each individual i on job j at time t. We do not include an education variable as we estimate the model for different education groups. The model of individual log earnings can be written as:

$$w^j_{it} = h(X^j_{it}) + f(T^j_{it}) + f_{ji} + a_i + \tilde{w}_{ijt} \qquad (1)$$

The two unobservables (f_{ji} and a_i) represent a job-match effect specific to a particular job and an individual specific fixed effect respectively, and the third term ($\tilde{w}_{ijt}$) is an error term,

[24] A problem with identification of wage growth is that mobility of individuals is endogenous. Note however that estimation of within job wage growth conditions on individual specific effects, and therefore eliminates time-constant job match effects as well as individual specific effects. This leads to consistent estimates of within – job wage growth as long as the differenced time variant residual is uncorrelated with changes in tenure and experience - an assumption frequently made in the literature on the estimation of tenure - and experience effects (see e.g. Topel 1991).

the properties of which we will analyze below. We define $\tilde{w}_{ijt}$ to be uncorrelated with T and X, conditional on f_{ji} and a_i.
In the literature (e.g., Mincer and Jovanovic [1981]) h(.) and f(.) are usually expressed as low order polynomials in X and T.
As f_{ji} and/or a_i are likely to be correlated with X or T, OLS on (1) results in biased estimates of the effects of tenure or experience on wages (see Topel, 1991). Here we are not interested in recovering these parameters; our objective is to understand the dynamics of wage growth within firms, conditional on individual fixed effects and a systematic component in tenure and experience. We, therefore, estimate (1) in differences:

$$\Delta w_{jt} = \Delta h(X_{jt}) + \Delta f(T_{jt}) + \Delta \tilde{w}_{jt} \qquad (2)$$

where $?w_{jt}$ is the difference of earnings expressed as a function of the polynomial difference of labor market experience ($\Delta h(X_{jt})$) and current job tenure ($\Delta f(T_{jt})$). $\Delta \tilde{w}_{jt}$ is an error term that represents unobserved characteristics determining earnings.
Notice that estimation in differences allows only identification of the combined linear effect of experience and tenure. We then compute $\Delta \tilde{w}_{jt}$ and impose alternative processes on the covariance structure to understand the residual dynamics.

Table 7.3 reports the results of the estimates of the within wage growth for both countries, using different sets of regressors (panel (a) refers to Italy, and panel (b) refers to Germany). The results presented in this table refer to the overall sample of young workers in both datasets.

Table 7.3 - Within Job Wage Regressions, differences. Dependent variable: within wage growth

	Italy				Germany				
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(5)
Δ tenure squared		-0.009	-0.002	0.001		-0.003	0.001	0.001	-0.003
		(0.001)**	(0.001)*	(0.001)		(8.70)**	(0.92)	(1.22)	(4.42)**
Δ experience squared			-0.007	-0.008		-0.004	-0.005	-0.004	
			(0.001)**	(0.001)**		(7.69)**	(8.36)**	(6.90)**	
Skilled worker								-0.042	-0.040
								(10.02)**	(9.55)**
Total tenure				-0.006					0.008
				(0.001)**					(10.49)**
Δ (tenure + experience)	0.071	0.131	0.144	0.161	0.043	0.059	0.066	0.102	0.072
	(0.002)**	(0.004)**	(0.004)**	(0.005)**	(26.96)**	(24.14)**	(25.35)**	(23.12)**	(13.88)**
Obs.	15218	15218	15218	15218	18942	18942	18942	18942	18942

Absolute value of t statistics in parentheses. * significant at 5%; ** significant at 1%

Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

Column (1) reports results of regressing changes in wages on changes in tenure and experience only. Column (2) adds the changes in tenure squared among the regressors, and column (3) adds also the changes in experience squared. Note that coefficients on higher order polynomials are separately identified in a difference equation. For Germany, in column (4) we condition also on a dummy variable for skilled workers. Finally, in column (4) for Italy and (5) for Germany we control for the total job tenure on the particular job. Completed tenure is likely to be correlated with wage innovations, and the coefficient on this variable is to be interpreted as an association rather than a causal effect.

The results in column (1) suggest that the within job average rate of annual wage growth for young workers is about 7 percent in Italy and 4 percent in Germany. Topel and Ward (1992) report within job wage growth of about 14 percent for the US – substantially larger than in both countries. Furthermore, as indicated by column (3) the initial within wage growth in Italy is higher than in Germany (14.4 and 6.6 respectively). The specifications of columns (2)-(5) include a quadratic term for tenure and for experience. Experience squared has the expected negative value. This illustrates a decreasing rate of the impact of experience on within job wage growth. Columns (4) in the German panel includes a dummy variable for skilled workers. In Germany workers that went through formal training (skilled workers) experience a lower within job wage growth than unskilled workers. Finally, column (4) of panel (a) and column (5) of panel (b) of table 7.4 control also for the completed duration of the current job. We find that more durable jobs offer lower wage growth in Italy and higher wage growth in Germany.

To summarize the results of this section, we find that young workers in Italy and Germany experience a higher within job wage growth than in Germany. Moreover, as we observed in the descriptive section, the two countries differ in the wage growth experienced by workers when changing firm. As we observed in the previous section, both in Italy and in Germany wages decrease with number of jobs as bad workers move. On the other hand, we find evidence that between wage growth is positive (though lower than within wage growth in Italy). This indicates that in Germany although movers are low quality, they do increase their wages by moving.

In the next section we analyze the time series properties of wage innovations using the sub-sample of young workers with 7 years of tenure in Germany, and, given the shorter length of the panel, the sub-sample of young workers with 6 years of tenure in Italy.

5.3 Variance Covariance structure of wage changes

In the previous paragraph we found that young workers in Italy have higher within job wage growth than Germany. In this paragraph we study the autocovariance structure of the residuals of wage growth, using the difference equation specified in the previous paragraph (equation (2)). The objective of the analysis of the covariance structure is to observe whether experience and tenure are sufficient statistics for the distribution of wage growth. If, for example, within firm wages grow only with tenure and experience, then $\Delta\tilde{w}_{jt}$ in equation (2) should be represented by a white noise process. If, on the other hand, there are also other reasons why wages grow within firm apart from tenure and experience, then these would show in a more complicated structure of the residuals. Our ultimate aim is to

establish whether $\Delta\tilde{w}_{jt}$ is iid. One structure that generates this is wage residuals being a random walk, as has been found by Topel and Ward for the US. If this is the case, we can characterize the distribution of future wages on the job as a function of current wages, tenure and experience. We will use this to develop more structural implications of a search model.
We compute $\Delta\tilde{w}_{jt}$ and then impose alternative processes on their covariance structure to understand the residual dynamics[25]. We identify the error structure of the residuals from the second moments of the residuals of the differenced equation. We first consider case where wages within firms grow systematically only with tenure and experience, and the residual process is white noise and measurement error.

We implement our testing procedure as follows. First, we estimate the residual wage growth within jobs, conditional on tenure and experience (see details below). Second, we compute the variance – covariance structure of the differenced residuals. Note that time t is measured in years of tenure.

Suppose first that all residual dynamics is due to measurement error (ME) which is independent over time, and denote
Let $\Delta\tilde{w}_{jt} = u_{jt} - u_{jt-1}$, with

$$E(u_{jt}) = 0, \qquad Var(u_{jt}) = s_{uu}$$

and

$$Cov(u_{jt}, u_{js}) = 0, \; t \neq s$$

In this case, the covariance structure for the residual wage changes $\Delta\tilde{w}_{jt}$ is given by

$$\begin{aligned} Cov[u_{jt}, u_{js}] &= 2s_{uu}, && \text{if t=s} \\ Cov[u_{jt}, u_{js}] &= -s_{uu}, && \text{if |t-s|=1} \\ Cov[u_{jt}, u_{js}] &= 0, && \text{if |t-s|>1} \end{aligned} \qquad (3)$$

Equation (3) describes the entire covariance structure of wages in terms of only one parameter: s_{uu}.

Below we will test whether the data rejects this process. We will do this by first estimating the covariance matrix of the differenced residuals and then imposing the above structure by Optimal Minimum Distance (OMD), following Abowd and Card (1989). Details are provided in the appendix.

An alternative residual structure would be one where wage growth is driven by an individual specific component, representing in levels an individual specific permanent

[25] Since we are working with first differences, differences in ability, and in backgrounds that are constant for each individual are wiped out. However, this does not exclude the possibility that wages grow differently with time according to individual specific growth rates. Below we will test for this hypothesis. The time scale in our analysis is years of seniority with a particular firm. Whenever a worker changes firm, we consider the new firm-worker pair as a new observation.

component g_i interacted with tenure (T). This would represent a situation where individual career profiles within firms differ not only in levels, but also in slope. Such processes have been suggested by Lillard and Weiss (1979). Individual specific growth rates in wages imply a fixed component in autocovariances of wages at any lag length.

