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When are the most sucessful matches between worker and firm established?

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Abstract

This dissertation investigates the role of the external labor market conditions on job matching quality, proxied by real wages and tenure. First, it assesses the impact of current and initial unemployment rates on wages determination. It presents evidence that real wages tend to react in a procyclical way and there is a learning process of match quality that decreases the impact of the business cycle on real wages. Through a duration model, I show that jobs initiated during an economic downturn tend to last less than those initiated during an expansion. Then, applying a multinomial model to real wages and tenure quartiles, I demonstrate a positive impact of the unemployment rate prevailing at the start of the job for those who receive higher wages and those who have longer tenures relatively to those at the bottom of the match quality. It also presents empirical evidence supporting the prediction that jobs initiated during recessions tend to have larger real wages adjustments, especially, when the business cycle improves.

Keywords: Match quality, real wages, job tenure, annual wage growth rates, duration models, multinomial models.

JEL classification: J24, J31, J41, J64.

Em que fase do ciclo económico se estabelecem as melhores relações laborais entre trabalhadores e empresas?

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Resumo

Este estudo tem como principal objectivo analisar a importância do ciclo económico na qualidade das relações laborais, sendo, para este efeito, consideradas como proxies, os salários reais e a duração do emprego. Numa primeira fase, demonstra-se que os salários reais reagem de forma pró-cíclica às taxas de desemprego observadas no início e ao longo do contrato de trabalho, e que existe um processo de aprendizagem da qualidade da relação laboral que atenua o impacto negativo do ciclo económico nos salários reais. Recorrendo a um modelo de duração, comprova-se que as relações laborais formadas durante recessões tendem a ter menor duração do que aquelas estabelecidas durante expansões. Numa segunda fase, através de um modelo multinomial, demonstra-se que existe um efeito positivo do ciclo económico para os trabalhadores que recebem salários mais elevados e têm maior estabilidade no emprego, quando comparados com aqueles que se situam no quartil mais baixo em termos de qualidade da relação laboral. Para concluir, é apresentada evidência empírica de que as relações laborais iniciadas durante fases de recessão tendem a apresentar maiores ajustamentos salariais, sobretudo quando o ciclo recupera.

Palavras-Chave: Qualidade do emprego, salários reais, estabilidade do emprego,taxas de crescimento salarial, modelos de duração, modelos multinomiais.

Classificação JEL: J24, J31, J41, J64.

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1 Introduction

When are the most successful worker-firm matches established? What is the role played by business cycle in match quality at the time of job creation?

The impact of the business cycle on job match quality is not clear in literature since there are two contradictory forces in action during recessions - agglomeration and congestion effects. When the pool of unemployed workers is larger (agglomeration effect), the employer can chose the most qualified workers whose skills are best suited to the job. Since the employer is not interested to lose them when the labor market improves he must compensate the workers through pecuniary and non-pecuniary conditions, which leads to better matches. On the other hand, empirical evidence suggests that during recessions it is harder, especially for unskilled workers, to find or keep their jobs. When there are fewer vacancies available, workers are more willing to accept jobs that require lower skills (congestion effect) which can lead to worse matches. From this point of view, when the cycle recovers, workers tend to look for better opportunities, probably better paid-jobs. So, job matches created during recessions tend to have a short duration (see Bowlus (1995)).

The main objective of this study is to investigate - using panel data for the United States - if the agglomeration effect outweighs the congestion effect which leads to the conclusion that the best matches are established during recessions or if the opposite happens and expansions are more conducive to high-quality match formation.

Job match quality is not directly observable, so duration and compensation measures have been considered as their proxies. In this study a good match is one that endures and allows higher wages. A match formed during a recession is a good match if there is a correspondence between the employee abilities and occupation skills required that can be accessed by higher tenures, and if the wage is at least as good as he/she could obtain in an expansion. Match quality is here evaluated using two proxies, current wages and tenure. Current wages are related to *ex ante* expec-

tations of the employer in relation to worker abilities and to *ex post* performance of the employer. Tenure is considered as an alternatively *ex post* measure of match quality.

There is a strong dependency between the starting and subsequent wages, and Bowlus (1993) found that starting wages are more procyclical than wages throughout the match. This means that the initial conditions play a major role on wages determination and wages tend to suffer minor adjustments throughout the match. So, following Jovanovic (1979) match is evaluated as an "experience good" in sense that the match quality is not completely known at the moment of match creation, through the initial wage, but must be experienced. If the employer wants to keep the worker, he must provide him with good working conditions that are beyond the remuneration and that will certainly lead to a longer duration of the match.

This study has two main parts. The first investigates the role of the business cycle, proxied by both current and initial unemployment rates, on real wages and job tenure. For this purpose I use fixed-effects panel data and duration models. The findings are in agreement with the literature - real wages are procyclical and the probability of a job being terminated increases with the unemployment rate. Following Arozamena and Centeno (2001), the impact of tenure and education on current wage-business cycle measure elasticity is tested in the sense that real wages should be less procyclical for the most tenured and educated workers. Applying this idea to tenure regressions it is tested if the probability of a job being terminated increases less the higher the level of education is. The results show that tenure decreases the current wage-unemployment rate (both current and initial) elasticity, but education has an ambiguous effect. The results are stronger for the unemployment rate prevailing at the start of the job than for the current one which confirms the hypothesis that initial conditions establish the worker wage level.

In the second part − the main innovation of this study − the focus is on the unemployment rate prevailing at the start of the job. The objective is to test if good

matches are established during recessions. For this purpose I use a multinomial model, to determine the effect of the cycle on the probability of belonging to a particular wage, annual wage growth rate and tenure quartile. The hypothesis is that the workers with higher abilities − those who receive higher wages and have higher tenures − can establish good matches during economic downturns. The findings are in agreement with this hypothesis since the probability of being in the highest wage, annual wage growth rate and tenure quartile instead of first increases with the unemployment rate prevailing at the start of the job.

The following section presents the literature review and section 3 describes the data and the criterion used to construct the sample. The econometric methodology and the main empirical results are presented in sections 4 and 5, and section 6 concludes.

2 Literature Review

The cyclicality of real wages has received great attention in the literature. Empirical results seem ambiguous since some studies find real wages to be procyclical and others to be countercyclical. The main source of the differences in results across studies seems to arise from the use of aggregate or micro data.

Macroeconomic studies tend to find stable movements of real wages throughout the business cycle and some evidence of countercyclicality. Microeconomic studies show a procyclical reaction of wages to recessions and expansions. This could be explained by composition bias in aggregate analyses as first discussed by Solon et al. (1994). The changes in the business cycle lead to changes in the work-force composition; during expansions more low-skilled workers are employed which means that more workers with low earnings are employed, so the average wage tends to decrease.

A number of microeconomic studies for the United States investigate the wage

cyclicality of different workers and different sources of income. Bils (1985), using the National Longitudinal Survey for Youth data (NLSY), and Barlevy (2001), using NLSY and the Panel Study of Income Dynamics (PSID), found that the cyclicality of real wages is stronger for firm changers and those who move in and out of the work force than for firm stayers. Shin and Shin (2003), for the PSID sample, showed procyclical movements of both job changers and job stayers wages, which can be explained by large wage adjustments occurred in expansions during re-negotiation periods.

Devereaux (2001) found stronger procyclicality to hourly workers than salaried workers and a great cyclicality of real wages for those who receive income from bonuses, commissions or overtime, using the PSID sample. Swanson (2007), using the same data bases, confirmed the procyclicality of the most variable pay margins and showed a great real wages procyclicality of lower-income, younger, and less educated workers. Anger (2011) using German employer-employee matched data compared different wage measures, with results that are similar to those for the United States - variable pay components and flexible working hours exhibit strong procyclicality. Considering duration models Jovanovic (1979), Bowlus (1995) and Centeno (2002) found higher probabilities of a job being terminated if it had started during a recession.

