# Can expected wage growth explain why voluntary job changes lead to a drop in wages?

Gastón Mullin

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## 1 Introduction

Job-to-job transitions are central to describing the trajectories of workers, accounting for a substantial share of separations in developed countries (Jolivet et al. (2006); Bjelland et al. (2011)). As a result, on-the-job search has long been incorporated into standard search models by the literature, following seminal contributions by Pissarides (1994) and Burdett and Mortensen (1998), and has helped to analyze a wide range of issues, including wage inequality, wage growth and the relation between the labor market and the business cycle.

In a standard model, employed workers receive offers at a given rate and accept an offer when the posted wage improves over the current wage. Under this model, workers can be described as ascending on a wage ladder when they take a new position (either from employment or unemployment) and falling off the ladder when hit by a layoff shock.

Several papers have noted that this basic model leaves no room for apparently voluntary job-to-job transitions that result in a wage reduction, while this is a somewhat

commonly observed phenomenon in the data: Jolivet et al. (2006) show that between 20% and 35% of job-to-job transition in the United States and a selection of European countries are associated with a wage decrease, and Vejlin and Veramendi (2023) finds this number to be around 35% for the United States using data from the Panel Study of Income Dynamics (PSID).

Four different reasons have been presented that could explain this phenomenon: measurement errors, compensating differentials, reallocation shocks, and back-loaded wage profiles. All these mechanisms are sensible additions to search models and affect not only the way the model works in producing job-to-job transitions that result in wage cuts but also job-to-job transitions resulting in wage gains or even wage changes without a job change.

This thesis zooms into the characteristics of job-to-job transitions resulting in wage cuts in the US using survey data and examines the extent to which back-loaded contracts can explain these transitions. I estimate a model in which jobs are described by two parameters, one affecting the initial wage and one the growth of wage as the worker accrues tenure in the job. Upon receiving job offers workers decide whether to accept a new job or not depending not only on the current change in wages but also on the discounted value of the current and future positions.

I find that such a model performs marginally better than a standard wage posting model in terms of explaining the share of workers going through transitions due to quits that are value improving, and that reallocation shocks, which correspond to transitions in which a worker is constrained to accept whatever offer that arrives, play a significant role.

The outline of the thesis is as follows: the second section describes the relevant literature and mechanisms that have been explored to explain voluntary transitions with wage cuts, the third section describes the data and presents descriptive evidence

related to such transitions, the fourth section introduces the model and estimation approach, the fifth section shows the results of the model estimation and the final section concludes.

## 2 Mechanisms

Measurement errors have been introduced as possible reasons leading to misclassified wage declining transitions in two ways. First, it can be that transitions presented as voluntary job-to-job transitions are not so because there was an intervening unemployment period or because the transitions were a layoff rather than a quit. Several papers working with administrative data (Postel-Vinay and Robin (2002); Jolivet et al. (2006) among others) do not have access to the motive of separation and define job-to-job transitions based on whether the period between leaving a job and beginning another is sufficiently short, which could lead to some misclassification. Secondly, there could be misreporting in wages, which leads to some transitions being classified as wage-declining when they are not so necessarily.

The large share and prevalence of transitions with wage losses in many studies for different countries and using both survey and administrative record data suggest that it is unlikely that measurement errors can account for the phenomenon.

The second reason that has been mentioned is the existence of compensating differentials, in which a worker trades a lower wage for better amenities that characterize the position, such as flexibility, distance to work, working conditions, and job security. Under this explanation, workers could obtain a better match when switching jobs, even when this does not reflect a higher wage. Bonhomme and Jolivet (2009) find that workers value these amenities, but these are not reflected in compensating differentials due to the high correlation between wages and amenities in job offers. Jarosch (2023)

incorporates heterogeneity in job security explicitly, through different separation rates by job, and finds similarly that there is a positive correlation between better paying and more secure jobs.

The third explanation has been described as reallocation shocks (Vejlin and Veramendi (2023); Tjaden and Wellschmied (2014); Jolivet et al. (2006)) or constrained mobility (Bonhomme and Jolivet (2009)) and refers to a situation in which a worker receives a shock which essentially reallocates him to another position, as the worker is no longer given the option to continue in his previous job but only can choose between an alternative offer or going into unemployment. The literature has linked this shock to mobility decisions at the household level or advance notice (Bagger and Lentz (2019)), which in many institutional frameworks is mandated by law.

This shock is generally parameterized through an offer arrival rate $\lambda^r$ which is estimated freely, without links to the job separation rate $\delta$ or the arrival of offers during unemployment or employment $\lambda^u$, $\lambda^e$. Taber and Vejlin (2020) is a notable exception, proposing that upon a separation shock, individuals receive a job offer with probability $P^*$, which they can accept and avoid unemployment.

Vejlin and Veramendi (2023) estimate separate models accounting for compensating differentials and reallocation shocks and find that the parameter for compensating differentials variance or the reallocation shocks arrival rate have to be economically significant in order to accommodate the high fraction of job-to-job transitions resulting in lower wages. Bonhomme and Jolivet (2009) show that in a model that allows for reallocation shocks, compensating differentials are not relevant, but they would be in the absence of reallocation shocks.

Finally, two main streams of literature present back-loaded wage profiles that can explain workers choosing to take immediate wage cuts in anticipation of higher future wages. Postel-Vinay and Robin (2002) posit a mechanism in which workers go from

less productive firms to more productive firms accepting, at times, wage cuts, as the arrival of new offers leads to an increase of the bargaining power of the worker over time, which results in an increased wage path over the long term. Similarly Burdett and Coles (2003, 2010); Shi (2009) have proposed a model that allows for wage-tenure offers, in which workers could abandon a firm in favor of another which offers a back-loaded wage profile but an immediate wage cut.