In particular, consider the following error structure for within firm wages:
$w_{jt} = a_i + g_i T + u_{jt}$

where g_i is an individual specific rate of return to seniority.

Differencing results in
$\Delta w_{jt} = g_i (T - (T-1)) + \Delta u_{jt} = g_i + \Delta u_{jt}$,

which implies the following covariance structure:
$Cov[\Delta w_{jt}, \Delta w_{js}] = Cov[g_i g_i] + Cov[\Delta u_{jt}, \Delta u_{js}]$
Even if $Cov[\Delta u_{jt}, \Delta u_{js}] = 0$, then $Cov[\Delta w_{jt}, \Delta w_{js}] = Cov[g_i g_i]$ whatever the lag length. As we will show below, visual inspection of the variance-covariance matrix of the residuals rejects this hypothesis.

The last process we will test is one where we allow for a more complex earnings process, containing both random walks and serially-correlated transitory component[26]. We follow Topel and Ward (1992) by imposing a simple ARMA structure that allows testing whether within job residual wage growth follows a random walk. If this is the case, then this has important implications for further tests of whether wage- and mobility dynamics in our data is compatible with a search model, as explained in detail and tested in the next section.

We decompose the error term $\tilde{w}_{jt}$ as $\tilde{w}_{jt} = e_{jt} + h_{jt}$, where e is a systematic shock to wages and h is a purely transitory disturbance. If we allow the permanent component to follow an AR(1) process with parameter r >0, then the theoretical autocovariances of $\Delta\tilde{w}_{jt}$ are:

$$
\begin{aligned}
&Var[\Delta\tilde{w}_{jt}] = 2s_{vv}/(1+r) + 2s_{hh} \\
&Cov[\Delta\tilde{w}_{jt}, \Delta\tilde{w}_{j,t-1}] = -s_{vv}(1-r)/(1+r) - s_{hh} \\
&Cov[\Delta\tilde{w}_{jt}, \Delta\tilde{w}_{j,t-2}] = -s_{vv}(1-r)r/(1+r) \\
&\ldots\ldots \\
&Cov[\Delta\tilde{w}_{jt}, \Delta\tilde{w}_{j,t-k}] = -s_{vv} r^{k-1}(1-r)/(1+r)
\end{aligned}
\qquad (4)
$$

where s_{nn} is the variance of innovations to the systematic shock to wages e ($e_t = r * e_{t-1} + n_t$).

[26] In the literature, ARMA processes of low order, of order no greater than two, are considered. See for instance Topel and Ward, 1992 and Abowd and Card, 1989.

The three parameters $q = (r, s_{nn}, s_{hh})$ give a parsimonious description of the empirical covariance structure. As for the measurement error case, the estimation of the parameters is done through OMD.

In order to remove the systematic part of wage growth due to tenure and experience, we regress the differences in the log wages within job on tenure, tenure squared and experience squared, as we explain above. We obtain residuals from estimate specification (2) in table 7.5, and restricting our sample to individuals who have at least 7 years of tenure in the case of Germany, and 6 years of tenure in the case of Italy. We do this to obtain a sufficiently large number of second moments to estimate the three parameters explained above. Changes of the tenure minimum do not affect the key results we present below. The residuals of this regression constitute then the data vector

$$\tilde{y}_j = \begin{bmatrix} \Delta\tilde{w}_{j1} \\ \cdot \\ \cdot \\ \Delta\tilde{w}_{jT} \end{bmatrix}$$

which has dimension T, where T is the number of changes observed in the data set. In particular, if we restrict our sample on individuals who have at least 6 years of tenure, then T will be equal to 5.

The covariance matrix of these changes is represented by $C = (1/N)\sum_j (\tilde{y}_j \tilde{y}_j')$, and its variance-covariance matrix is given by the matrix of corrected fourth moments (see Abowd and Card (1989) for details on computation).

Estimates of the matrix C are reported in table 7.5. Panel A reports the variance covariance values for Italy, separately for typical and for Cfl workers. Panel B reports the variance covariances for Germany, first for skilled workers and then for unskilled workers. In particular, in table 7.5 we report the variances and covariances between $\Delta\tilde{w}_T$, where T represents the difference between two consecutive years of tenure (e.g. T=1 corresponds to the difference between one and two years of tenure, T=2 refers to the difference between two and three years of tenure, and so on). Covariances are reported below the diagonal, standard errors in Italics below, and correlations above the diagonal.

Tab. 7.5 – Variance Covariance matrices of the residuals of equation (2) by tenure[(a)].
Panel a - Italy

	TYPICAL WORKERS Covariance of:					CFL WORKERS Covariance of:				
	$\Delta\tilde{w}_1$	$\Delta\tilde{w}_2$	$\Delta\tilde{w}_3$	$\Delta\tilde{w}_4$	$\Delta\tilde{w}_5$	$\Delta\tilde{w}_1$	$\Delta\tilde{w}_2$	$\Delta\tilde{w}_3$	$\Delta\tilde{w}_4$	$\Delta\tilde{w}_5$
$\Delta\tilde{w}_1$	**0.0277** *0.009*	-0.4871	-0.0687	-0.0713	0.0594	**0.0361** *0.0091*	-0.6238	-0.0045	-0.0763	-0.0768
$\Delta\tilde{w}_2$	-0.0124 *0.0069*	**0.0234** *0.0079*	-0.1184	0.0070	-0.1219	-0.0173 *0.0068*	**0.0213** *0.0059*	-0.1366	0.1258	0.0857
$\Delta\tilde{w}_3$	-0.0012 *0.009*	-0.0019 *0.0013*	**0.011** *0.0024*	-0.1953	-0.1151	-0.0001 *0.001*	-0.0023 *0.0012*	**0.0133** *0.0047*	-0.2598	-0.0542
$\Delta\tilde{w}_4$	-0.0011 *0.0008*	0.0001 *0.001*	-0.0019 *0.0014*	**0.0086** *0.0018*	-0.1657	-0.0015 *0.0012*	0.0019 *0.0012*	-0.0031 *0.0019*	**0.0107** *0.0026*	-0.1209
$\Delta\tilde{w}_5$	0.0009 *0.001*	-0.0017 *0.001*	-0.0011 *0.0012*	-0.0014 *0.0007*	**0.0083** *0.0017*	-0.0014 *0.0015*	0.0012 *0.0012*	-0.0006 *0.0008*	-0.0012 *0.0009*	0.0092 *0.0018*

Panel B - Germany

	SKILLED WORKERS Covariance of:						UNSKILLED WORKERS Covariance of:					
	$\Delta\tilde{w}_1$	$\Delta\tilde{w}_2$	$\Delta\tilde{w}_3$	$\Delta\tilde{w}_4$	$\Delta\tilde{w}_5$	$\Delta\tilde{w}_6$	$\Delta\tilde{w}_1$	$\Delta\tilde{w}_2$	$\Delta\tilde{w}_3$	$\Delta\tilde{w}_4$	$\Delta\tilde{w}_5$	$\Delta\tilde{w}_6$
$\Delta\tilde{w}_1$	**0.0311** *0.0084*	-0.3595	-0.0326	0.0028	0	-0.0085	**0.0437** *0.0119*	0.1369	-0.0183	0.02971	-0.1410	-0.0065
$\Delta\tilde{w}_2$	-0.011 *0.007*	**0.0301** *0.0101*	-0.3482	-0.0261	0.0605	-0.0130	0.0083 *0.007*	**0.0841** *0.0239*	0.2008	0.0826	0.0203	-0.1077
$\Delta\tilde{w}_3$	-0.0012 *0.0008*	-0.0126 *0.007*	**0.0435** *0.0125*	-0.5748	-0.0302	0.0072	-0.0007 *0.0039*	0.018 *0.0098*	**0.0955** *0.0293*	-0.0402	0.0432	-0.1605
$\Delta\tilde{w}_4$	0.0001 *0.0006*	-0.0009 *0.0007*	-0.0238 *0.0101*	**0.0394** *0.0123*	-0.3879	0	0.0007 *0.0017*	0.0027 *0.0051*	-0.0014 *0.0034*	**0.0127** *0.0022*	0.2420	0
$\Delta\tilde{w}_5$	0 *0.0004*	0.0015 *0.0011*	-0.0009 *0.0012*	-0.011 *0.0076*	**0.0204** *0.0082*	-0.2487	-0.004 *0.0023*	0.0008 *0.0025*	0.0019 *0.0049*	0.0037 *0.0013*	**0.0184** *0.0055*	-0.1286
$\Delta\tilde{w}_6$	-0.0002 *0.0004*	-0.0003 *0.0013*	0.0002 *0.0014*	0 *0.0006*	-0.0047 *0.0034*	**0.0175** *0.0067*	-0.0003 *0.0016*	-0.0068 *0.003*	-0.0108 *0.0115*	0 *0.0012*	-0.0038 *0.0052*	**0.0474** *0.0316*

[(a)] covariances below the diagonal (standard errors are reported under the coefficient estimate), and correlations above the diagonal.
Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

Inspecting first the diagonal elements of table 7.5, we observe that in Italy there is some evidence for non-stationarity, in the sense of declining variances of $\Delta\tilde{w}_T$. This is observed also in the German data.