Another strand of literature accounts for the effect on wages of the accumulation of specific human capital. The main objective of these studies is to differentiate returns to general and specific human capital. The first is related with returns to experience and second is related with returns to tenure on wages. The conclusions are not clear in sense that some studies, such Altonji and Shakotko (1987) and Abraham and Farbe (1987), found that wages are not related to tenure on the current job and others, such Topel (1986, 1991) and Felli and Haris (1996), found a strong positive relationship between wages and tenure. Mincer and Jovanovic (1981) and Topel and Ward (1992) considering the role of the specific human capital focuses

on labor mobility. The first explored the implications of human capital and search behavior on labor mobility since differences in firm-specific human capital behavior lead to heterogeneity in mobility behavior. The second found that job-specific wages are a key determinant of mobility given that jobs offering higher wage growth are significantly less likely to end in worker-firm separations than jobs offering lower wage growth. Arozamena and Centeno (2001) connected the previous with this strand of literature and found that real wages are related to tenure at the current job. They also found that the impact of the business cycle on real wages decreases with tenure at job, which means that real wages for the most tenured workers are less procyclical.

3 Data

This study is based on the Panel Study of Income Dynamics (PSID), a longitudinal data for the United States available for the 1968-2007 period. The adequacy of the PSID can be assessed by the coverage of a complete business-cycle and the representativeness of ages which allows to detect a certain job stability.

The subsample used in this study covers the 1978-1996 period and includes male workers aged 18 to 65 that worked at least 500 hours per year. This subsample does not consider families of immigrants and Latino sample as well as agriculture, forestry, fisheries and mining industries. Only household heads were considered since data are more detailed, accurate, and complete than for other sample members. As there is a tiny percentage of female heads in the sample I only keep male workers.

In the PSID, questions about personal and job characteristics refer to the time of the interview. Questions on income and hours worked refer to the preceding calendar year, so they must be lagged one year. Interviews were made every year until 1997 and every two years from there. So, from 1996 it is not possible merge wages and hours with individual and job information which limits the sample. This means

that, take an observation from year t, for this individual we have all t information except wages and hours worked, that refers to $t-1$ year. Until 1996 we could recover the year t wages and hours in the year $t+1$ survey. But for any year after 1996, the next survey is in $t+2$ with wages and hours from year $t+1$, therefore, we cannot match it with year t's characteristics.

To measure the impact of the business cycle on real wages both annual and hourly wages were considered; the first was reported by the worker and the second was computed from total annual hours worked on the main job. Between 1978 and 1984 the hours worked on the main job variable is not available, so total annual hours worked on all jobs were considered, but those who reported an extra job were dropped from the sample. Real variables were obtained using Consumer Price Index (1982-1984=100) from the Bureau of Labor Statistics.

The PSID data has incomplete and inconsistent tenure information over time. To overcome this problem, I correct tenure information from the start working year reported. However, the start working year reported has a large portion of missing information because the variable is not available for all years of the sample. So, I considered that all observations for the same individual that remains between the moment he provides the information of the start working year and the start working year reported corresponds to the same job, since he reports the same job industry. Then, tenure was completed and corrected and match identification was created from approximate start working year variable.

For each individual the remaining variables considered are age, education, experience (which equals age minus education minus six years), number of children, marital status, race, occupation, industry, region, and union status.

A few variables used in this study required modifications in order to remove deficiencies or make them comparable to other years data. Wages and salaries as well as hours worked are top coded, but these values have changed over time. As there are a very few top coded observations, those data were omitted.

The cyclical variables are proxied by current unemployment rate and unemployment rate at start of job both for the state of residence, extracted from Bureau of Labor Statistics for the 1978-1996 period. Annual rates were considered in detriment of monthly unemployment rates due to lack of information on the starting month of the job.

To study job tenure, the panel was transformed so that each observation corresponds to an employment spell. In an attempt to identify cases in which the last tenure information is censored, a censoring variable was created. This variable takes value one if we are sure that the match is over, which happens when the last observation of an employment spell at time t was followed by an observation of a different employment spell to the same individual at time $t+1$. In this subsample were considered employment spells which started between the 1978-1996 period and these were observed until 2007. This way, we can better observe the match evolution and minimize the censoring observations. However, from 1997 interviews were made every two years, which means that every employment spells that end after 1996 are considered to be censored due to the restrictive way to compute the censoring.

3.1 Summary Statistics

Table 1 presents means and standard deviations for the variables of interest in the PSID sample.

One of the main advantages of this data base is to be very representative of the age structure of the labor force; it covers a wide range of ages, with an average of 38 years and a standard deviation of 10 years. The range of ages considered allows to detect higher job stability contrary to what happens with other data bases usually used for this purpose, which is reflected in an average tenure of 8 years.

The proportion of whites is slightly higher than non-whites, the majority of men in the sample are married and, on average, there is one child per person. The mean level of education in the sample is 13 years - about 44 percent of the sample has

Table 1: Descriptive Statistics

	Mean	Standard Deviation
Log real wage	9.8767	0.7389
Log real hourly wage	2.2599	0.6827
Total annual hours worked	2110.8	528.44
Log state current unemployment rate	1.8510	0.2829
Log state unemployment rate at start of Job	1.8813	0.2863
Age (in years)	37.590	10.366
Tenure (in years)	7.9480	8.0960
White	0.6899	0.4626
Married	0.8243	0.3806
Number of Children	1.1385	1.2147
Experience	18.667	10.732
Highest grade completed	12.915	2.4698
Union status	0.2670	0.4424
Region		
Northeast	0.1641	0.3704
North Central	0.2396	0.4269
South	0.4456	0.4958
West	0.1607	0.3672
Occupation		
White collar	0.5078	0.4999
Blue collar	0.3813	0.4857
Job service	0.1109	0.3140
Sector of activity		
Construction	0.1120	0.3154
Manufacturing	0.2862	0.4520
Transportation, communications and other public utilities	0.1147	0.3186
Wholesale and retail trade	0.1604	0.3670
Finance, insurance and real estate	0.0439	0.2048
Business and repair services	0.0591	0.2358
Personal services	0.0164	0.1272
Entertainment and recreation services	0.0087	0.0928
Professional and related services	0.1103	0.3133
Public administration	0.0882	0.2836

1. The PSID data is composed of male workers in PSID over the period 1978-1996.
2. Real variables are deflated using the CPI (1982-1984=100) from Bureau of Labor Statistics.
3. State annual unemployment rates are taken from the Local Area Unemployment Statistics from the Bureau of Labor Statistics for the period 1978-1996.

at least one year of college, about 39 percent has high school and the remaining 17 percent have less than 12 years of schooling.

Annual and hourly wages are in average high, $23,089.71 and $11.04, which reflect the 19 years of average experience, the average of education and consequently occupational composition of the sample, since about half of the sample members

have white collar occupations.

4 Econometric Methodology

This section presents the different regression models used to assess the impact of the business cycle on match quality.

4.1 Linear Models

In the first part of this study it is estimated a general linear model for panel data:

$$y_{it} = \alpha + x'_{it}\beta_{it} + u_{it}, i = 1, ..., N; t = 1, ..., T, \tag{1}$$

where y_{it} is both real annual and hourly wages, x_{it} is a vector of independent variables, such as tenure, experience, marital status, number of children, race, occupation, industry, union status and both initial and current unemployment rate, u_{it} is a scalar disturbance term, i indexes individual and t indexes time. The error component model for the disturbance is the following form:

$$u_{it} = \mu_i + v_{it} \tag{2}$$

where μ_i denotes the unobservable individual-specific effect and v_{it} denotes the remainder disturbance.

Depending on the assumption on the μ_{it} correlation over time and with x_{it} different models are estimated.

The pooled OLS model is the most restrictive. This model can be consistently estimated if the regressors are uncorrelated with the error. If the error term is correlated over time for a given individual, the pooled OLS model yield inefficient estimates and invalid standard errors. In the presence of unobserved heterogeneity,

we must use random or fixed effects models.

The fixed effects model is an appropriate specification if we are focusing on a specific set of N individuals. In the fixed effects model μ_i are assumed to be fixed parameters to be estimated and the remainder disturbances stochastic with v_{it} independent and identically distributed $IID(0, \sigma_v^2)$. The X_{it} are assumed independent of the v_{it} for all i and t.

The random effects model is an appropriate specification if we are drawing N individuals randomly from a large population and the individual effect is characterized as random. In the random effects model $\mu_i \sim IID(0, \sigma_\mu^2)$, $v_{it} \sim IID(0, \sigma_v^2)$ and μ_i are independent of the v_{it}. The X_{it} are assumed independent of the μ_i and v_{it} for all i and t.

4.2 Duration Models

To address the match quality through the tenure at job I use a duration model. Econometric models of duration are models of the length of time spent in a given state before transition to another state.