Postel-Vinay and Robin (2002) find that within their setting, the simulated share of transitions leading to wage cuts of at least 5% is far lower than what is observed in the data (10% vs 30% in general, with specific values changing by category), which can be related to the fact that they estimate very high discount rates for most workers. Tjaden and Wellschmied (2014) find that is implausible that back-loaded wage-tenure profiles explain voluntary transitions with wage declines, as wage growth for job switchers is lower for those who receive wage cuts than for those who see their wage increased at the moment of transition. Both papers use a short time frame, which could mean that there needs to be more time for eventual gains to show up directly in the data and, as such, inform the model estimation.

Connolly and Gottschalk (2008) directly tackles whether workers take wage cuts in job-to-job transitions in expectation of a future wage increase. They find that a large fraction of job transitions that lead to wage cuts are actually value-inducing because of the increased wage growth the worker obtains. While interesting, the work appears to be limited by the very narrow number of possibilities that they consider for the wage-tenure contracts: linear functions with two possible values for the intercept and three possible values for the slope. This leads to a collapse of the heterogeneity in the data, which could lead to jobs with somewhat different wages and tenure profiles being lumped into the same categories. Other relevant limitations of this paper are the fact that they do not use discount rates, which leads to an overestimation of how much

workers do, in fact, value the future, and that it uses four years of data, which means that if a job-to-job transition occurs at the middle of the period, there will not be more than two years worth of data to determine the wage growth of the old and new jobs.

Overall, the most relevant paper to explain the many possible mechanisms behind these wage-lose transitions is Taber and Vejlin (2020). They estimate a search model based on Danish registry data, which studies how much wage inequality can be explained due to intrinsic differences in workers, search frictions, accumulation of human capital, and compensating differentials. In particular, they analyze how these factors can explain the large share of workers with job-to-job transitions with wage declines, finding that all of the four mechanisms detailed above contribute to explaining the transitions.

A difference from this paper arises from the type of data used and its implications. While registry data allows for a vast number of observations and identification of firm levels contributions to wage processes, survey data such as PSID helps in distinguishing between separations due to layoffs and quits, reporting on variables that can be mapped to compensating differentials or circumstances that can lead to mobility for reasons other than wage-improving job turnover.

# 3 Data and descriptive evidence

I work with PSID yearly data from 1982 to 1997. PSID is a representative panel from the US population that follows households over time, including periodical entries to the panel and split-offs from incumbent households. During this period, the survey covers the employment situation of respondents extensively and can be harmonized with relative ease as questions vary only slightly over the years. This 16-year period provides a somewhat long time to observe worker trajectories. This, together with the

inclusion of other covariates in the survey, allows me to explore the possible motives that could explain quits resulting in lower wages.

Table 1: Descriptive statistics

| | All heads | All employed | Job stayers | J-J laid off | J-J quits |
|---|---|---|---|---|---|
| Age | 43.71 | 38.39 | 39.42 | 33.82 | 32.38 |
| Male | 0.70 | 0.78 | 0.80 | 0.83 | 0.76 |
| Less than HS | 0.31 | 0.22 | 0.20 | 0.27 | 0.19 |
| Completed HS | 0.33 | 0.35 | 0.35 | 0.38 | 0.34 |
| Some college | 0.20 | 0.23 | 0.23 | 0.23 | 0.26 |
| Completed college | 0.16 | 0.20 | 0.22 | 0.12 | 0.21 |
| Median Hourly Wage (2023 dollars) | | 23.61 | 25.96 | 19.30 | 19.25 |
| # of Households | 17,933 | 14,331 | 10,521 | 1,903 | 3,973 |
| # of Year-HH observations | 130,814 | 89,218 | 57,067 | 2,571 | 6,997 |

Note: All heads column includes unemployed, inactive, retired, and student heads of households. For the column of job stayers, job-to-job switchers who are laid off, and job-to-job switchers who quit, the reported wage is from the year before the potential transition.

Table 1 shows basic demographic data for household head workers in the sample, differentiating between those staying in a job from one given year to the next and those changing jobs with reasons stated as being laid off or quitting. Workers are classified as having job-to-job (J-J) transitions if they report having a different job in successive surveys, even when they may have endured periods of unemployment in between the surveys. Workers who stay in the job tend to be older than those switching jobs and earn a higher hourly wage. Among switchers, those that quit jobs are generally better educated and are less likely to be male, while mean age and median hourly wage are remarkably close to that of laid-off workers.

## 3.1 Wages

Respondents report the earnings they receive from their jobs, the structure of the pay (salaried or hourly pay), the number of hours worked, when they started in the organization and several other variables such as occupation and industry of the organization. I focus in the main-job wages of non self-employed workers.

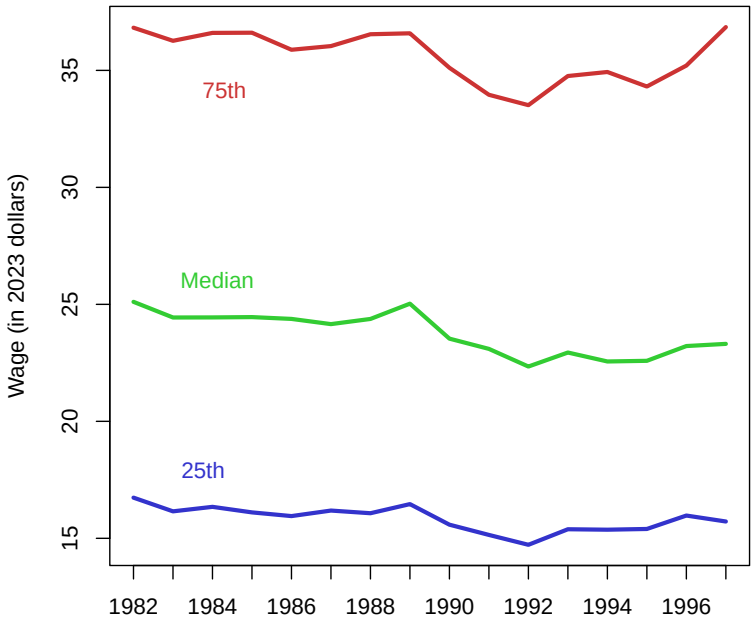
Until 1992, workers report both salaried and per-hour wages in hourly rates, while after 1993 the salaried wage can be reported as hourly, monthly or yearly pay and I construct the hourly rate using the information on hours worked. While this brings about the possibility of measurement error in a relevant variable, I see no evidence of systematic changes when analyzing the wages of workers staying in the same job in the years when the switch in reporting occurs.