For both Italy and in Germany covariances at lags larger than one are not significantly different from zero[27]. This strongly suggests the absence of an individual specific wage growth component, as we have discussed above. This relatively simple covariance structures suggests that wage changes might be generated by some relatively parsimonious statistical model. However, we reject the hypothesis that the error process can be

[27] These results are similar to those obtained by Topel and Ward (1991) and Abowd and Card (1989).

represented by a simple measurement error model.[28] A more complex process for the residual earnings structure which allows for an AR(1) process as well as a serially-correlated transitory component, as explained at the beginning of this chapter.

Table 7.7 reports the estimates of the vector *?* (made up of the three parameters s_{nn}, r and s_{hh}) for the four samples, Cfl and Typical workers in Italy and Skilled and Unskilled workers in Germany.

Tab. 7.7 Estimated error structure – AR(1)

		Italy		Germany	
		Cfl	**Typical**	**Skilled**	**Unskilled**
structural coefficients	s_{nn}	0.0068	0.006	0.0052	0.0127
	Stde	0.0011	0.0014	0.0005	0.0023
	t-stat (H_0: s_{vv} =0)	6.121	4.376	10.581	5.513
	r	1.0288	0.8846	0.9805	1.0273
	Stde	0.0929	0.119	0.0335	0.0601
	t-stat (H_0: ? =0)	11.071	7.433	29.250	17.089
	t-stat (H_0: ? =1)	0.330	-0.969	-0.582	0.454
	s_{hh}	0.0015	0.0012	0.0062	0.0011
	Stde	0.0006	0.0007	0.0016	0.001
	t-stat (H_0: $s_{??}$ =0)	2.482	1.736	3.743	1.042
Minimum Dist. Stat.		12.34	10.53	17.98	87.9
	(d.o.f.)	12	12	18	18
	P value	0.419	0.569	0.457	0

Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

In table 7.7, s_{nn} is the variance of innovations to the systematic shock to wages, s_{hh} is the variance of the transitory disturbance, and r is the parameter of the AR(1) process assumed to be followed by the permanent component. We report the test statistics of interest for the parameters of the vector J (the null hypothesis of zero for the sigmas, and also the null of one for r). The estimate for r is not materially different from unity both in Italy and Germany. Therefore, current wage, adjusted for predictable growth due to accumulated experience and seniority, is a good predictor of future wages on a particular job.

If $\Delta\tilde{w}$ is i.i.d., then the evolution of wages within a job is, therefore, a random walk with drift. Past wage innovations predict future growth, and the current wage, experience and tenure are sufficient statistics for the distribution of future wages on a job.
A similar structure is found using NLSY data for the US by Topel and Ward (1992). In particular, they find a value for s_{nn} equal to 0.0173, that r is equal to 0.97, and that s_{hh} is

[28] See appendix B.

equal to 0.0128.

The analysis of the time series properties of $\Delta\tilde{w}_T$ conducted in this paragraph is functional to our subsequent analysis of mobility decisions of young workers in Italy and in Germany. In section 6 we will in fact provide a formal analysis of mobility, on the basis of the evidence obtained about within wage growth, and about between wage growth. Regarding within wage growth, in the present paragraph we showed that the evolution of wages within jobs approximates a random walk with drift both for Italy and for Germany. Regarding between wage growth the evidence indicates a positive between job wage growth for Germany, but no effect of job changes on wages for Italy. While the two countries differ in the wage growth experienced by workers when changing firm, we find that young workers in Italy and Germany have similar within job wage growth.

6. Does a simple search model fit the Italian and German evidence?

In the descriptive analysis of the previous sections we found that young workers in Italy and in Germany are rather immobile. However, while in Germany, as experience accumulates, the frequency of job changing declines gradually, in Italy there is evidence of job changing only at the very beginning of the careers. Furthermore, in Italy within wage growth is low: average wage growth within jobs during the first 10 years is about 3.5 percent, and 5.6 percent for entrants. Within wage growth in Germany is not substantially different from that observed in Italy. Finally, and most remarkably, between job wage growth is on average negative though not significantly different from zero for Italy. In Germany, on the other hand, between wage growth is higher than within wage growth.

In this section, we follow Topel and Ward (1992) and explore the implications of job search for the relationship between experience, tenure, and wages, and the probability that a worker leaves the firm.

6.1 A Simple Model of Mobility

Consider an individual who is employed. During each period Δt the individual receives a wage offer w^0 from a potential new employer. These offers are drawn from a known wage offer distribution, whose location differs across individuals. Offers depend on (observable) experience. Then the probability that the worker receives an offer below some threshold z is given by

$$\Pr ob(w^0 < z; X) = G(z; X), G_X \leq 0.$$

The last inequality characterizes how wage offers depend on experience. If $G_X < 0$, expected wage offers are increasing with experience. One reason could be that productivity is increasing with experience. Notice that observed wage offers (in other words, accepted wage offers) will always increase with experience, even if there is no human capital accumulation.

Now consider the distribution of internal wage offers. Our analysis above (paragraph 7.3) has shown that the evolution of wages within jobs follows roughly a random walk with drift. Therefore, the probability distribution of new internal wage offers w^w depends on the previous wage, experience and tenure only; in fact, the triplet w, T, X is a sufficient statistic of current and future wage rise on the job. Conditional on the current wage, previous wages do not contain any more information about future wage or wage growth. The probability to receiving an internal wage offer that is smaller than y is given by

$$\Pr ob(w^w < y; w, X, T) = F(y; w, X, T)$$

Higher current wages increase the distribution of future offers: $F_w < 0$. Furthermore, concavity of the within-job wage profile (as we have established above) suggests that the expected wage growth is non-increasing in experience and tenure: $F_X \geq 0; F_T \geq 0$.

This is a very simple model for wage changes and mobility within and between jobs. These two decision rules, together with the information set for future within-job wage growth being determined by current wages, experience and tenure only, imply a reservation wage $R(w, X, T)$, being the external wage offer that makes individuals just indifferent between remaining on the current job, and leaving the current job to take on another employment. This reservation wage is determined by

$$V(R(w, X, T), w, 0) = V(w, X, T),$$

where the left hand side is the value from accepting an outside offer that pays wage w (notice that any job change leads to the loss of tenure), and the right hand side is the expected discounted present value of lifetime wealth from searching on a job that currently pays w. Denoting the probability of receiving a job offer in the period Δt by p, the probability of leaving the job at tenure T, given that the individual is still on the job is

$$q(w, X, T) = p \Pr ob(w^0 > R(w, X, T)) = p[1 - G(R(w, X, T); X)] \qquad (5)$$

with the following partial derivatives: $q_w < 0$: as higher wages increase the value of the current job, they will decrease the conditional probability of leaving; $q_T > 0$: as tenure profiles are concave, new jobs at the same wage are more valuable than older jobs, as they offer higher expected wage growth. The sign of q_X is not so straightforward. The separation probability increases in experience, because (as we have pointed out above) wage offers increase with experience, *conditional* on the current wage; this is the direct effect. However, experience does also affect the reservation wage – through its effects on the current as well as the alternative offer – and this effect can not be signed. However, as Topel and Ward (1992) point out, the reservation wage is independent of experience at the beginning of a new job (T=0), as the current wage is the least acceptable wage. Therefore, at T=0, mobility will be increasing with experience, as only the direct effect (experience increases outside offers) will be present. The idea is that of two identical workers, both receiving the same wage, then one with higher levels of experience is employed in the poorer match.

This is an implication that seems apparently in contrast to findings presented in section 6.2, which clearly states that mobility decreases with experience. In that section, we have explained this as being due to individuals climbing up the search distribution, thus reducing the probability of receiving an offer that is better than the current one. Furthermore, we have also shown that mobility decreases with tenure. This was explained by the accumulation of job-specific human capital, requiring an outside match to be higher for people with high tenure.