To study job duration, it will be estimated a Cox (1972) proportional hazard model. The hazard function allows us to approximate the probability of exiting the initial state within a short interval, conditional on having survived up to the starting time of the interval. The hazard function, which here represents the probability of employment termination conditional on the duration lasting up to t, takes the following form:

$$\lambda(t|X(t)) = \lambda_0(t) \exp\left(\beta' X(t)\right) \tag{3}$$

where $\lambda(t|X(t))$ is the conditional hazard rate, $X(t)$ is a vector of covariates that includes personal and match characteristics at the beginning of spell, such as age, education, number of children, marital status, race, union status, region and initial

unemployment rate. In equation (3) λ_0 is the baseline hazard rate at time t for the covariate vector $X(t) = 0$.

To estimate β I use the partial likelihood method suggested by Cox (1972), which makes no assumptions about the distribution of the survival times. For each uncensored observation this model assesses the sum of the probabilities that an employment spell terminates at time t_i, given that one employment spell terminates at time t_i:

$$\frac{\lambda(t_i)|X_i(t_i))}{\sum_{j \in R_i} \lambda(t_i|X_j(t_i))} = \frac{\exp(\beta' X_i(t_i))}{\sum_{j \in R_i} \exp(\beta' X_j(t_i))} \tag{4}$$

where $R_i : \{j : t_j \geq t_i\}$.

The availability of panel data in which we have more than one observation for the same individual implies the possibility that the unobserved components may be correlated across observation of the same individual. The key assumption used to incorporate unobserved heterogeneity are that heterogeneity are independent of the observed covariates, as well as starting times and censoring times; the heterogeneity has a distribution known up to a finite number of parameters; and the heterogeneity enters the hazard function multiplicatively. The unobserved heterogeneity is commonly included in the proportional hazard model in the following way:

$$\lambda_i(t|X_i(t_i), \theta_i) = \lambda_0(t_i) \exp(\beta' X_i(t) + \theta_i) \tag{5}$$

Cox's method is intended to be applied to a single spell for each sample unit. However, data considered have one observation by match and a different number of spells for each individual. This can be a problem as the number of spells and its duration may not be independent. To overcome this problem Chamberlain (1985) proposes to keep only the first two spells of each individual. However, this method may not be as random as expected according to Bowlus (1995).

As we discussed in the data description there are a substantial number of censored observations. The censoring occurs when an event has not happened before the study is finished or an individual is removed from the study before the event occurs. Thus, we cannot observe the exact duration of the match.

Hazard models deal easily with the problem of censoring since censored observations are simply treated as additional observations that have lasted for the length of the study but for which no failure has been observed. However, when censoring is dependent of the future value of the hazard for the individual, the estimates of the hazard distribution can be seriously biased. In this study this not seems to be a problem since there is no correlation between individual drop out of the sample and his tenure on the job, so we can assume that on average the hazard times are not over or under-estimated. On the other hand, the large portion of censoring observations may be over-estimated. As previously described, we are sure that the match is over when we observe a new match in the following year. If the individual becomes unemployed or simply leaving the sample, the last observation may correspond with the end of the job but I regard it as censored.

4.3 Multinomial Logit Models

The Multinomial Logit Model (MNLM), proposed by Luce (1959), is an extension of the binary Logit Model where the unordered response has more than two outcomes.

An individual chooses one random alternative from the group of the y unordered choices. In our study y represents a random wage, annual wage growth rate or tenure quartile taking on the values $\{1,...,4\}$, and x denote a set of conditioning variables, such as starting wage quartiles, experience, tenure at job, number of children, marital status, education, race, industry, occupation, region, year dummies and the unemployment rate prevailing at the start of the job. Our main interest in this model is to assess how *ceteris paribus* changes in the elements of x affect the

response probabilities, $P(y = j|x), j = 1,..., 4$. Since the probabilities must sum to unit, $P(y = 1|x)$ is determined once we know the probabilities for $j = 2,..., 4$.

The MNLM has the following response probabilities:

$$P_{ij} = P(Y_i = j|x_i) = \frac{exp(x_i'\beta_j)}{\sum_{h=1}^{J} \exp^{X_i'\beta_h}}, j = 1, ..., 4 \tag{6}$$

where β_j is $K \times 1$, $j = 1,..., 4$.

For MNLM's the coefficients have not an absolute interpretation, since a positive regression parameter does not mean that an increase in the regressor leads to an increase in the probability of that alternative. Instead, the interpretation for the multinomial logit model is relative to the reference or base category group, here first quartiles of wages, annual wage growth rates and tenure distributions. In this sense, a positive regression parameter means that the relative probability of being in a certain category instead of the base category increases with the regressor. The MNLM can be expressed as binary logit models since it can be interpreted in terms of relative risk of choosing alternative j rather than alternative 1:

$$P\frac{[y_i = j]}{[y_i = 1]} = \exp(x_i'\beta_j) \tag{7}$$

where, $\exp(\beta_j)$ gives the proportionate change in this relative risk when x_i changes by one unit.

The conditional model can be estimated using maximum likelihood that takes the following form:

$$\log \mathcal{L} = \sum_{i=1}^{I} \sum_{j=1}^{J} d_{ij} \log(P_{ij}), \tag{8}$$

where $d_{ij} = 1$ if individual i chooses alternative j and $d_{ij} = 0$ otherwise. The maximum likelihood estimator $\hat{\beta}$ is consistent, asymptotically efficient and normally

distributed.

In this study I do not report coefficients, but log odds-ratio since they allow a more direct interpretation of the parameter estimates:

$$\log\left(\frac{p_{ij}}{p_{ik}}\right) = x_i'(\beta_j - \beta_k) \tag{9}$$

A positive parameter means therefore that the relative probability of choosing j increases relative to the probability of choosing k.

The MNLM is intended to be applied to a cross section sample. To the tenure regressions we have just one observation by employment spell, but the wage and annual wage growth rate regressions were estimated based on panel data.[1] However, this could not be a problem since the estimation results for pooled, random and fixed effects regressions (tables 2-4, 9-14) are not substantially different.

5 Estimation Results

This section presents evidence that match quality, proxied by job tenure and both annual and hourly wages, reacts in a procyclical way to both current and initial unemployment rates. Tenure and education have positive returns on wages and tenure reduces the business-cycle effect on wages.

On the other hand, I demonstrate that the relative probability to have higher wages, annual wage growth rates or tenure increases with the unemployment rate prevailing at the start of the job, which are in agreement with the hypothesis that good matches could be established during economic downturns.

[1]Since we have previously discussed the problem of unobserved heterogeneity, the fixed and random effects MNL regressions should be estimated. I tried to run the `gllamm` routine for `Stata` program, but computational time required does not allow to obtain the results, which could be interesting for a future research.

5.1 Linear Models

This subsection presents the model used to analyze the impact of the business cycle on the process of wage formation and the main results of the estimated equations. It uses a fixed-effect panel data model since the results of the Hausman test (1978) show that there is evidence of the endogeneity of the regressors with the individual effects (Wald X^2 statistics in tables 2-4).

The basic wage equation takes the following form:

$$\ln w(i,t+j) = \theta_1 X_{i,t+j} + \theta_2 ten_{i,t+j} + \theta_3 educ_{i,t+j} + \theta_4 \Psi(t+j,t) + \varepsilon_{i,t+j} \qquad (10)$$

where the logarithm of real annual and hourly wages at time $t+j$ for an individual i that started working at time t, $w(i,t+j)$, are explained by a vector of covariates X − which includes experience, number of children, race, marital and union status, occupation, industry, region and year dummies − tenure at job (ten) and the highest grade of school completed ($educ$). The cycle effect is proxied by the initial and current-state unemployment rate, $\Psi(t+j,t)$.

As it was suggested before, this model predicts a positive θ_2 e θ_3 and a negative θ_4, which means positive returns to tenure and education and a negative influence of the unemployment rate on wages, i.e., procyclical wages.