One concern when taking a 16-year time frame is that real wages could increase in the period due to productivity gains. As has been covered extensively elsewhere, this is not a period known to have had steep increases in real wages of US workers, and Figure 1 shows this is the case for the PSID sample as well. While quantiles of the wage distribution move slightly (partially due to composition in the panel) there is no clear trend during this period.

Workers' wages change more between two successive years when there is a change in employer. Figure 2 shows the density of changes in the value of wages (measured in 2023 US dollars) for non-self-employed workers. It can be seen that most workers who do not change employers show relatively little changes in their wages. Table 2 reports that while 47% of those workers present losses in real terms, the losses are relatively small, and only 25% show losses in nominal terms. As can be expected, laid-off workers tend to obtain lower wages when employed with a different employer in the following year, but a higher variance also leads to having a fatter right tail than job stayers.

Workers who transition between employers voluntarily have a distribution that also

Figure 1: 25th, 50th and 75th percentiles of wage over time



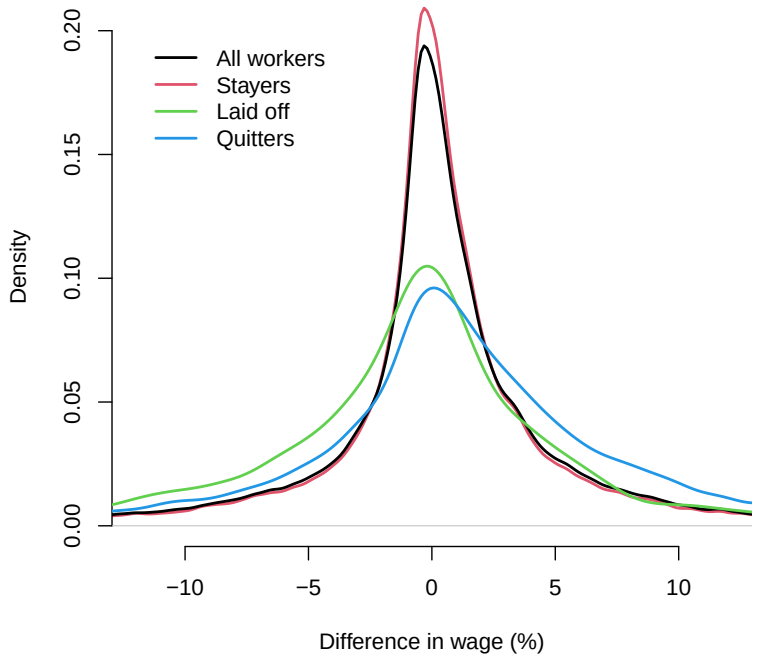

presents higher variance than for stayers but is accompanied by a higher wage on average than for those who are laid off. As mentioned above, there is still a sizeable share of workers that resign and get a new job, which results in a wage drop, with even 25% obtaining an hourly rate that is more than 10% lower.

As hypothesized by Postel-Vinay and Robin (2002) and Burdett and Coles (2010), workers may choose to transition to jobs with lower wages voluntarily if the new job has a higher path of wage growth[1]. I first fit the wage of job $j$ of worker $i$ to a linear trend, which depends on the tenure at the job $\tilde{\tau}_{ijt}$ in years.

$$w_{jt} = \alpha_j + \gamma_j * \tilde{\tau}_{jt} + \epsilon_{jt}$$

[1]Postel-Vinay and Robin (2002) find little evidence for this in a simulation they provide, and Burdett and Coles (2010) build an equilbirium model that, to the best of my knowledge, has not been put to the data.

Figure 2: Density of wage changes




Note: Computes the empirical density of percentage changes in hourly wage for all workers employed in two successive years. The density for all workers follows closely that of stayers, reflecting the large share of those observations in all workers.

This specification is a direct approach; below I explore another specification that I find to be a better fit to the data. The procedure is similar to the one detailed in subsection 5.2, and produces roughly equivalent results to the logarithmic expression detailed there.

Table 3 shows that for workers changing jobs due to quitting, a lower percentage transition into lower-paying jobs with lower $\alpha_j$ and $\gamma_j$ when compared to laid-off workers, while a similar share transition to lower-paying jobs with lower $\alpha_j$ and higher $\gamma_j$. Overall, this suggests that while there may be some room for quitting workers going to jobs with an immediate decrease in salary in return for higher future growth, at first glance, this effect appears only to be marginal.

Workers tend to have their wages grow with tenure. As seen in Table 2, while a

Table 2: Share of workers by change of hourly wage from year $t$ to $t+1$

| Real wage | $\Delta < 0\%$ | $\Delta <$ - 5% | $\Delta <$ - 10% |
|---|---|---|---|
| All workers | 0.47 | 0.26 | 0.18 |
| Stayers | 0.47 | 0.24 | 0.16 |
| Laid off | 0.56 | 0.44 | 0.36 |
| Quitters | 0.42 | 0.32 | 0.25 |
| Nominal wage | | | |
| All workers | 0.27 | 0.20 | 0.14 |
| Stayers | 0.25 | 0.18 | 0.12 |
| Laid off | 0.44 | 0.38 | 0.31 |
| Quitters | 0.32 | 0.27 | 0.22 |

Note: Computes shares of all workers who are employed in two successive years and observe a percentage change drop of at least 0%, 5% or 10%.