Notice that the implications derived here hold conditional on current wages: the current wage controls for any heterogeneity in match qualities, which were the driving force for the decreasing probabilities in experience above. Topel and Ward (1992) argue that, therefore, a direct test for wage offers rising with experience is that mobility must rise with experience, conditional on current tenure and current wages.

The approach Topel and Ward follow is to estimate job leaving probabilities using a discrete time hazard model, concentrating on the effects of current wages, tenure and experience on job separations. They point out that there may be in addition individual specific differences in mobility decisions, and in their estimation approach they take account of this by conditioning on fixed effects. This procedure leads in non-linear models to biased estimates if the number of time periods is small. They restrict their sample to individuals with more than 13 years of potential experience; we do not have sufficiently long observation window, at least in the case of Italy. Topel and Ward's paper, the structural nonlinear analysis did not lead to any change in the conclusions they drew from descriptive regressions.
Our analysis below will concentrate on the more descriptive exposition. We estimate linear probability models for ease of interpretation; logistic regressions yield basically the same results. Also, conditioning on individual specific fixed effects did not change the basic conclusions of the analysis we describe below.

The empirical implications of the model we have described above are as follows:

a. the unconditional probability of changing should decrease with experience;
b. conditioning on tenure and experience, larger wages should decrease the probability of changing;
c. conditioning on tenure and wages, the probability of changing should increase with experience if experience increases outside offers;
d. conditioning on tenure and wages, the probability of changing should increase with tenure because of the concavity of the tenure profile.

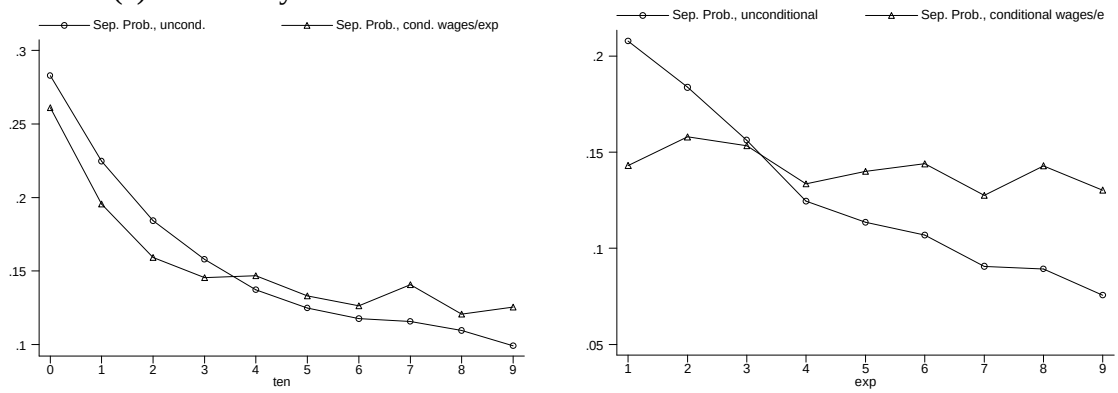
In the next section we test these implications. We do that by estimating probability models for changing firm. Our conditioning variables include job tenure, labor market experience, and the current wage. In addition we condition on firm size. We have estimated models separately for skilled/unskilled workers in Germany, and Cfl/typical workers in Italy. Results for the two groups were similar in both cases. We therefore present pooled estimates below, but we condition on a skill/Cfl dummy.

6.2 Empirical results

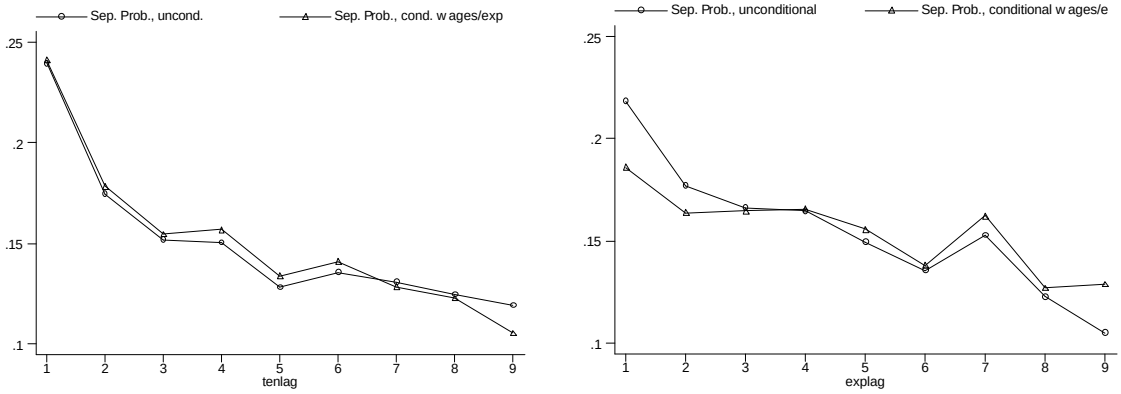
In the following we test the empirical implications of the search model outlined in the previous section using both the German IAB data and the Italian Inps archive.

In Figure 8.1 we plot the unconditioned and conditioned separation probability by tenure and experience for Germany and Italy (panel (a) and (b) respectively)[29].

Fig. 8.1 – Separation Probability by tenure and experience
Panel (a) – Germany



Panel (b) – Italy



Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

Let us first consider the exit probability by experience. Second column of figure 8.1 shows that the unconditional separation probabilities decline with experience both in Italy and in Germany. We observe that, in both countries a worker with nine years of labor market experience has less than half the probability to leave the job than a worker with only one year of experience. This decline is in line with the prediction of the theory (point (a) of the above mentioned empirical implication), and with our earlier descriptives (section 6.2). Topel and Ward (1992) find a similar evidence for the US using the LEED, the Longitudinal Employee-Employer Data.

[29] The graphs plotted in figure 8.1 refer to the whole sample of young workers in the two countries. We have also looked at the sub-sample of young workers that are non-employed for less than a month in between two jobs. Results do not differ (see appendix).

However, according to the theory, conditioning on the wage, this pattern should change (point (c) of the empirical implications listed above). In particular, conditioning on tenure and wages, the probability of changing should increase with experience if experience increases outside offers. Figure 8.1 plots, besides the unconditional exit probability, the conditional probability of a separation. Wage constant, in Germany a worker with nine years of experience has a probability to separate which is only 20 percent lower than a worker at his first year of experience (compared to an almost 64% decrease of the unconditional exit probability). In Italy, the percentage is higher (35% decrease) but still lower than when considering the unconditioned exit probability. Conditioning on tenure and wages, therefore, we do not observe an increase with experience in the probability of changing neither in Germany, nor in Italy. The US evidence, on the contrary, reports an increasing trend of the exit probability once conditioning on wages (Topel and Ward, 1992).
The prediction of the theory that when mobility is conditioned on the wage we should observe an increasing trend of job separation by experience, rests on the hypothesis that wage offers increase with experience. Neither for Italy nor for Germany we observe an increasing trend of job separation by experience after conditioning on wage. This is, on the other hand, observed for the US. The US evidence has been interpreted in favor of a search based model of job changing (Topel and Ward, 1992).

Another implication of the theory (point (b) in the list above) is that, conditioning on tenure and experience, higher wages should decrease the probability of changing. The effect of wages may be nonlinear. To take account of that, in estimating the exit probability we include dummy variables, indicating the quintile in the overall wage distribution in which the individual falls. These are the results we report in the tables and on which the graphs are based. We have also included a polynomial of degree three in log wages; results (not reported) were very similar.

While the graphs reported in figure 8.1 condition on a set of dummies, in the regressions reported in table 8.1 we have summarized these coefficients by grouping experience and tenure in five categories (the first refers to less than one year, the second one to one year, the third one to two years, the fourth groups years from 3 to 6, and the fifth refers to more than 6 years), and firm size in six categories (less than 10, 10-100, 100-500, 500-1000, 1000-5000, and more than 5000 employees).

Table 8.1 reports the estimation results, first for Germany and than for Italy, of regressing the exit probability on a number of covariates. For reference, column (1) reports the coefficients when only experience and a dummy for skilled workers in Germany (Cfl workers in Italy) are included among the regressors, and column (2) includes among the regressors only tenure and a skill level dummy (Cfl dummy for Italy). The third column considers among the regressors experience, tenure, a skill level dummy (Cfl dummy for Italy) and the size of the firm (grouped in four categories). Besides these regressors column (4) considers also the earnings of the worker, divided in 5 quintiles, and the sector of activity. Finally, column (5) in accord with the theory, which requires the experience effect to be evaluated at the beginning of a job, we also allow for an interaction between tenure and experience.