In an attempt to capture the effects of learning about match quality and job heterogeneity, interactions between job tenure, education and business cycle are introduced, following Arozamena and Centeno (2001). Equation (11) allows different wages-unemployment rates elasticities depending on individuals tenure and schooling:

$$\begin{aligned} \ln w(i,t+j) &= \delta_1 X_{i,t+j} + \delta_2 ten_{i,t+j} + \delta_3 educ_{i,t+j} + \delta_4 \Psi(t+j,t) + \qquad (11) \\ &+ \delta_5 \Psi(t+j,t) \times ten_{i,t+j} + \delta_6 \Psi(t+j,t) \times educ_{i,t+j} + \\ &+ \delta_7 ten_{i,t+j} \times educ_{i,t+j} + \delta_8 \Psi(t+j,t) \times ten_{i,t+j} \times educ_{i,t+j} + \varepsilon_{i,t+j} \end{aligned}$$

It is expected that δ_5 has a positive sign since the effect of unemployment rate on current wages decreases along the duration of the match. The match quality is unknown *ex-ante*, − it is here evaluated as an "experience good"and not as a "search good"− there is a learning process of match quality associated with tenure that should increase wages. The negative effect of the business cycle on wages should decrease with the accumulation of firm-specific human capital in the form of learning about match quality. Following the same arguments, it is expected that higher-skilled workers, here the most educated workers, are less affected by the business cycle, so δ_6 should be positive. Education must be interpreted as worker-specific human capital that plays an important role on match quality determination.

Table 2 exhibits the wages estimations considering the current unemployment rate as the business cycle measure.

As expected, the results show that tenure has a positive sign and it is significantly different from zero, both for annual and hourly wages. It can be interpreted as positive returns to tenure on wages due to a specific human capital accumulation. On the other hand, education has an ambiguous effect and it is not significantly different from zero. Both annual and hourly wages exhibit a procyclical movement since the coefficient of the state unemployment rate is negative and significantly different from zero.

When we control for unemployment rate-tenure interaction (column 2), tenure loses its significance. In both annual and hourly wages regressions, current wage-current unemployment rate elasticity decreases with tenure. For each extra year of tenure the elasticity decreases, in absolute terms, by about 0.0051 for annual and 0.0027 for hourly wages.

According to the literature, high-skilled workers are less affected by the business cycle. So, education should reduce current unemployment rate elasticity but the results presented here do not allow this conclusion, which may be due to low variability of education in the sample.

Table 2: Effect of Current Unemployment Rate on Current Real Wage

Dependent variable: Log(annual wage)				
	(1)	(2)	(3)	(4)
Tenure	0.0121***	0.0029	0.0121***	-0.0159**
	(0.0008)	(0.0019)	(0.0008)	(0.0129)
Education	0.0066	0.0061	-0.0029	-0.0229*
	(0.0078)	(0.0078)	(0.0096)	(0.0128)
Log Current UR	-0.0923***	-0.1355***	-0.1571***	-0.3103***
	(0.0156)	(0.0187)	(0.0454)	(0.0727)
Log Current UR×Tenure		0.0051***		0.0122***
		(0.0009)		(0.0041)
Log Current UR×Education			0.0049	0.0130**
			(0.0033)	(0.0053)
Tenure×Education				0.0014**
				(0.0006)
Log Current UR×Tenure×Education				-0.0005*
				(0.0003)
Marginal Effect of the Log Current UR		-0.0936***	-0.0937***	-0.0972***
		(0.0156)	(0.0155)	(0.0155)
Wald X^2 (df) statistic	629(39)	630(40)	631(40)	621(41)
Dependent variable: Log(hourly wage)				
Tenure	0.0116***	0.0068***	0.0116***	0.0071
	(0.0007)	(0.0018)	(0.0007)	(0.0078)
Education	-0.0001	-0.0005	0.0081	0.0056
	(0.0076)	(0.0076)	(0.0086)	(0.0116)
Log Current UR	-0.0547***	-0.0776***	-0.0018	-0.0158
	(0.0141)	(0.0172)	(0.0393)	(0.0663)
Log Current UR×Tenure		0.0027***		-0.0001
		(0.0009)		(0.0039)
Log Current UR×Education			-0.0043	-0.0048
			(0.0030)	(0.0051)
Tenure×Education				-0.0001
				(0.0006)
Log Current UR×Tenure×Education				0.0002
				(0.0003)
Marginal Effect of the Log Current UR		-0.0554***	-0.0535***	-0.0551***
		(0.0142)	(0.0140)	(0.0140)
Wald X^2 (df) statistic	639(39)	642(40)	638(40)	600(41)
N=35,264				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log current unemployment rate. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

In column (4) I take into account job heterogeneity − firm and worker-specific human capital. Tenure is an endogenous characteristic of the individual wage experience that can be interpreted as learning about match quality process in sense that match quality must be experienced. On the other hand, education is exogenous to the match quality but plays an important role to determine the duration of the relationship. Introducing the interaction between the unemployment rate, tenure and education we try to control the effect of belong to a labor-intensive firm and have a longer duration job on unemployment rate elasticity. It is expected that firms requiring higher-skilled workers and that prefer stable relationships pay higher wages. Thus, the interaction term should be positive − the most tenured and educated workers are less affected by the business cycle.

For annual wages we can conclude that higher education given tenure or higher tenure given education reduces the current unemployment rate elasticity but this effect is decreasing in both variables, which means that the effect of one extra year of education on current unemployment rate elasticity decreases the higher the tenure is and vice versa. For hourly wages the coefficients are no longer statistically significant.

The unemployment rate prevailing at start of job takes a leading role in this study since the main objective is to determine at what stage of the cycle, recession or expansion, the most successful matches are established. Thus, Table 3 explores equivalent specifications, but considering initial unemployment rate as the business cycle measure.

The conclusions are essentially the same as for the current unemployment rate. Tenure and education have positive returns and the business cycle has a negative impact on wages. For annual wages, tenure and education reduce the current unemployment rate elasticity on wages but this effect is decreasing in both variables. For hourly wages, tenure reduces and education increases the effect of the unemployment rate prevailing at the start of the job on wages and these effects are decreasing

Table 3: Effect of Initial Unemployment Rate on Current Real Wage

Dependent variable:	Log(annual wage)		Log(hourly wage)	
	(1)	(2)	(3)	(4)
Tenure	0.0161***	-0.0896**	0.0168***	-0.0557*
	(0.0014)	(0.0356)	(0.0014)	(0.0337)
Education	0.0332***	0.0269	0.0190*	0.0331*
	(0.0106)	(0.0201)	(0.0099)	(0.0185)
Log UR at Start of Job	-0.1292***	-0.1853	-0.1269***	-0.0203
	(0.0192)	(0.1252)	(0.0187)	(0.1150)
Log UR at Start of Job×Tenure		0.0492***		0.0284**
		(0.0188)		(0.0177)
Log UR at Start of Job×Education		0.0017		-0.0097
		(0.0091)		(0.0087)
Tenure×Education		0.0063**		0.0044**
		(0.0025)		(0.0025)
Log UR at Start of Job×Tenure×Education		-0.0028**		-0.0016*
		(0.0014)		(0.0013)
Marginal Effect of the Log UR at Start of Job		-0.1156***		-0.1163***
		(0.0195)		(0.0190)
Wald X^2 (df) statistic	458(39)	416(42)	411(39)	371(42)
N=23,707				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

in tenure and increasing in education. In both cases the marginal effect of the unemployment rate at start of job at mean tenure and education levels is significant and substantially lower than when no interactions are considered, about 11 per cent lower for annual wages (from -0.1292 to -0,1156) and 8 per cent for hourly wages (from -0,1269 to -0,1163). The marginal effect of the initial unemployment rate at the mean level of tenure and education on wages is stronger than the marginal effect obtained previously for current unemployment rate. Both annual and hourly wages are greatly influenced by the unemployment rate prevailing at the start of the job,

since the marginal effects are similar (Table 3). On the other hand, for the current unemployment rate we have a stronger marginal effect on annual than hourly wages (Table 2).

Table 4 presents the results of the business cycle impact on current wages when both initial and current unemployment rates are included.