Table 3: Share of transitions by comparison between wage growth

| Quitter | $< \alpha_j, < \gamma_j$ | $< \alpha_j, > \gamma_j$ | $> \alpha_j, < \gamma_j$ | $> \alpha_j, > \gamma_j$ | All |
|---|---|---|---|---|---|
| Higher wage | 0.03 | 0.21 | 0.52 | 0.22 | 1.00 |
| Lower Wage | 0.13 | 0.45 | 0.32 | 0.09 | 1.00 |
| Laid off | | | | | |
| Higher wage | 0.07 | 0.30 | 0.47 | 0.14 | 1.00 |
| Lower Wage | 0.20 | 0.47 | 0.27 | 0.04 | 1.00 |

Note: $\alpha_j$ represents the estimated expected real hourly wage that a worker earns with 0 years of tenure, while $\gamma_j$ is the estimated parameter controlling wage growth when tenure increases, which in this specification occurs linearly.

sizeable share of workers staying in their jobs tend to have small real wage reductions, most workers see gains in real wages from one year to the next. Moreover, the fraction of workers receiving a positive increase in wages is higher than the fraction of workers receiving an equivalent wage drop in wages. The literature has discussed extensively whether returns to tenure occur at the firm, industry, or occupation level; while solid evidence suggests that the later two may be more relevant, it is not possible to obtain tenure at the industry or occupation reliably from the data. On that note, the returns

to tenure at the firm presented below may be better understood as encapsulating a combination of returns to firm, industry, and occupation all at once.

Figure 3 presents the predicted returns to tenure $\tilde{\tau}_{ijt}$ after controlling for age $\tau_{it}$, in a fixed effects regression under different specifications. Two parametric regressions are estimated, using the expressions below, together with a flexible regression, in which the effect at each distinct number of years of tenure are estimated through dummy variables.

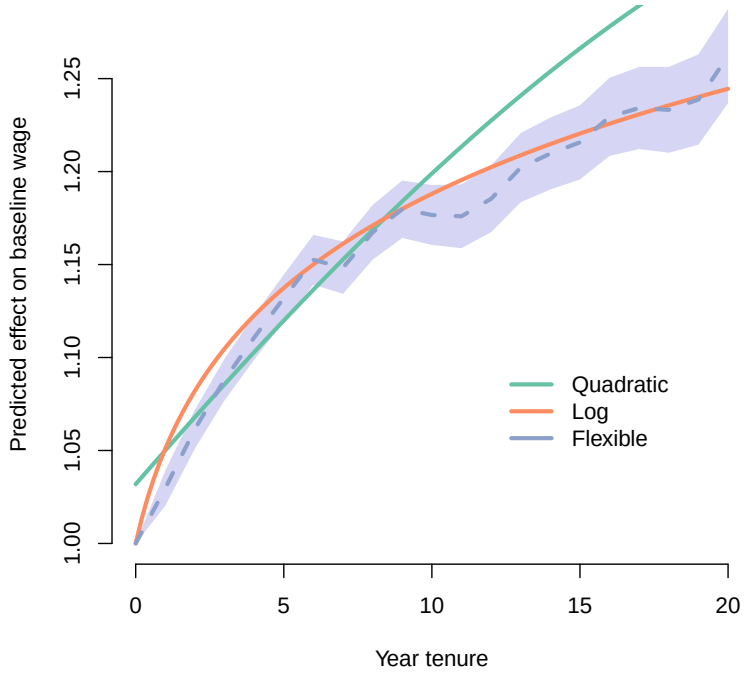
$$log(w_{ijt}) = log(\alpha_i) + \gamma_1 \cdot \tilde{\tau}_{ijt} + \gamma_2 \cdot \tilde{\tau}^2_{ijt} + f(\tau_{it}) + \epsilon_{ijt} \qquad \text{(1 - Quadratic)}$$

$$log(w_{ijt}) = log(\alpha_i) + \gamma \cdot log(\tilde{\tau}_{ijt} + 1) + f(\tau_{it}) + \epsilon_{ijt} \qquad \text{(1 - Log)}$$

Remarkably, the flexible regression produces estimates that are very close to the parametric regressions and validates returns that follow a decreasing return but are positive to tenure. While the expression that uses a linear and quadratic term on the right-hand side is more prevalent in Mincer-like regressions in the literature, I choose to work with the *Log* specification, as it allows to introduce heterogeneity on job positions later on using only two parameters: job-specific constant $\alpha_i$ and growth rate parameter $\gamma_i$. The results are qualitatively equivalent to the effect of tenure obtained using a cross-section equation that controls for the workers' characteristics.

Figure 3 pools workers of different education levels with significantly different wages. Figure 4 shows that the effects of tenure are present in the four education levels considered but more marked for lower education levels. The returns to tenure when analyzing just male workers, as common in the labor literature, are similar as for the sample with both men and women (Figures 12 and 13).