Table 8.1 – Exit Probability (different specifications) - Panel (a) Germany

	(1)	(2)	(3)	(4)	(5)
	Unconditional, Experience	Unconditional, Tenure	No wage included	Wage included, no interaction	Wage included interaction included
Experience=1year	-0.011		0.039	0.051	0.051
	(2.07)*		(5.44)**	(7.19)**	(7.18)**
Experience =2years	-0.035		0.044	0.067	0.067
	(5.93)**		(5.66)**	(8.58)**	(8.55)**
Experience >2&<7years	-0.088		0.012	0.054	0.054
	(18.28)**		(1.76)	(7.74)**	(7.74)**
Experience >6years	-0.132		-0.015	0.042	0.042
	(16.39)**		(1.28)	(3.56)**	(3.45)**
Skilled worker	-0.055	-0.046	-0.049	-0.013	-0.013
	(12.41)**	(10.46)**	(11.20)**	(2.85)**	(2.85)**
Tenure=1years		-0.053	-0.073	-0.066	-0.066
		(10.34)**	(11.15)**	(10.14)**	(10.04)**
Tenure=2years		-0.093	-0.114	-0.103	-0.103
		(15.69)**	(14.53)**	(13.34)**	(12.82)**
Tenure>2&<7years		-0.137	-0.130	-0.122	-0.120
		(28.30)**	(18.47)**	(17.44)**	(12.36)**
Tenure>6years		-0.167	-0.132	-0.126	-0.122
		(15.89)**	(8.77)**	(8.44)**	(5.23)**
Firm size>9&<100			-0.017	0.005	0.005
			(4.03)**	(1.30)	(1.29)
Firm size>99&<500			-0.018	0.016	0.016
			(2.85)**	(2.52)*	(2.52)*
Firm size>499&<1000			0.019	0.058	0.058
			(1.13)	(3.54)**	(3.54)**
Firm size>999&<5000			-0.031	0.016	0.016
			(2.34)*	(1.23)	(1.23)
Firm size>4999			-0.110	-0.050	-0.050
			(13.54)**	(5.75)**	(5.75)**
2nd wage quintile				-0.045	-0.045
				(7.72)**	7.72)**
3rd wage quintile				-0.108	-0.108
				(17.71)**	(17.70)**
4th wage quintile				-0.141	-0.141
				(22.14)**	(22.13)**
5th wage quintile				-0.151	-0.151
				(21.97)**	(21.92)**
Experience*tenure					-0.000
					(0.20)
Constant	0.242	0.247	0.254	0.268	0.268
	(52.55)**	(60.00)**	(47.33)**	(47.36)**	(47.36)**
Observations	37892	37892	37892	37892	37892
p-value F test: Experience profile >1 equal to each other			Prob>F=0.000	Prob>F=0.0975	Prob>F=0.1200

Absolute value of t statistics in parentheses

* significant at 5%; ** significant at 1%

Reference group: experience= less than one year; tenure= less than one year; unskilled worker; firm size<10 workers; lowest wage quintile.

Source: IAB dataset 1980-1995, own calculations

Panel (b) Italy

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
	Unconditional, experience	Unconditional, tenure	No wage included	Wage included, no interaction	Wage included, interaction incl.
Experience=1year	-0.057		-0.031	-0.036	-0.039
	(9.96)**		(5.54)**	(6.41)**	(6.97)**
Experience =2years	-0.099		-0.045	-0.051	-0.061
	(14.71)**		(6.84)**	(7.86)**	(9.29)**
Experience >2&<7years	-0.116		-0.047	-0.056	-0.087
	(19.56)**		(7.98)**	(9.33)**	(12.99)**
Experience >6years	-0.137		-0.054	-0.062	-0.147
	(9.38)**		(3.81)**	(4.40)**	(8.98)**
Cfl worker	-0.075	-0.048	-0.039	-0.028	-0.027
	(16.16)**	(10.70)**	(8.62)**	(6.24)**	(5.96)**
Tenure=1years		-0.174	-0.165	-0.160	-0.165
		(30.21)**	(28.36)**	(27.67)**	(28.55)**
Tenure=2years		-0.229	-0.220	-0.211	-0.226
		(34.67)**	(33.05)**	(31.87)**	(33.36)**
Tenure>2&<7years		-0.261	-0.245	-0.237	-0.278
		(44.34)**	(40.56)**	(39.29)**	(38.39)**
Tenure>6years		-0.279	-0.258	-0.245	-0.359
		(19.18)**	(17.51)**	(16.77)**	(19.60)**
Firm size>9&<100			-0.014	-0.002	-0.002
			(2.79)**	(0.41)	(0.34)
Firm size>99&<500			-0.029	-0.015	-0.014
			(4.26)**	(2.03)*	(2.00)*
Firm size>499&<1000			-0.054	-0.047	-0.046
			(4.36)**	(3.75)**	(3.70)**
Firm size>999&<5000			-0.065	-0.055	-0.055
			(6.30)**	(5.21)**	(5.17)**
Firm size>4999			-0.068	-0.065	-0.065
			(6.80)**	(6.03)**	(6.01)**
2nd wage quintile				-0.023	-0.021
				(3.38)**	(3.20)**
3rd wage quintile				0.005	0.005
				(0.73)	(0.77)
4th wage quintile				0.035	0.035
				(5.13)**	(5.04)**
5th wage quintile				0.040	0.039
				(5.62)**	(5.52)**
Experience*tenure					0.005
					(10.28)**
Constant	0.261	0.309	0.343	0.288	0.295
	(68.81)**	(94.68)**	(73.29)**	(26.20)**	(26.84)**
Observations	29733	29733	29733	29731	29731
p-value F test: Experience profile >1 equal to each other			Prob>F=0.0302	Prob>F =0.0003	Prob > F =0.00
Absolute value of t-statistics in parentheses					

Reference group: experience<1 year; tenure<1 year; typical worker; firm size<10 workers; lowest wage quintile.
Source: Inps archive 1986-1996, own calculations.

Table 8.1, shows that the empirical evidence on the relationship between wages and the probability to change job, after conditioning on tenure and experience, is different for Italy and for Germany. In particular, in line with the implication of the theory, and with the empirical literature on the US, we find that in Germany, conditioning on tenure and experience, higher wages decrease the probability of changing jobs. In Italy, on the other

hand, we observe on average positive effect of the current wage on the probability to separate. In particular, the analysis by percentile, indicates, with respect to the reference category of workers with wages in the lower percentile, first a decrease and than an increase of the relationship between the wage level and the probability to exit (column (4) of table 8.1)[30]. In other words, at lower part in the wage distribution, the separation probability decreases with wages; however, at higher levels of wages this relationship reverses. One reason could be that individuals with higher propensity to move are also high earners. To check this, we condition in addition on individual specific effects (results not reported). Notice that identification is an issue here as it depends on job changes within an individual. We obtain nevertheless precise estimates on the wage coefficients, which are following the same pattern than those described in the table. This is an odd finding, and clearly contrary to the implications of a pure search model.

To check for regional differences, we have tested the joint significance of region dummy interactions (where the region dummy is for the North-East) with tenure (grouped in 5 categories), experience (grouped in 5 categories), and earning (divided in 5 quintiles) in the exit probability regression. The coefficients on the interaction terms measure the difference between the North-East of the country relative to the rest of the country for the particular category (wages, experience, tenure). As I distinguish between 5 quintiles of wages, 5 groups of experience, and 5 groups of tenure, I am testing the joint significance of each of these categories with the North-East dummies. The tests do not suggest that the NE is different in the way experience, tenure, and wages affect separation probabilities from the rest of the country[31].

There are some obvious explanations for this trend observed in the Italian data. There may be non-pecuniary, but match specific characteristics which affect mobility. Such match-specific characteristics may compensate for low wages, and lead workers to stay in a low wage job.

In the 3rd to 5th specification of the exit probability estimate, we have included the size of the firm where the worker is employed, grouped in 6 categories. In Italy we observe a decreasing propensity to change firm the larger is the firm where the workers is currently employed (see columns 3-5, table 8.1, panel (b)). Although there may be several interpretation of this fact, one is that large firms internalize transitions that would show if firms were of smaller size. We are referring to the existence of internal labor markets that allow workers to develop their career within the firm. In large organizations, there may not be lower mobility among tasks, but this is internalized within the firm.

Finally, let us consider the empirical implications on the relationship between exit probability and tenure (point (d) of the above list of empirical implications of the theory).

[30] We also looked at the relationship between wages and the probability to exit for the sub-sample of workers that experience a non-employment spell between two consecutive jobs shorter than a month. We get substantially the same results both for Italy and for Germany.