Table 4: Effect of Current and Initial Unemployment Rate on Current Real Wage

Dependent variable:	Log(annual wage)		Log(hourly wage)	
	(1)	(2)	(3)	(4)
Tenure	0.0158***	-0.0074	0.0168***	0.0040
	(0.0015)	(0.0068)	(0.0014)	(0.0063)
Education	0.0337***	0.0332***	0.0191*	0.0190*
	(0.0106)	(0.0106)	(0.0099)	(0.0099)
Log Current UR	-0.0591***	-0.0926***	-0.0140	-0.0096
	(0.0221)	(0.0298)	(0.0206)	(0.0282)
Log UR at Start of Job	-0.1115***	-0.1114***	-0.1227***	-0.1412***
	(0.0206)	(0.0258)	(0.0200)	(0.0246)
Log Current UR×Tenure		0.0088**		0.0010
		(0.0037)		(0.0036)
Log UR at Start of Job×Tenure		0.0040		0.0058*
		(0.0035)		(0.0033)
Marginal Effect of the Log Current UR		-0.0572**		-0.0055
		(0.0227)		(0.0213)
Marginal Effect of the Log UR at Start of Job		-0.0951***		-0.1178***
		(0.0210)		(0.0204)
Wald X^2 (df) statistic	460(40)	466(42)	413(40)	415(42)
N=23,707				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log current unemployment rate and the log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

As we had seen before, the unemployment rate prevailing at the start of the job plays a stronger role on wages determination than the current unemployment rate, for both annual and hourly wages.

Table 4 shows that the effect of a one per cent change in the current unemployment rate on current annual wages (column 1) is about half the effect of the same change in the initial unemployment rate. When we consider the interactions between the unemployment rates and tenure (column 2), the marginal effect of business cycle measures is smaller and significant - at the mean level of tenure the elasticity is reduced from -0.0591 to -0.0572 for current unemployment rate and from -0.1115 to -0.0951 for unemployment rate prevailing at the start of the job.

For hourly wages, only the initial unemployment rate is statistically significant (columns 3 and 4) and the interactions between tenure and the business cycle variables lead, once again, to a decreasing of the elasticity (-0.1227 to -0.1178).

Comparing the results for annual and hourly wages, we can conclude that the current unemployment rate is only statistically significant for annual wages and the impact of the unemployment rate prevailing at the start of the job is greater for hourly than annual wages. This happens because during a recession, the probability of being fired is higher, which reduces the amount of hours worked and therefore the wage received during the year. On the other hand, when hourly wages are considered, they create a certain independence between the value and amount of work, which are more likely to be influenced by the starting conditions than by the current unemployment rate.

5.2 Duration Models

In this study, a good match is also one that endures, since the current wages may not capture all the match quality. Following Akerloff, et al. (1988) tenure is considered to capture non-pecuniary match characteristics.

The findings suggest that, similar to what happens to real wages, job tenure exhibits a procyclical movement. Recessions increase the probability of good matches to employers and mismatches to employees. In this sense, the matches established during recessions tend to end up when the cycle improves and more and better paid

jobs are available (see Bowlus (1995) and Centeno (2002)).

The results of table 5 are obtained considering one observation by employment spell. We followed Centeno (2002) and kept only one random spell per individual to avoid problems of correlation between observations from the same individual that result from unobserved heterogeneity. This resulted in a subsample of 4,073 observations of which 75 per cent are censored. However, whe report the results for all employment spells since, when all 8,102 observations are considered, the percentage of censored data reduced to 61 per cent and the results remained qualitatively similar.

Table 5 reports the duration model results, which are consistent with previous evidence. Higher starting unemployment rates increase the probability of a job being terminated, which means shorter job tenures. This probability is decreasing with education, since the coefficients of both high school and college are negative and significantly different from zero and the effect is stronger for college-educated workers, (colums 3-4).

Table 5: Estimates for the Proportional Hazard Model

Risk variable: tenure on the job

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Starting hourly wage indicator					0.1473***	0.1487***	0.1587***	0.1606***
					(0.0400)	(0.0399)	(0.0408)	(0.0407)
Starting hourly wage					-0.0837***	-0.0838***	-0.0751***	-0.0752***
					(0.0257)	(0.0258)	(0.0252)	(0.0252)
High school	-0.1841***	-0.1887	-0.1975***	-0.2792	-0.1201**	-0.0078	-0.1444***	-0.1202
	(0.0543)	(0.3212)	(0.0526)	(0.3155)	(0.0543)	(0.3110)	(0.0527)	(0.3071)
College	-0.2572***	-0.5796	-0.2698***	-0.7703*	-0.1410*	-0.4590	-0.1675**	-0.6314
	(0.0735)	(0.4122)	(0.0720)	(0.4004)	(0.0728)	(0.4044)	(0.0721)	(0.3955)
Log UR at start of job	0.3188***	0.2789*	0.0482	-0.0413	0.2023**	0.1998	0.0513	-0.0008
	(0.0995)	(0.1597)	(0.1363)	(0.1840)	(0.0933)	(0.1535)	(0.1298)	(0.1776)
Log UR at start of job×High school		0.0013		0.0408		-0.0598		-0.0141
		(0.1621)		(0.1591)		(0.1576)		(0.1554)
Log UR at start of job× College		0.1705		0.2640		0.1690		0.2454
		(0.2080)		(0.2011)		(0.2042)		(0.1990)
Wald X^2 (df) statistic	385(22)	395(24)	227724(40)	228371(42)	327(24)	333(26)	79860(42)	84653(44)
Year dummy	No	No	Yes	Yes	No	No	Yes	Yes
N	8,102	8,102	8,102	8,102	6,873	6,873	6,873	6,873

1. Data is composed of a panel of workers from the PSID that start working over the period 1978-1996. The business cycle is measured by log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Year dummies refer to the start working year.
3. Covariates included in each regression are 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), region dummies, age, number of children, marital status dummy, union dummy and white dummy.
4. From column 5 to 8, start hourly wage is the first wage observed that may not correspond to the starting wage. The starting hourly wage indicator included takes the value 1 when the first wage observed in data bases corresponds to the starting wage and takes the value 0 in the otherwise.
5. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size. The sample size is smaller when the log of the start hourly wage is included due to missing data for this variable in some observations.
6. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

The literature suggests that the most educated workers are the less affected by the business cycle. So, similar to what was done to wages, I controlled for the interaction of education − high school and college − with the unemployment rate prevailing at the start of the job. Again, the interactions between education levels and initial unemployment rate are not significantly different from zero and the effect is not the expected. Bowlus (1995) obtains similar results computing hazard models for workers with different levels of education what in her opinion *"may indicate that during recessions less educated workers cannot find work at all, while higher educated workers can but tend to mismatch more during recessions"*.[2]

Then I introduced the starting hourly wages to test if the labor market internalizes most of the business-cycle effect through initial wages and to eliminate or reduce the omitted variable bias. When the starting hourly wages were introduced, the results, contrary to what would be expected, appear not statistically significant due to a loss of observations. So, to overcome this problem, the starting hourly wage was replaced by the first hourly wage observed for each individual in the sample. The starting hourly wages refers to wages at the start of the employment spell and the first wages observed (reported in table 5) refers to the first wages observed for each employment spell that could correspond with the starting wages or not. Since these two measures may greatly differ, a censor indicator, which takes the value one when the first wage observed is indeed the wage received in the first year of the employment spell, was included. When, in Table 5 (columns 5-8), we consider the first hourly wages observed, the initial unemployment rate coefficient decreases in magnitude and loses some significance but remains significantly different from zero, which means that wages are capturing a part of the cycle effect.

Thus, the results are in agreement with literature (columns 5-8) starting hourly wage is statistically significant and exhibits a negative sign, and unemployment rate prevailing at the start of the job loses some significance when starting wages are

[2]In Journal of Labor Economics, Vol. 13, No. 2 (1995), p. 343

included, which means that cyclical fluctuations in match quality are internalized by labor market through initial wages.

In columns 3, 4, 7 and 8 we control for time effects including dummies variables indicating the starting year of the employment spell. The coefficients of the initial unemployment rate decrease significantly and become not statistically different from zero. This happens probably because when controlling for region and the start working year, the initial unemployment rate has small variations in the sample.

5.3 Multinomial Logit Models

Hitherto, the main findings of this study are in agreement with the literature. The results presented suggest that wages are procyclical and this applies especially for those who start working in periods of high unemployment rate. The probability to leave an employment is greater for those who start working in a recession, which implies lower tenures on the job. On average, wages and tenure tend to react in a procyclical way, which means that, on average, the match quality decreases with the unemployment rate. So, we can conclude that, at the mean level, the congestion effect outweighs the agglomeration effect. On the other hand, empirical evidence suggests that high-skilled workers are less affected by external conditions. As mentioned above, when there are more workers available the employer can choose the best ones. If the mismatching occurs - job requires different skills or provides lower wages - the match tends to end up. As the employer is interested in keeping the best workers, he must provide them with good conditions at work, so it is possible that good matches are established during economic downturns.