Figure 3: Effect of tenure on wages



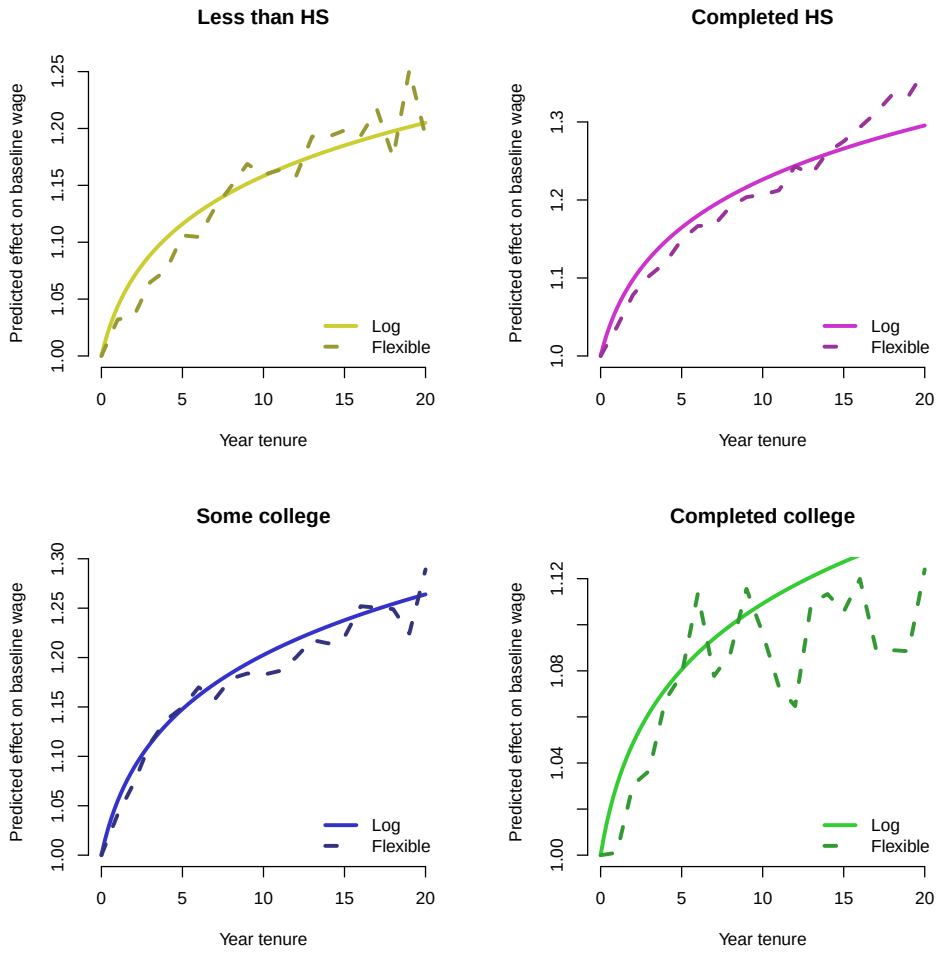

Note: Fitted estimated effect from individual-job-time fixed effects model, values in y-axis approximate the multiplier of each tenure level over a wage with 0 years of tenure. The shaded area indicates the 95% confidence interval for the flexible regression.

## 3.2 Possible factors leading to resignations with wage losses

As mentioned above, two of the explanations that have been presented to explain transitions resulting in wage losses are compensating differentials and constrained mobility. PSID contains some variables that may be useful in exploring these mechanisms.

On compensating differentials, the data source covers variables that may be associated with job security, job stability, and flexibility, such as whether the type of pay is salaried or by the hour or if it is covered by a union as well as questions on whether the worker wishes to work more or fewer hours than at their current job. At the same time, changes in the family, such as a change to spousal employment status or the birth of

Figure 4: Effect of tenure on wages by educational level




Note: Fitted estimated effect from individual-job-time fixed effects model, values in y-axis approximate the multiplier of each tenure level over a wage with 0 years of tenure. Each panel shows the estimated effect for the group of workers with a given educational level

new children, are easily tracked in the data and could be associated with job changes for reasons other than strict wage considerations.

Table 4 shows how the wages of quitting and laid-off workers interact with job changes along with variables that can be associated with job security and other amenities. From the workers' perspective, if a position is seen as more secure, they may be willing to forgo wages to obtain these more preferable amenities; on the other hand, as

Bonhomme and Jolivet (2009) pointed out and others have found, one of the challenges to finding compensating differentials in the data is that there could be a positive correlation in job offers so that jobs that are are also more preferable from an amenities perspective also pay better wages.

Salaried positions are commonly seen as more secure than hourly paid work. Hamermesh (2002) also finds that salaried positions are usually associated with better amenities, including flexibility. The first two panels of Table 4 show that going from salaried to hourly paid jobs is accompanied by a decline in wages by a large share of both quitters and laid-off workers while going in the opposite direction gives workers generally higher wages. The fact that quitting workers moving from hourly to salaried positions are making much higher gains than laid-off workers goes against the idea that these workers accept lower wages in return for job security or other amenities and points to the general alignment between pecuniary and non-pecuniary dimension of jobs.

Similarly, workers moving from non-unionized to unionized jobs are more likely to have a wage bump. In contrast, those moving in the opposite direction tend to have wage losses, even for quitting workers, in line with the established idea of the existence of a union-premium Budd and Na (2000). Moving from private to government jobs, which also can be characterized as a movement towards a more secure position, is associated with higher wage gains for quitting workers. Here, the evidence aligns with Jarosch (2023) in that more secure jobs are generally better paid.

Table 4: Wage losses by change of payment structure, union status and private-government status