[31] The respective p-values for the F-tests are: F-tests: Regional difference (North-East/Rest of Italy) for wages, Prob>F = 0.8152; Regional difference (North-East /Rest of Italy) for experience, Prob>F = 0.1703; Regional difference (North-East /Rest of Italy) for tenure, Prob>F = 0.6557.
We have done the same exercise distinguishing the rest of Italy in 3 macro regions (Nort-West, Centre and South of Italy). Again, there are no significant differences between these macro-regions and any of the rest of the country.

The theory predicts that conditioning on tenure and wages, the probability of changing job should increase with tenure, because of the concavity of the tenure profile. This pattern of the exit probability by tenure is plotted in the first column of figure 8.1, and reported in table 8.1. We observe that, as for the exit probability by experience, the unconditional separation probabilities decline with experience both in Italy and in Germany (column (2) of table 8.1). However, differently to what observed for the probability to separate by experience, the pattern by tenure is substantially unchanged when considering the conditioned probability to separate from the firm (see both graph 8.1, and table 8.1 columns (4) and (5)). The same result is obtained for the US by Topel and Ward (1992). This result is not surprising. The prediction of an increase of the probability to separate by tenure was, in fact, based on the hypothesis of concavity of wage growth profiles on successive jobs. Only under the assumption of concave tenure profiles, new jobs offer higher expected wage growth, and among young workers, the evidence in favor of this hypothesis is not that strong (tab.7.4, section 7.2[32]).

The main findings of this section can be summarized as follows:

a. in line with the empirical implications of the model, the unconditional probability of changing job decrease with experience both in Italy and in Germany;
b. we find evidence of the expected decrease in the exit probability due to larger wage, when conditioning on tenure and experience, for Germany but not for Italy;
c. according to the theory, conditioning on tenure and wages, the probability of changing should increase with experience if experience increases outside offers; we don't find evidence of this reversal of the pattern of exit probability nor in Germany nor in Italy. This is evidence against the hypothesis that wage offers grow with experience; the opposite is found in the empirical literature for the US (Topel amd Ward, 1992) and this has been interpreted as evidence in favor of search based models of job search;
e. finally, the implication of the theory that, conditioning on tenure and wages, the probability of changing should increase with tenure is not supported nor by the evidence for Germany nor by Italy. This empirical implication of the model, however, is the weakest among those considered here, given that rests largely on the hypotheses of the concavity of the tenure profile (of which we do not have evidence among young workers).

7. Discussion and Conclusions

In this paper we investigate mobility and wage growth of male workers. We concentrate our analysis on young workers, and we select the samples in a way that allows us to construct complete work histories for these workers, from the moment they enter the labor market onwards.

While there exists a large literature on wage and mobility for the US, little evidence is available for Europe. First on the light of the theories of job mobility outlined above we interpret the evidence on job and wage mobility that we observe for Italy and Germany.

[32] Conditional on experience, the squared effect of tenure in the within wage growth regression is insignificant.

Then, on the basis of the results of the descriptive sections, following Topel and Ward (1992), we propose a simple search framework that explains why workers change firm.

There are reasons to believe that the European labor markets differ from the US labor market. They are, among other things, characterized by a much higher degree of institutional restrictions than the US. Moreover, the US and the European countries differ considerably in the degree of investment in on-the-job training. This is relatively lower in the US than in many European countries.

We choose for our analysis two countries: Germany, the largest European economy with a labor market historically characterized by a strong investment in on-the-job training, and Italy, a highly institutionalized country with a very rigid earnings structure, but full of leakages that allow getting around these restrictions.

We concentrate our analysis on young workers younger than 17 years in 1986 in Italy, and workers who have been not older than 15 years in 1980 in Germany. These selection criteria allow us to observe them from the entry to the labor force onwards. These workers in Germany either start working without further training or they go through the apprentice scheme. In Italy there is no clear dual entry mode in the labor market. Among the alternative young workers have in Italy, we consider entries with typical open-end contracts, and entries via a transition period of employment with a "Training and Work" contract. To our knowledge our analysis is the first to study in parallel wage growth and job mobility of young workers in the Italian and the German labor markets.

As comparison, we also look at the US. Our comparison refers to existing literature on young workers mobility (e.g. Topel and Ward, 1992). We also provide descriptives for the US, based on data from the NLSY.

For our analysis we use administrative data covering the period between 1986 and 1996 for Italy and between 1980 and 1995 for Germany. Because of the nature of the data we use, our analysis is limited to the regular labor market of the private sector. We follow Italian workers for 10 years, and German workers for 15 years. The US NLSY data we use for the descriptive analysis on mobility cover the period from 1979 to 1995.

We first investigate mobility of workers. Then we investigate wages and wage growth, both within firms and between firms.

Our results are interesting and surprising in many respects. Among the descriptive findings we observe that

- First, young workers at their first entry in the labor market in Italy and in Germany are rather immobile. While for the US, young workers are on their 7^{th} job after 10 years of potential labor market experience, in Italy and Germany they are almost on their third job only (no difference is observed between typical and Cfl workers in Italy).
- Second, in the US wage increases within jobs are substantial at the start of a worker's career: about 14 percent for new entrants, and about 7 percent on average (Topel and Ward, 1992). While in Italy, we observe a similar wage growth within jobs, within wage growth in Germany is much lower.

- Finally, and most remarkably, while job shopping is a very important factor for wage growth in the US - between job wage growth for young workers is on average about 11 percent - such between job wage growth is lower than within wage growth for Italy. This is true regardless of the entry mode in the labor market. In Germany, on the other hand, between wage growth is higher than within wage growth, though still much lower than in the US.

After examining the 'unconditional' patterns in the data, we introduce more elaborate error structures to take into consideration the fact that workers' mobility is likely to be influenced by unobservables that we cannot directly control for. An error structure made up of a time invariant person specific random effect plus white noise fits both the Italian data and the German data, particularly for skilled workers. We conclude that tenure and experience are sufficient statistics for the distribution of wage growth, and that the evolution of wages within jobs approximates a random walk with drift.

Finally we explore the implications of job search for the relationship between experience, tenure, and wages, and the probability that a worker leaves the firm. Following Topel and Ward (1992) we provide a formal analysis of mobility, on the basis of the evidence obtained in the previous sections about between wage growth and about the evolution of wages within jobs. The main findings are that:

- first, in line with the empirical implications of the search model, the unconditional probability of changing job decrease with experience both in Italy and in Germany.
- Second, conditioning on tenure and wages, the probability of changing job does not increase with experience, as the theory would imply. In Italy it declines and in Germany it is rather flat. The opposite is found in the empirical literature for the US (Topel and Ward, 1992) and this has been interpreted as evidence in favor of search based models of job search.
- Third, as implied by the theory, when conditioning on tenure and experience, we find evidence of an inverse relationship between exit probability and wage. However we only get this result for Germany and not for Italy.
- Finally, the implication of the theory that, conditioning on tenure and wages, the probability of changing should increase with tenure is not supported nor by the evidence for Germany nor by Italy.

The low mobility of young workers in Italy can be traced back to a number of factors. First, we found evidence that within wage growth is higher than between wage growth, and, second, that wage offers decline with experience. The finding that, conditioning on tenure and wages, the probability of changing job declines with experience, is evidence that wage offers decrease with experience. This is compatible with the evidence that the little mobility we observe for these workers is concentrated at the very early stages of their careers. Given that the longer they stay in the market the lower the external wage offers they receive, workers move at the very beginning of their career, but as experience accumulates they have lower incentive to separate from the current employer. This evidence is in contrast to what would be expected in a search framework.

About the evidence of a lower between than within wage growth (we find evidence of this also when considering only job-to-job transitions) there are several interesting implications. Within the search model we have considered, the mobility decision depends on a

reservation wage $R(w, X, T)$, being the external wage offer that makes individuals just indifferent between remaining on the current job, and leaving the current job to take on another employment. This assumption may be fallacious in the case of Italy for different reasons. Most importantly, there may be non-pecuniary reasons for sticking with the current employer. Second, there may be pecuniary reasons however not visible in the official records we are using for the analysis. In both cases, the observed last wage does not correspond to the reservation wage. Examples of pecuniary reasons not visible in the official wage figures are money transfers that occur either via a variety of benefits offered by the employer (e.g. payment of health insurance for the whole family of the worker, company car), or via transfers of money not reported in the company books. Supporting this last observation is the estimated size of the black economy in Italy. The average size of the shadow economy in Italy is, in fact, well above not only the size of the black economy in Germany, but it is higher than the average of the OECD countries[33]. It might be that job mobility in this sector is larger than that of the regular sectors of the economy. However, my analysis is limited to the regular, dependent workers of the private sectors both in Italy and in Germany and does not intend to draw conclusions on the mobility of workers in the overall economy.