This subsection addresses the impact of the initial conditions on match quality considering different points in the distribution of match quality and not an average match quality. We test the hypothesis that the high-skilled workers establish better matches during recessions which means that, for them, the agglomeration effect outweighs the congestion effect. Once again, I present the effect of the unemployment

rate prevailing at the start of the job on match quality proxied by real wages and tenure at the job. However, contrary to what was done in the previous sections, different relative business-cycle effects are considered, depending on wages and tenure quartiles.

The worker abilities are not directly observable so are usually proxied by education, occupation and industry or wages, in sense that the high-skilled workers are the most educated workers; those who are working in a human-intensive industry whose occupation requires higher abilities; or those who receive a higher wage. We consider that the most qualified workers are those who have higher wages and tenures at the job. Thus, our hypothesis predicts that the business-cycle effect is more favorable for those who have a real wage and tenure in the highest quartile.

Table 6 shows the results of the MNLM to real annual and hourly wages. As expected, the probability of belonging to a higher wage category increases with tenure, education and white race. Mobility in the wage distribution is limited, therefore I include dummies for the starting wage quartiles. These variables have a great explanatory power and influence considerably the probability of staying in the same quartile, capturing some effects that may be due to variables that explain the low mobility but are omitted and also to the simple fact that there is statistical persistence.

Looking at the main interest variable, unemployment rate at start of the job, we can conclude that it is not significantly different from zero for the second and third annual wage categories. Being in second or third wage quartiles instead of first is not explained by unemployment rate prevailing at the start of the job. For those who have a wage in the fourth category, initial unemployment rate is significant. An increase of one percent raises the probability of being in fourth category instead of first by about 74 per cent. When hourly wages are considered, the unemployment rate prevailing at the start of the job is, once again, significantly different from zero only for the fourth wage category instead of first. The relative probability of being

Table 6: Multinomial Logit Model for Real Wages

Dependent variable: Log(annual wage)						
	2nd quantile	3rd quantile	4th quantile	2nd quantile	3rd quantile	4th quantile
Tenure	1.5624***	2.0893***	2.4472***	1.5618***	2.0893***	2.4438***
	(0.0493)	(0.0766)	(0.0983)	(0.0493)	(0.0763)	(0.0976)
Education	1.0996***	1.2499***	1.6981***	1.1002***	1.2506***	1.6990***
	(0.0223)	(0.0319)	(0.0543)	(0.0224)	(0.0320)	(0.0542)
Log UR at	1.1777	1.2183	1.7393***			
Start of Job	(0.1648)	(0.1902)	(0.3198)			
Medium UR				1.1324	1.1095	1.3892**
at Start of Job				(0.0984)	(0.1187)	(0.1822)
High UR				1.1550	1.1692	1.6329***
at Start of Job				(0.1100)	(0.1266)	(0.2189)
N=10,141						
Dependent variable: Log(hourly wage)						
	2nd quantile	3rd quantile	4th quantile	2nd quantile	3rd quantile	4th quantile
Tenure	1.3883***	1.8426***	2.0947***	1.3863***	1.8407***	2.0876***
	(0.0425)	(0.0640)	(0.0893)	(0.0423)	(0.0639)	(0.0889)
Education	1.0982***	1.2641***	1.6764***	1.0990***	1.2646***	1.6797***
	(0.0205)	(0.0292)	(0.0491)	(0.0206)	(0.0294)	(0.0491)
Log UR at	0.9475	1.0543	1.6691***			
Start of Job	(0.1228)	(0.1579)	(0.2881)			
Medium UR				1.0738	1.1059	1.7119***
at Start of Job				(0.0866)	(0.1160)	(0.2121)
High UR				1.0059	1.0687	1.6836***
at Start of Job				(0.0858)	(0.1083)	(0.2066)
N=10,141						

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log unemployment rate at the start of the job and three unemployment rate at the start of the job quantiles dummies. UR is the abbreviation for Unemployment Rate.
2. Dependent variable is a multinomial dummy of the hourly wage quartiles.
3. Covariates included in each regression are 4 dummies of start wage quantiles, 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, tenure squared, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

in the highest wage quartile compared to the lowest increases about 66 per cent with the initial unemployment rate.

The second equation in table 6 try to capture non-linear effects of the unemployment rate prevailing at the start of the job. When the pool of unemployed workers is larger the employer can choose the best ones (agglomeration effect). However,

when there are too high unemployment rates become difficult to the employers find the most qualified workers (congestion effect). For this purpose, we consider a low, medium and high tertile of the initial unemployment rate. The lower tertile contains unemployment rates between 2.3 and 5.7 per cent, the medium and the high tertile include the unemployment rates between 5.8 and 7.2 per cent and between 7.3 and 17.4, respectively.

We can conclude that there is still no evidence that being in the second or the third wage quartile compared with being in the first is influenced by the initial external conditions. On the other hand, the probability to have an annual wage in the highest quartile instead of first is increasing with the unemployment rate prevailing at the start of the job, since the highest tertile has the greater effect on wages.

For the hourly wages, a one per cent increase in a medium unemployment rate compared with a lower one raises the odds of being in the highest wage category instead of lowest one by about 71 per cent. This relative probability increases with the highest in relation to lower initial unemployment rate, but only about 68 per cent.

For Table 6 we can conclude that, for jobs initiated during economic downturns, the probability that the current level of wages is the highest rather than the lowest increases with the initial unemployment rate. This means that when the unemployment rate is high the employer chooses the best workers, here those who receive the highest wages, and try to keep them in the firm through a good wage − really good jobs observed today are established in bad years (agglomeration effect). Or, on the other hand, really bad jobs formed in bad years tend to disappear when the business-cycle improves, and therefore the relative probability of finding someone still on the lowest quartile (relative to the highest one) decreases with the initial level of the unemployment rate (congestion effect).

To apply a multinomial logit model to tenure (Table 7) at the job we used a

sample with one observation by employment spell per individual, as in the duration model. In the first tenure quartile are employment spells lasting less than 3 years, in second quartile those that lasted between 3 and 6 years, in third quartile those that lasted between 7 and 12 years and in the highest quartile those that lasted more than 12 years. The results in table 7 show that the effect of the education level is increasing with the tenure quartile for all regressions. For example, in the first specification in column (1), one additional year of schooling increases the odds of being in the third tenure quartile instead of first by about 3 per cent and the odds of being in the fourth tenure quartile instead of first by about 7 per cent.

The results of the initial unemployment rate effect on tenure quartiles are in agreement with our hypothesis. The probability of being in the highest tenure quartile instead of first increases about 55 per cent with the initial unemployment rate. For the remaining quartiles the business cycle measure is not relevant. When non-linearities in the unemployment rate prevailing at the start of the job are considered, we can conclude that the medium tertile compared with the lower tertile is not significantly different from zero. The relative probability of being in the fourth tenure quartile instead of first increases by about 37 per cent with the highest tertile compared with the lowest tertile of initial unemployment rate.

The probability of staying at a job is increasing with the starting hourly wages (column 2). An increase of one per cent in the starting hourly wage increases the odds of being in the second tenure quartile instead of first by about 34 per cent, the odds of being in the third instead of first by about 53 per cent and the odds of being in the fourth instead of first by about 71 per cent. When starting hourly wages are considered, the business-cycle measure loses all the significance which means that cyclical fluctuations on match quality are internalized by labor market through wages, as we have seen before. Considering the initial conditions, the conclusions are in agreement with those we obtain to real hourly wages; the agglomeration effect outweighs the congestion effect until an unemployment rate of 7.2 per cent, from

there the impact of a one per cent increase in the unemployment rate on tenure at job is not significantly different from zero.

In column 3 the starting year dummies were included to capture time effects. The results are consistent with those we obtain previously but the unemployment rate prevailing at the start of the job loses all the significance. This occurs because there is not enough variability in state unemployment rate which leads the year effect to prevail.