| | Share of all changes | Median wage change | Share of row $\Delta <$ 0% | Share of row $\Delta <$ -5% | Share of row $\Delta <$ -10% |
|---|---|---|---|---|---|
| Quits | | | | | |
| Salaried → Salaried | 0.25 | 1.70 | 0.38 | 0.29 | 0.23 |
| Salaried → Hourly | 0.09 | -0.16 | 0.51 | 0.43 | 0.38 |
| Hourly → Salaried | 0.10 | 1.98 | 0.35 | 0.31 | 0.24 |
| Hourly → Hourly | 0.55 | 0.70 | 0.41 | 0.27 | 0.21 |
| Laid off | | | | | |
| Salaried → Salaried | 0.15 | 0.32 | 0.48 | 0.38 | 0.29 |
| Salaried → Hourly | 0.09 | -1.52 | 0.59 | 0.55 | 0.48 |
| Hourly → Salaried | 0.07 | -0.05 | 0.51 | 0.42 | 0.35 |
| Hourly → Hourly | 0.68 | -0.44 | 0.58 | 0.43 | 0.35 |
| Quits | | | | | |
| Non-union → Non-union | 0.83 | 0.91 | 0.41 | 0.31 | 0.25 |
| Non-union → Union | 0.07 | 2.71 | 0.29 | 0.22 | 0.17 |
| Union → Non-union | 0.05 | -1.18 | 0.60 | 0.51 | 0.45 |
| Union → Union | 0.05 | 0.44 | 0.46 | 0.29 | 0.22 |
| Laid off | | | | | |
| Non-union → Non-union | 0.78 | -0.34 | 0.55 | 0.43 | 0.35 |
| Non-union → Union | 0.05 | 1.07 | 0.43 | 0.38 | 0.32 |
| Union → Non-union | 0.09 | -3.60 | 0.76 | 0.67 | 0.61 |
| Union → Union | 0.08 | -0.38 | 0.55 | 0.33 | 0.22 |
| Quits | | | | | |
| Private → Private | 0.82 | 0.81 | 0.42 | 0.31 | 0.25 |
| Private → Govt | 0.07 | 1.78 | 0.35 | 0.29 | 0.25 |
| Govt → Private | 0.05 | 0.22 | 0.48 | 0.44 | 0.39 |
| Govt → Govt | 0.05 | 1.14 | 0.38 | 0.25 | 0.19 |
| Laid off | | | | | |
| Private → Private | 0.90 | -0.42 | 0.56 | 0.43 | 0.35 |
| Private → Govt | 0.04 | -1.11 | 0.59 | 0.52 | 0.46 |
| Govt → Private | 0.04 | -1.53 | 0.59 | 0.54 | 0.49 |
| Govt → Govt | 0.03 | -0.58 | 0.62 | 0.40 | 0.33 |

Note: Real wage changes in 2023 dollars for workers employed at time $t$ and $t+1$. $\Delta$ change represents a proportional change in real wages.

Table 5 shows the coefficient estimates of a multinomial logistic regression in which the baseline category is no transition from year $t$ to $t+1$, and the other four categories are transitioning due to a layoff, with or without an ensuing wage gain; and transitioning due to a resignation, with or without an ensuing wage gain, over a set of demographic

variables. Overall, this points to workers who quit with ensuing wage losses having characteristics that are closer to quitting workers who get a higher-paid job than workers who transitioned between jobs due to layoffs.

Higher age is associated with lower transition probability in any of the four categories described above. Women are less likely to be fired and more likely to resign, particularly when that leads to a wage loss. The marginal effect of being a woman, when evaluated at the mean value of other covariates, is to increase the probability of quitting to a new position with a lower wage by 1.06 percentage points (the overall frequency of such an event is 4.26%) and the effect of quitting to a job with higher wage is to increase the probability by 0.84 percentage points (overall frequency for this is 5.95%).

Workers with higher education levels are less likely to be laid off, while workers who have completed college are more likely to quit and obtain wage gains but less likely to quit and transition to jobs with lower pay.

Wages of workers in year $t$ are not included in the regression due to being mechanically linked to the definition of the categories: workers with meager wages in year $t$ have a limited range of jobs that would result in a wage loss, and similarly for workers with high wages. When running the regression defining the outcomes as no transition, transitions due to layoffs, and transitions due to quits, both latter outcomes have a negative coefficient for the wage of jobs in year $t$, highlighting that well-paid workers are generally less likely to have turnover.

Higher tenure is associated with lower transition between jobs, as expected. The marginal effect at the means of one additional year of tenure is to increase the probability of staying in a job by 1.45 percentage points and to lower the probability of each of the other four categories.

PSID includes other variables that could in theory, help explain the reasons behind voluntary transitions with wage cuts. However, many of these variables are not present

Table 5: Multinomial regression of type of transitions on demographics

| | *Dependent variable: type of transition* | | | |
|---|---|---|---|---|
| | Laid-Off | Laid-off | Quit | Quit |
| | Wage loss | Wage gain | Wage loss | Wage gain |
| | (1) | (2) | (3) | (4) |
| Age | $-0.023^{***}$ | $-0.020^{***}$ | $-0.032^{***}$ | $-0.049^{***}$ |
| | (0.003) | (0.004) | (0.003) | (0.003) |
| Female | $-0.307^{***}$ | $-0.231^{**}$ | $0.250^{***}$ | $0.154^{***}$ |
| | (0.082) | (0.092) | (0.054) | (0.047) |
| Completed HS | $-0.284^{***}$ | $-0.441^{***}$ | $-0.245^{***}$ | $-0.115^{*}$ |
| | (0.078) | (0.090) | (0.066) | (0.059) |
| Some College | $-0.426^{***}$ | $-0.434^{***}$ | $-0.028$ | 0.075 |
| | (0.090) | (0.100) | (0.069) | (0.063) |
| Completed College | $-1.121^{***}$ | $-1.049^{***}$ | $-0.180^{**}$ | $0.175^{***}$ |
| | (0.118) | (0.129) | (0.075) | (0.065) |
| Tenure in Years | $-0.097^{***}$ | $-0.163^{***}$ | $-0.110^{***}$ | $-0.148^{***}$ |
| | (0.007) | (0.010) | (0.006) | (0.006) |
| Constant | $-1.746^{***}$ | $-1.826^{***}$ | $-1.152^{***}$ | $-0.248^{***}$ |
| | (0.133) | (0.149) | (0.105) | (0.096) |

Note: Significance levels denoted by: $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01. The baseline category for the dependent variable is no transition between jobs. The baseline for education level is less than completed high school.

in the entire timespan I consider. Table 6 reports the results of adding covariates to the previous multinomial regression, one at a time. Coefficients for the basic demographic variables of Table 5 are not reported but suffer little to no change.