An aspect that could influence worker's mobility is the development of the renting market. In particular, in Italy the relatively smaller renting market may hamper the movement of young workers. Recent literature for the UK has found evidence that the housing market may restrict mobility: mobility of low-skill workers is low with respect to that of graduates, and this has been related to the less efficient functioning of the housing market for low skill/education people (Gregg, Machin and Manning, 2004). Similar considerations may be true for Italy: here the renting market is remarkably tight as compared to other countries. This may be one factor in explaining the small geographic mobility in the mid `80s to mid `90s. In fact, Contini et al. (2002) find small geographical movement of workers: more than 95 percent of young workers in Italy (men between 15 and 20 years old) do not move between macro-region when changing job.

Non-pecuniary reasons for not changing job may have to do with the trustful and loyal relationship established between the worker and the employer after some time they work together, or more generally with the high social capital observed in Italy. This characteristic is believed to be an important lubricant to the economic system (see e.g. Glaeser, Laibson, Scheinkman and Soutter, 1999). However, this highly developed social and familiar network also explains the higher cost of breaking social relations, and this clearly has a considerable impact on job mobility decisions. This evidence supports the hypothesis that young workers in Italy do not change jobs for wage reasons only, but that reasons other than the official job wage are more relevant in determining mobility of these workers. Workers do not move, regardless of higher external offers, if the quality of their present working environment is good or anyway familiar to them. On the other hand, they may change job, regardless of a lower external wage offer, if the new job offers a better working and living environment. This opens to future research on the impact on mobility of non-pecuniary remunerations, and of those components of the wage that do not show in the official records.

The evidence for Germany is different from that for Italy in many respects. First,

[33] In particular, for the years we consider in our analysis, the average size of the black economy in Italy as a percentage of the GDP has been estimated to be around 26%. The average OECD figure is of less than 16%, in Germany is 13.5%, and in the US 8.8% (source: Currency demand approach, Schneider (2000)).

conditioning on tenure and wages, we observe a rather flat probability of changing job by experience. Within the interpretation of our simple search model, this means that wage offers stay constant with experience. Second, even though we have observed that in Germany the average number of jobs experienced within the first year in the labor market is very low, as experience accumulates workers keep changing job. The pace at which German workers move from one job to another is definitely not as high as in the US, but does not come to a stop after few years of labor market experience as to does in Italy. This is in line with our finding about the flat trend of external wage offers. External wage offers do not increase with experience, but are on average higher than within job's.

Young workers in Italy do not seem to change jobs for wage reasons only, but reasons other than the official job wage seem to be more relevant in determining. Workers may not move, regardless of higher external offers, if the quality of their present working environment is good or anyway familiar to them. On the other hand, they may change job, regardless of a lower external wage offer, if the new job offers a better working and living environment. One hypothesis to explain the Italian evidence is stigma. A negative stigma may be attached to young workers that do not develop a loyal relationship with an employer that endures in time. An alternative explanation of the low mobility among young workers in Italy might be that job search does in fact occur, but at an earlier stage, and before workers enter the labor market. While the empirical evidence for Italy is not in favor of a search model of job changing, our evidence for Germany is more similar to what found by the existing literature on the US, where the job changing activity of young workers is consistent with job-matching models of search.

8. References

Abowd J. and Card D., "On the Covariance Structure of Earnings and Hours Changes", *Econometrica*, vol.57, n.2, Mar. 1989, pp.411-445

Acemoglu D. and Pischke J., "Why Do Firms Train? Theory and Evidence", *The Quarterly Journal of Economics*, Vol. 113, No. 1, Feb. 1998, pp. 79-119.

Altonji J. and Shakotko R., "Do Wages Rise with Job Seniority", *The Review of Economic Studies*, vol.54, n.3, Jul. 1987, pp.437-459

Altonji J. G. and Williams N., "The effects of Labor Market Experience, Job Seniority and Job Mobility on Wage Growth", mimeo, 1996

Altonji J. G. and Williams N., "Do Wages Rise with Seniority? A Reassessment", mimeo, 1997

Antel J., The Wage Effects of Voluntary Labor Mobility with and without Intervening Unemployment, *Industrial and Labor Relations Review*, Vol.44, N.2, Jan. 1991, pp.299-306

Bartel A., "Earnings Growth on the Job and Between Jobs", NBER working paper n.117, 1980, pp. 123-137

Bartel A. and Borjas G., "Wage Growth and Job Turnover: An Empirical Analysis", *Studies in Labor Markets*, Sherwin Rosen, ed. (Chicago: University of Chicago Press for NBER), 1982

Bell B., R. Blundell and J. Van Reenen, 'Getting the Unemployed back to Work: the Role of Targeted Wage Subsidies', wp no. W99.12, Institute for Fiscal Studies, London, 1999

Bender S., Haas A. and Klose C., "IAB Employment Subsample 1975-1995. Opportunities for Analysis Provided by the Anonymised Subsample", IZA Discussion Paper n. 117, February 2000

Bertola G., "Job Security, Employment, and Wages", *European Economic Review*, n.34, 1990, pp. 851-886

Blundell R., A. Duncan and C. Meghir, 'Estimating Labour Supply Responses using Tax Reforms', *Econometrica*, 1998

Blumen I, Kogen M. and McCarty P., *"The Industrial Mobility of Labor as a Probability Process"*, Itacha, NY: Cornell Studies in Industrial and Labor Relations, Vol.6, 1955

Brunello G. and Brugiavini A., "An empirical analysis of interfirm mobility in Italy", *Giornale degli economisti e annali di economia*, fascicolo 1, vol.57, 1998, pp. 1 – 34

Burdett K., “A Theory of Employee Job Search and Quit Rates”, *American Economic Review*, LXVIII, 1978, pp. 212-20

Buttler F., Brandes W., Dorndorf E., Gaum W. and Walwei U, “Flexibility and Job Security in the Federal Republic of Germany”, Technical Report 1, SAM working paper, 1992

Cappellari L., “Mobilita` dei bassi salari in Italia.”, Salari, incentivi e mobilita` nell`economia italiana, Dell`Aringa C. and Lucifora C. (a cura di), V&P universita`, 2002, pp.51-84

Carroll, M. and Powell, J., ”The Immediate Returns to Early Career Mobility”, *Issues in Political Economy*, 2002, Vol. 11., Elon University

Contini B. (ed.), “Labour Mobility and Wage Dynamics in Italy”, Rosenberg & Sellier, 2002

Contini B. and Villosio C., “Job Changes and Wage Dynamics”, Working Paper n.5, LABORatorio R. Revelli, 2000

Deaton A., ‘Panel data from time series of cross-sections’, *Journal of Econometrics*, 30, 1985

Dell`Aringa C. and Piccirilli G., “La mobilita` occupazionale in Italia. Teoria ed evidenza empirica”, in Salari, Incentivi e mobilita` nell`economia italiana, Dell`Aringa C. and Lucifora C. (a cura di), V&P universita`, 2002, pp.17-50

Dustmann C. and Meghir C., “Wages, Experience and Seniority”, *Review of Economic Studies*, (forthcoming), 2004

Erikson C. and Ichino A., “Wage Differentials in Italy: Market Forces, Institutions, and Inflation”, NBER working paper n.4922, Nov. 1994

Eurostat, “Statistics in focus. Industry, Trade and Services”, Theme 4, no.39, 2002

Farber H., “The Analysis of Interfirm Worker Mobility”, *Journal of Labor Economics*, Vol.12, n.4, Oct. 1994, pp. 554-593

Farber H., “Mobility and Stability: the Dynamics of Job Change in Labor Markets”, Working paper n.400, Princeton University, Industrial Relations Section, June 1998

Flinn C., “Wages and Job Mobility of Young Workers”, *The Journal of Political Economy*, vol.94, issue 3, 1986, pp.89-110

Freeman R.B. and Katz L.F. (eds), “Differences and Changes in Wage Structures”, Chicago, The University of Chicago Press

Glaeser E., Laibson D., Scheinkman J. and Soutter C., "What is Social Capital? The Determinants of Trust and Trustworthiness", NBER Working Paper No. 7216, 1999

Gottschalk P., "Wage Mobility within and between jobs", Boston College Working Papers in Economics, n.486, 2001

Gregg P., S. Machin and A. Manning, "Mobility and Joblessness", in R. Blundell, D. Card and R. Freeman (eds) "*Seeking a Premier League Economy*", 2004

Johnson W.R., "A Theory of Job Shopping", *Quarterly Journal of Economics*, 92, May 1978, pp. 261-277

Jovanovic B., "Job Matching and the Theory of Turnover", *Journal of Political Economy*, 87, Oct. 1979a, pp. 972-990

Jovanovic B., "Firm-Specific Capital and Turnover", *Journal of Political Economy*, 87, Dec. 1979b, pp. 1246-1259

Kiefer N., "Economic Duration Data and Hazard Functions", *Journal of Economic Literature*, vol. 26, n. 2, June 1988, pp. 646-679

Kruppe T., Oschmiansky H., and Schoemann K., "Self-employment: Employment Dynamics in the European Union", *inforMISEP*, no.64, 1998, p.35.