Table 7: Multinomial Logit Model for Tenure on Job

Dependent variable: tenure									
	(1)			(2)			(3)		
	2nd quantile	3rd quantile	4th quantile	2nd quantile	3rd quantile	4th quantile	2nd quantile	3rd quantile	4th quantile
Starting hourly wage				1.3362***	1.5297***	1.7042***	1.3406***	1.5166***	1.6815***
				(0.1310)	(0.1307)	(0.2323)	(0.1289)	(0.1315)	(0.2502)
Education	1.0066	1.0334**	1.0713***	1.0121	1.0621**	1.1036***	1.0176	1.0763**	1.1372***
	(0.0149)	(0.0163)	(0.0188)	(0.0227)	(0.0304)	(0.0405)	(0.0231)	(0.0313)	(0.0418)
Log UR at Start of Job	1.1134	1.0148	1.5519**	1.0026	0.9231	1.4586	0.9830	0.9819	0.6808
	(0.1682)	(0.2071)	(0.3244)	(0.2064)	(0.2386)	(0.3903)	(0.2523)	(0.3241)	(0.2482)
Starting Hourly Wage				1.3371***	1.5302***	1.7041***	1.3401***	1.5151***	1.7019***
				(0.1310)	(0.1308)	(0.2324)	(0.1287)	(0.1314)	(0.2556)
Education	1.0066	1.0340**	1.0711***	1.0117	1.0625**	1.1011***	1.0176	1.0765**	1.1337***
	(0.0149)	(0.0163)	(0.0188)	(0.0225)	(0.0303)	(0.0407)	(0.0230)	(0.0312)	(0.0419)
Medium UR at start of Job	1.0883	1.0203	1.2404	1.0749	0.9631	1.4562**	1.0061	1.0098	1.1646
	(0.1529)	(0.1467)	(0.1689)	(0.1830)	(0.1634)	(0.2576)	(0.1819)	(0.1847)	(0.2268)
High UR at start of Job	1.0886	1.0506	1.3724**	1.0003	0.9616	1.3001	1.0021	1.0161	0.7829
	(0.1318)	(0.1557)	(0.1990)	(0.1551)	(0.1718)	(0.2485)	(0.1880)	(0.2209)	(0.1949)
	(N=11,453)			(N=4,487)			(N=4,487)		

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log unemployment rate at the start of the job and three dummies of unemployment rate at start of the job quantiles. UR is the abbreviation for Unemployment Rate.
2. Dependent variable is a multinomial dummy of the tenure quartiles.
3. Covariates included in each regression are 4 region dummies, 10 industry dummies, 9 occupation dummies, age, censor dummy, number of children, marital status dummy, union dummy and white dummy. At column (3) year dummies were considered.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size. The sample size is smaller when the log of the start hourly wage is included due to missing data for this variable in some observations.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

In this study we conclude that real wages and tenure tend to be procyclical. However, the business-cycle measure has a different impact for each real wage and tenure quartiles − for those who are in the highest quartile of match quality the business cycle has a positive effect compared with those in the lowest one. This result seems to be in agreement with our hypothesis, however it is not strong enough to conclude that the really good matches are established during economic downturns. For this purpose, we apply the multinomial logit model to annual wage growth rate quartiles, in sense that, if real wages tend to be procyclical for workers in every point in the distribution of match quality, we identify a good match established during a recession if the wage adjustments are larger, especially, during economic improvements. Larger annual wage growth rates could be an indicator that the employer is trying to keep the worker in the firm, so we could expect higher wage adjustments for those who start working in an economic downturn.

Table 8 presents a multinomial logit model for the annual growth rate quartiles of wages. The results show that tenure at job exhibits the same behavior for annual and hourly wages; for every specifications tenure increases the odds of being in the second wage growth rate quartile instead of first but this relative probability is decreasing in the following quartiles, which can lead to the conclusion that the larger wage adjustments are made in the first years of the employment spell, from a given time real wages tend to stabilize.

The probability of being in the highest wage growth rate quartile instead of first increases by about 17 per cent with the unemployment rate prevailing at the start of the job for annual wage growth rates (specification 1). When we consider both initial and current unemployment rates (specification 2), this probability increases to 34 per cent. On the other hand, the odds of being in the highest wage growth rate quartile instead of first decreases with current unemployment rate. This means that for a worker employed during a recession period the wage growth rate is lower than for those who are employed during an expansion period, independently of the

Table 8: Multinomial Logit Model for Annual Wage Growth Rates

Dependent variable: annual wage grow rate						
	2nd quantile	3rd quantile	4th quantile	2nd quantile	3rd quantile	4th quantile
Tenure	1.1950***	1.1050***	0.8473***	1.1941***	1.1040***	0.8460***
	(0.0276)	(0.0255)	(0.0183)	(0.0276)	(0.0255)	(0.0183)
Education	1.0243*	1.0404***	1.0056	1.0240*	1.0400***	1.0047
	(0.0134)	(0.0145)	(0.0129)	(0.0134)	(0.0145)	(0.0130)
Log UR at	1.0568	1.0181	1.1653*	1.1223	1.0986	1.3364***
Start of Job	(0.0920)	(0.0841)	(0.1019)	(0.1050)	(0.1023)	(0.1366)
Log Current UR				0.8488	0.8066*	0.6960***
				(0.1094)	(0.0943)	(0.0889)
N=15,380						
Dependent variable: hourly wage grow rate						
	2nd quantile	3rd quantile	4th quantile	2nd quantile	3rd quantile	4th quantile
Tenure	1.2064***	1.1142***	0.9327***	1.2062***	1.1140***	0.9323***
	(0.0255)	(0.0226)	(0.0199)	(0.0255)	(0.0226)	(0.0198)
Education	0.9914	1.0138	1.0093	0.9913	1.0137	1.0091
	(0.0139)	(0.0141)	(0.0133)	(0.0139)	(0.0141)	(0.0133)
Log UR at	0.9924	1.0976	1.1289	1.0057	1.1085	1.1715
Start of Job	(0.0812)	(0.0853)	(0.0960)	(0.0898)	(0.0994)	(0.1151)
Log Current UR				0.9646	0.9748	0.9059
				(0.1161)	(0.1081)	(0.1070)
N=15,380						

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log current unemployment rate and the log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are annual growth rates of the annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, tenure squared, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

initial conditions.

For the annual growth rate of hourly wages the business cycle coefficients are in agreement with those obtained to annual wages, but they are not significantly different from zero. As we have previously discussed, hourly wages tend to be more stable than annual wages, so the estimated coefficients tend to be less significant.

6 Conclusions

The purpose of this dissertation is to analyze at what stage of the business cycle the most successful matches are established, using the PSID data for the United States. The quality of job matches is measured by current wages and job tenure, which means that the match quality is interpreting as an "experience good".

The main findings suggest that real annual and hourly wages are strongly procyclical, regarding both current and initial unemployment rates. These effects are stronger and more significant to unemployment rate prevailing at the start of the job than to current unemployment rate. Tenure and education have positive returns on wages. Tenure at job decreases the business-cycle effect on wages, which means that the most tenured workers have less procyclical real wages. Hourly wages are less responsive to local current unemployment rate than annual wages. Annual wages are greatly dependent of the amount of annual hours worked which are quite procyclical. Hourly wages are greatly influenced by the initial conditions but tend to be stable throughout the match.

Using a duration model it was found that jobs initiated during booms last longer than those initiated during recessions. The job duration increases with starting hourly wages and the business cycle loses significance since the labor market internalizes most of the cycle effect through initial hourly wages.

To test the hypothesis that during recessions, with more workers available, employers have an incentive to choose the best ones and try to keep them in the firm, we used a multinomial logit model for real wages and tenure quartiles. The business-cycle has different effects on each real wage and tenure quartiles. The relative probability to have higher real wage and tenure instead of lower one increases with the initial unemployment rate. This effect is non-linear such that the effect of the medium unemployment rate is stronger than the effect of the highest one. The odds of being in the highest annual wage growth rate instead of the first one increase with the unemployment rate and decrease with tenure. We can conclude

that there seems to be evidence that the match quality increases during economic downturns for those who have higher wages and tenure, typically the high-skilled workers. However, when the unemployment rate is too high the effect is reversed; the pool of unemployed workers is so high that it makes difficult for an employer choose the best ones.

The results seem to be in agreement with the hypothesis that, for the most qualified workers, reccessions are conducive to high match quality formation. However, as I previously refered, for a future research I would like to test the results robustness implementing random and fixed effects into multinomial logit model regressions.