On mobility, results show that changing states from year $t$ to year $t+1$ is positively associated with quits but not significantly with layoffs. The coefficient and marginal effects are similar for both categories of quitting workers. Workers that respond that they might move in the future, in year $t$, are more likely to switch jobs from year $t$ to $t+1$. Mainly, the coefficient for moves due to work-related reasons is positive for workers who quit and those who are laid off, which hints at some level of anticipation that might be unexpected for laid-off workers. Overall, this suggests that workers changing housing locations are also more likely to change jobs, but that this is not a differential trait of workers quitting to lower-wage jobs; that is, constrained labor turnover due to mobility considerations does not appear to be playing an outsized role. Because housing mobility and job turnover can be concentrated during particular times of the lifecycle, I control more freely for age but find that results are unaffected.

Household considerations can also lead to job changes for reasons other than pure wage motives. Spouses changing job status is associated with higher job turnover for heads; these results are certainly expected to be endogenous since it can be the case that the spousal job status change is a response to the head job change rather than the other way around. However, it is worth pointing out that household heads quitting to jobs with lower wages are slightly more common when the spouse switches status from housekeeping to active in the labor market, perhaps reflecting changing household dynamics. A more thorough examination of this channel would require a focus on the timing of both decisions. The birth of a new child to the household head either in year $t$ or $t-1$ is generally not correlated with increased job turnover, while a newborn in year $t+1$ is marginally associated with increased quitting probability to jobs with a higher

wage, the significance of the coefficient disappears when controlling more flexibly for age. A cursory exploration shows that spousal working status responds strongly to new children's birth.

For a short period during the start of the considered time frame, the survey collects information on whether workers had the possibility of working more or fewer hours in their current jobs and if they desired to do so. Workers who wished to work more hours in year $t$ are more likely to incur job turnover into any of the four categories mentioned, while workers desiring to work fewer hours are more likely to quit but not to be laid off. Workers who report that they wish to work fewer hours and have a decrease in hours worked from year $t$ to $t+1$ are disproportionally those who quit jobs with lower wages.

Overall, there appears to be evidence that workers quitting into lower-paying jobs are observationally similar to workers quitting into higher-paying jobs in most dimensions but educational attainment. At the same time, workers who show a higher predisposition to changes in housing or work arrangements are expected to have a higher probability of having job turnover through either layoffs or quits. Possible sources of compensating differentials listed above do not appear to explain the decision to quit into lower-paying jobs either.

# 4 Model

This sections present a model in which jobs have differing starting wages and growth rates with tenure, to explor if backloaded contracts could be a possible mechanism behind workers voluntary transition to jobs that pay immediately lower wages. The model builds on a standard job-search model in discrete time, with the main difference arising from the fact that jobs are described not only by the wage at a given level of tenure, but also by the growth of the wage as tenure increases. Below I introduce the

Table 6: Multinomial regression of type of transitions on added covariates

| | *Dependent variable: type of transition* | | | |
|---|---|---|---|---|
| | Laid-Off | Laid-off | Quit | Quit |
| | Wage loss | Wage gain | Wage loss | Wage gain |
| | (1) | (2) | (3) | (4) |
| **Change State (1982-1997)** | | | | |
| Change State | 0.113 | 0.052 | 0.668*** | 0.688*** |
| | (0.097) | (0.114) | (0.060) | (0.052) |
| **Might move in the future (1982-1994)** | | | | |
| Housing/Family reasons | 0.189** | 0.232*** | 0.325*** | 0.416*** |
| | (0.073) | (0.085) | (0.057) | (0.050) |
| Other reasons | 0.004 | 0.277* | 0.527*** | 0.529*** |
| | (0.148) | (0.154) | (0.096) | (0.085) |
| Work related | 0.265** | 0.531*** | 0.774*** | 0.836*** |
| | (0.130) | (0.136) | (0.083) | (0.070) |
| **Newborn in household (1986-1997)** | | | | |
| Newborn in year $t$ | 0.130 | 0.013 | 0.032 | 0.023 |
| | (0.101) | (0.152) | (0.097) | (0.084) |
| Newborn in year $t+1$ | −0.014 | 0.033 | 0.025 | 0.033** |
| | (0.028) | (0.027) | (0.020) | (0.017) |
| **Spouse working status (1982-1997)** | | | | |
| Spouse changes status | 0.502*** | 0.378*** | 0.188** | 0.238*** |
| | (0.086) | (0.103) | (0.075) | (0.063) |
| **Wants change hours (1984-1988)** | | | | |
| Wants to work less | 0.281 | 0.002 | 0.303* | 0.404*** |
| | (0.247) | (0.305) | (0.172) | (0.142) |
| Wants to work more | 0.641*** | 0.644*** | 0.269*** | 0.239*** |
| | (0.111) | (0.120) | (0.088) | (0.075) |

Note: Significance levels denoted by: *p<0.1; **p<0.05; ***p<0.01. The baseline category for the dependent variable is no transition between jobs. Each division in the table reports variables added to the baseline regression of Table 5. The years depicted indicate the timespan used for the regression based on the variable availability in the survey.

different components of the model.

*Workers*

Workers differ in the productivity levels $\pi_i$ due to education attainment. I work with prime-age individuals from which I assume that from the moment workers enter the sample, they keep the same education level throughout. Workers accumulate age $\tau$ and retire at age $\bar{\tau}$, which will be key for estimating the value functions through backward induction.

*Jobs*

Jobs are composed of two parameters: an initial wage $\alpha_j$ and a wage growth rate parameter $\gamma_j$. Offers do not vary by employment status, education level, or age and follow a distribution $F(\alpha, \gamma)$. I assume that upon meeting a worker with a given education level, the initial wage $\alpha_j$ is multiplied by $\pi_i$, reflecting different productivities of the worker.