Light A and McGarry K., "Job Change Patterns and the Wages of Young Men", *The Review of Economics and Statistics*, Vol.80, No.2, 1998, pp.276-286

Lillard L. and Weiss Y., "Components of Variation in Panel Earnings Data: American Scientists 1960-70", *Econometrica*, Vol. 47, No. 2, Mar. 1979, pp. 437-454

Mincer J., "Wage Changes and Job Changes", *Research in Labor Economics*, Vol.8, part A (Greenwich, CT: JAI Press), 1986, pp. 171-91

Mincer J. and Jovanovic B., "Labor Mobility and Wages", in Sherwin Rosen (ed.), *Studies in Labor Markets* (Chicago: University of Chicago Press), 1981

Mortensen D., "Wages, Separations, and Job Tenure: On-the-Job Specific Training or Matching?", *Journal of Labor Economics*, vol.6, issue 4, Oct. 1988, pp. 445-471

Munich D., Svejnar J., and Terrell K, "The Returns to Job Mobility during the Transition: Evidence from the Czech Republic", CERGE (mimeo), 2002

Murphy K. and Welch F., "The Structure of Wages", Q*uarterly Journal of Economics*, CVII, 1992, pp. 285-326

Naticchioni P. and Panigo D., "Employment Protection, Job-Tenure and Short Term Mobility Wage Gains: a New Explanation for the Italian Case", mimeo, 2004

Naticchioni P. and Rustichelli E., "The Impact of Job-to-Job Labour Mobility on Wage Dynamics in the Medium-long Run in Italy", mimeo, 2003

Neal D., "Industry-Specific Human Capital: Evidence from Displaced Workers", *Journal of Labor Economics*, 13, 1995, pp. 653-677

Parent D., "Matching, Human Capital, and the Covariance Structure of Earnings", *Labour Economics*, 2002, pp.375-404

Parent D., "Industry-Specific Capital and the Wage Profile: Evidence from the NLSY and the PSID", Working Paper n.795, Universite de Montreal, Centre de Recherche et Development en Economie, 1995

Parsons D., "Quit Rates Over Time: A Search and Information Approach", *The American Economic Review"*, Vol. 63, N.3, June 1973, pp. 390-401

Parsons D., "The Job Search Behavior of Employed Youth", *The Review of Economics and Statistics*, Vol.73, n.4, Nov.1991, pp. 597-604

Rodriguez M., "Job Mobility and Wage Mobility at the Beginning of the Working Career: Young European Workers Escaping from Badly-Paid Jobs", mimeo, 2004

Rogerson R. and Wright R., "Search-Theoretic Models of the Labor Market: A Survey", Working Paper, University of Pennsylvania, Philadelphia, 2001

Schneider, Friedrich and Enste, Dominik, (2000a), Shadow Economies: Size, Causes and Consequences, *Journal of Economic Literature* 38/1, March 2000, pp. 77-114

Singer B. and Spilerman, "Some Methodological Issues in the Analysis of Longitudinal Surveys", *Annals of Economic and Social Measurement* (New York: Columbia University Press for NBER), 1976

Soskice D., "Reconciling Markets and Institutions: The German Apprenticeship System", in Lynch (ed.) *Training and the Private Sector – International Comparison* (Chicago: University of Chicago Press for NBER), 1994

Sullis G., "Wage Mobility in the Italian abour Market: Comparing Search, Matching and Training Models", mimeo, 2003

Topel R., "Specific Capital, Mobility and Wages: Wages Rise with Job Seniority", *Journal of Political Economy*, 99, 1991, pp. 145-176

Topel R. and Ward M., "Job Mobility and the Careers of Young Men", *Quarterly Journal of Economics*, 107, 1992, pp. 439-79

Van Den Berg G., "Empirical Inference with Equilibrium Search Models of the Labour Market", The Economic Journal, June 1999

Verbeek M., 'Pseudo-panel data', in Matyas L. and P. Sevestre (eds.), *The econometrics of panel data : a handbook of the theory with applications,* Kluwer, Dordrecht, 1996

Von Wachter T., "In the Right Place at the Wrong Time – The Role of Firms und Luck in Young Workers' Careers", University of California Berkeley, Job Market Paper, 2002

Wiederstedt B., "Moving or Staying: Job Mobility as a Sorting Process", Umea Economic Studies n.464, UMEA University, 1998

Appendix A – The Minimum Distance Estimator

In this appendix we briefly explain our estimation strategy, explaining the Optimal Minimum Distance Estimator (OMD) we use for recovering the structural coefficients from the reduced form coefficients of our wage growth variance-covariance matrix. We follow closely the approach set out by Chamberlain (1984), as implemented by Abowd and Card (1989).

Let *m* be the vector of the distinct element of the covariance matrix of the tenure and experience adjusted changes in wages (C). Consider a model for the vector of covariance elements that depends on a vector *b* of lower dimension. In particular, $m = f(b)$ for a known, continuously differentiable function $f : \Re^P \to \Re^S$, so that f maps the structural parameters into the reduced form parameters.

Estimation of b requires to chose an estimator b^0 for b by minimizing the distance between $m$and $f(b^0)$.

The Minimum Distance (OMD) estimator, b^0, is defined as the estimator for b which minimizes the weighted squared differences between m and $f(b)$:

$$(m - f(b))'V^{-1}(m - f(b))$$

The estimator can be defined for any positive semi-definite weighting matrix. If $f(b)$ is a linear function in b, it is simply a GLS estimator. In our case, $f(b)$ is nonlinear, and the resulting estimator can be seen as a generalized non-linear least squares estimator. We consider the efficient weighting matrix V^{-1}, the inverse of the matrix of the corrected fourth moments of $\tilde{y}$. Chamberlain (1982, 1984) has shown that this is the optimal weighting matrix, resulting in the Optimal Minimum Distance Estimator (OMD). Using this weighting matrix, the minimized quadratic form

$$N(m - f(b^0))'V^{-1}(m - f(b^0))$$

is asymptotically distributed as c^2 with degrees of freedom (S-P) equal the difference between the dimension of the vector of reduced form parameters *m* (S) and the dimension of the vector of parameters of the structural model (P) – in other words, the number of restrictions imposed on the reduced form parameters.

Appendix B - Measurement error results

The measurement error model would generate correlations at lag length 1, but not at larger lag lengths. However, it imposes a strong restriction on the relationship between covariances and variances.

Table 7.6 reports the results of the minimum distance estimation for both Italy and Germany. The first two columns of the table refer to Italy. In particular, first are reported the results for Cfl workers and then for workers with a typical contract. Column (3) and (4) report the result of the minimum distance procedure for skilled and for unskilled workers in Germany. In the ME model, the entire covariance structure of wages is described in terms of one parameter only (s_{uu}). Estimates of this parameter are reported in table 7.6 below.

Tab. 7.6 – Estimated error structure - Measurement Error

		Italy		Germany	
		Cfl workers	**Typical workers**	**Skilled workers**	**Unskilled Workers**
Dimention cov		5	5	6	6
indep. Elem. In Cov.		15	15	21	21
N. Observations		132	166	783	175
Structural coefficient	**coeff**	0.0036	0.0031	0.0073	0.011
	stde	0.0005	0.0004	0.0009	0.0012
	t-stat	7.5231	7.4194	8.1746	9.369
Minimum Dist. Stat.		50.43	54.19	210.54	310.55
	(d.o.f.)	14	14	20	20
	P value	0	0	0	0

Source: Inps archive 1986-1996 and IAB dataset 1980-1995, own calculations

As we explain in some detail in appendix A, the optimal minimum distance statistic evaluated at the estimated parameter values follows, under the null hypothesis that the restrictions are valid, a Chi squared distribution, with degrees of freedom equal to the number of restrictions imposed on the data. In the last columns we report this statistic, and the associated p-values. In all cases, we reject the hypothesis that the error process can be represented by a simple measurement error model.