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Appendix

Table 9: Effect of Current Unemployment Rate on Current Real Wage (*Pooled OLS*)

Dependent variable: Log(annual wage)				
	(1)	(2)	(3)	(4)
Tenure	0.0180***	0.0146***	0.0180***	0.0123
	(0.0005)	(0.0024)	(0.0005)	(0.0100)
Education	0.0839***	0.0839***	0.0817***	0.0751***
	(0.0018)	(0.0018)	(0.0083)	(0.0128)
Log Current UR	-0.0238	-0.0395	-0.0391	-0.1823**
	(0.0225)	(0.0254)	(0.0607)	(0.0902)
Log Current UR×Tenure		0.0019		0.0126**
		(0.0013)		(0.0053)
Log Current UR×Education			0.0012	0.0118*
			(0.0045)	(0.0068)
Tenure×Education				0.0003
				(0.0008)
Log Current UR×Tenure×Education				-0.0009**
				(0.0004)
N=35,264				
Dependent variable: Log(hourly wage)				
Tenure	0.0175***	0.0169***	0.0176***	0.0095
	(0.0005)	(0.0021)	(0.0005)	(0.0098)
Education	0.0794***	0.0794***	0.0869***	0.0788***
	(0.0016)	(0.0016)	(0.0074)	(0.0112)
Log Current UR	-0.0210	-0.0237	0.0310	-0.0661
	(0.0215)	(0.0236)	(0.0538)	(0.0788)
Log Current UR×Tenure		0.0003		0.0089*
		(0.0011)		(0.0051)
Log Current UR×Education			-0.0040	0.0037
			(0.0039)	(0.0059)
Tenure×Education				0.0007
				(0.0008)
Log Current UR×Tenure×Education				-0.0007*
				(0.0004)
N=35,264				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log current unemployment rate. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

Table 10: Effect of Initial Unemployment Rate on Current Real Wage (*Pooled OLS*)

Dependent variable:	Log(annual wage)		Log(hourly wage)	
	(1)	(2)	(3)	(4)
Tenure	0.0353***	0.0262	0.0321***	0.0181
	(0.0013)	(0.0416)	(0.0011)	(0.0390)
Education	0.0918***	0.0941***	0.0847***	0.0882***
	(0.0023)	(0.0178)	(0.0021)	(0.0157)
Log UR at Start of Job	-0.0304*	-0.1198	-0.0358**	-0.0541
	(0.0172)	(0.1308)	(0.0154)	(0.1140)
Log UR at Start of Job×Tenure		0.0139		0.0058
		(0.0228)		(0.0211)
Log UR at Start of Job×Education		0.0016		-0.0024
		(0.0096)		(0.0084)
Tenure×Education		-0.0015		-0.0005
		(0.0031)		(0.0029)
Log UR at Start of Job×Tenure×Education		0.0001		0.0004
		(0.0017)		(0.0016)
N=23,707				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

Table 11: Effect of Current and Initial Unemployment Rate on Current Real Wage (*Pooled OLS*)

Dependent variable:	Log(annual wage)		Log(hourly wage)	
	(1)	(2)	(3)	(4)
Tenure	0.0352***	-0.0065	0.0321***	0.0057
	(0.0013)	(0.0086)	(0.0011)	(0.0076)
Education	0.0918***	0.0918***	0.0847***	0.0847***
	(0.0023)	(0.0023)	(0.0021)	(0.0021)
Log Current UR	-0.0207	-0.0785*	-0.0099	-0.0260
	(0.0253)	(0.0402)	(0.0237)	(0.0345)
Log UR at Start of Job	-0.0217	-0.0472	-0.0317*	-0.0676**
	(0.0188)	(0.0337)	(0.0164)	(0.0279)
Log Current UR×Tenure		0.0152***		0.0062
		(0.0051)		(0.0042)
Log UR at Start of Job×Tenure		0.0080*		0.0083**
		(0.0046)		(0.0038)
N=23,707				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log current unemployment rate and the log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

Table 12: Effect of Current Unemployment Rate on Current Real Wage (*Random effects*)

Dependent variable: Log(annual wage)				
	(1)	(2)	(3)	(4)
Tenure	0.0152***	0.0061***	0.0152***	-0.0039
	(0.0007)	(0.0019)	(0.0007)	(0.0081)
Education	0.0768***	0.0767***	0.0727***	0.0626***
	(0.0034)	(0.0034)	(0.0072)	(0.0110)
Log Current UR	-0.0936***	-0.1350***	-0.1219***	-0.2504***
	(0.0175)	(0.0204)	(0.0470)	(0.0728)
Log Current UR×Tenure		0.0050***		0.0127***
			(0.0010)	(0.0042)
Log Current UR×Education			0.0021	0.0090*
			(0.0035)	(0.0054)
Tenure×Education				0.0008
				(0.0006)
Log Current UR×Tenure×Education				-0.0006*
				(0.0003)
N=35,264				
Dependent variable: Log(hourly wage)				
Tenure	0.0147***	0.0100***	0.0147***	0.0142*
	(0.0007)	(0.0018)	(0.0007)	(0.0080)
Education	0.0727***	0.0726***	0.0840***	0.0861***
	(0.0031)	(0.0031)	(0.0064)	(0.0099)
Log Current UR	-0.0571***	-0.0784***	0.0219	0.0084
	(0.0166)	(0.0194)	(0.0412)	(0.0659)
Log Current UR×Tenure		0.0026***		0.0014
		(0.0009)		(0.0041)
Log Current UR×Education			-0.0060*	-0.0065
			(0.0031)	(0.0050)
Tenure×Education				-0.0003
				(0.0006)
Current UR×Tenure×Education				0.0001
				(0.0003)
N=35,264				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log current unemployment rate. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

Table 13: Effect of Initial Unemployment Rate on Current Real Wage (*Random effects*)

Dependent variable:	Log(annual wage)		Log(hourly wage)	
	(1)	(2)	(3)	(4)
Tenure	0.0230***	-0.0508	0.0226***	-0.0252
	(0.0015)	(0.0377)	(0.0014)	(0.0363)
Education	0.0975***	0.0907***	0.0876***	0.0985***
	(0.0043)	(0.0170)	(0.0038)	(0.0155)
Log UR at Start of Job	-0.0664***	-0.1953	-0.0579***	-0.0335
	(0.0187)	(0.1202)	(0.0176)	(0.1083)
Log UR at Start of Job×Tenure		0.0361*		0.0177
		(0.0202)		(0.0193)
Log UR at Start of Job×Education		0.0028		-0.0078
		(0.0087)		(0.0080)
Tenure×Education		0.0040		0.0026
		(0.0027)		(0.0027)
Log UR at Start of Job×Tenure×Education		-0.0019		-0.0008
		(0.0015)		(0.0014)
N=23,707				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.

Table 14: Effect of Current and Initial Unemployment Rate on Current Real Wage (*Random effects*)

Dependent variable:	Log(annual wage)		Log(hourly wage)	
	(1)	(2)	(3)	(4)
Tenure	0.0227***	-0.0019	0.0225***	0.0091
	(0.0015)	(0.0072)	(0.0014)	(0.0069)
Education	0.0975***	0.0974***	0.0876***	0.0876***
	(0.0043)	(0.0043)	(0.0038)	(0.0037)
Log Current UR	-0.0554**	-0.0966***	-0.0160	-0.0174
	(0.0233)	(0.0319)	(0.0218)	(0.0292)
Log UR at Start of Job	-0.1039***	-0.1010***	-0.1071***	-0.1241***
	(0.0205)	(0.0274)	(0.0189)	(0.0245)
Log Current UR×Tenure		0.0103**		0.0021
		(0.0040)		(0.0037)
Log UR at Start of Job×Tenure		0.0034		0.0052
		(0.0039)		(0.0035)
N=23,707				

1. Data is composed of a panel of workers from the PSID over the period 1978-1996. The business cycle is measured by the log current unemployment rate and the log unemployment rate at the start of the job. UR is the abbreviation for Unemployment Rate.
2. Dependent variables are log deflated annual and hourly wages.
3. Covariates included in each regression are 4 region dummies, year dummies, 10 industry dummies, 3 occupation dummies (blue collar, white collar and job service), experience, experience squared, years of schooling, number of children, marital status dummy, union dummy and white dummy.
4. Standard errors are in parentheses. They are corrected to allow for group effects within state-year cells. N is the sample size.
5. (*) significant at 0.10 level
   (**) significant at 0.05 level
   (***) significant at 0.01 level.