*Wages*

Workers receive a wage according to their productivity level $\pi_i$, the wage-tenure profile of the job $j$ described by $\alpha_j$ and $\gamma_j$, and their tenure in the job denoteb with $\tilde{\tau}_{ijt}$.

$w(\pi_i, \alpha_j, \gamma_j, \tilde{\tau}_{ijt}) = \pi_i \alpha_j \ (\tilde{\tau}_{ijt} + 1)^{\gamma_j}$

While in unemployment, workers receive flow utility $b$. Since I assume following Bonhomme and Jolivet (2009) that workers accept all job offers out of unemployment, $b$ should be sufficiently low for that to be the case. As jobs are homogeneous in the separation rates, and the set of offers received in employment is the same as in unemployment, $b$ does not enter in any decision rule of the workers and thus does not affect the likelihood.

*Utility equivalent jobs*

An employed worker of age $\tau_{it}$, current job with parameters $\alpha_j$ and $\gamma_j$ and tenure in the job $\tilde{\tau}_{ijt}$ receives discounted value $U^j(\pi_i, \tau_{it}, \alpha_j, \gamma_j, \tilde{\tau}_{ijt}) = U^j(\Omega^e_{ijt})$, where $\Omega^e_{ijt}$ denotes the information set for the employed worker, containing their age, characteristics and tenure at the current job ($\Omega^u$ for the unemployed worker is just her age and education level).

If the worker receives and accepts a new offer, she enters the new job $j'$ with tenure $\tilde{\tau}_{i,j'} = 0$, so that an employed worker will only accept an offer if one of $\alpha'$ or $\gamma'$ is higher. Intuitively, if the worker has a lot of accrued tenure in her current position or is close to retirement age, she will have to receive an offer with a substantial improvement in either the intercept or the growth rate to accept it.

For every worker of given age $\tau$, either employed or unemployed, a job ladder forms in terms of the discounted utility, as each offer with values $\alpha$ and $\gamma$ maps to a discounted utility so that it follows a distribution $H_\tau(U)$. Then, for the employed worker, if her current position produces discounted utility $U^j(\Omega^e_{it})$, she will only take a new position, conditional on receiving an offer, with probability $1 - H_\tau(U^j(\Omega^e_i))$.

Unemployed workers are assumed to accept all offers that they receive. This assumption is key for estimating the distribution of job offers that workers receive and relies on the idea that firms do not post offers that workers will not accept.

*Transition parameters*

- With probability $\delta$, workers receive a separation shock, which leads to unemployment.
- Conditional not receiving a separation shock, with probability $\lambda^r$, workers receive a reallocation offer, which leads to a change of jobs that may or may not be value increasing.

- Conditional not receiving a separation or reallocation shock, with probability $\lambda^e$ workers receive new job offers while employed, the offer will be accepted if its value with tenure of 0 years is higher than that of the current job with current tenure.
- With probability $\lambda^u$ workers receive job offers while unemployed.
- Workers discount future utility at discount factor $\beta$.

# 5 Estimation

The estimation procedure requires multiple steps; first, auxiliary parameters are obtained from the data, and then the transition parameters are estimated through maximum likelihood following a similar approach to Bonhomme and Jolivet (2009).

## 5.1 Criteria for selecting job transitions

Although, in principle, the survey allows for a relatively direct identification of different job spells for each household head, the data is often noisy, so some criteria have to be established. A worker is defined as having a change in jobs whenever he reports that he left a previous main job in $t$, or he does not report a change but the tenure with the current employer is set back to a low level in $t$ from a higher level in $t-1$. Since there is much apparent inconsistency when reporting tenure for long-tenured employers, I do not define an employer change when the number of months does not decrease and the reported tenure is higher than 24 months in both $t-1$ and $t$ or when the reported number of months is higher than 48 months in both $t-1$ and $t$ even when said number decreases.

The data processing follows the following steps, first I identify if the household and

the household head are the same from the previous years. Then, I harmonize the tenure data so that tenure increases by one year when there are no job interruptions.

## 5.2 Auxiliary parameters

*Education productivity*

The values of $\pi_i$ and $\alpha_j$ cannot be separately identified. As I assume that all workers receive offers from the same distribution $F(\alpha, \gamma)$, the parameter $\pi_i$ helps to make sense of the different values of wages received by workers with differing levels of education. I estimate $\pi_i$ as the median of the wage of workers with a given educational level. From this, the marginal distribution of $\alpha_j$ is normalized to being centered around 1.

*Intercept and growth parameters*

Each job is defined to have an intercept $\alpha_j$ and a parameter $\gamma_j$ controlling wage growth due to tenure. For each job spell that a worker has, I estimate the values $\pi_i \cdot \alpha_j$ and $\gamma_j$ fitting the expression:

$$w_{ijt} = \pi_i \alpha_j (\tilde{\tau}_{i,j} + 1)^{\gamma_j} \tag{2}$$

I also consider a linear expression of the type:

$$y_{ijt} = \pi_i (\check{\alpha}_j + \check{\gamma}_j \tilde{\tau}_{i,j}) \tag{3}$$

Using either wage expression produces similar results, and the fit is similar, if only marginally better, for the expression in equation 2.

All valid data points are used for jobs that last at least two years to obtain the values $\alpha\pi$ and $\gamma$ producing the best fit. For job spells that last only one year, when said job is left in the following year for a new position, the survey provides information

on the final wage before the transition; that information is, however, not available when the worker is unemployed in the following year or when the spell is right censored, so for those cases the observations are not used in the likelihood of job-to-job transitions.

*Distribution of offers*

The distribution of job offers $F(\alpha, \gamma)$ is obtained from the positions of workers getting a job out of unemployment or having a job-to-job transition where the reason for leaving the previous work is that the worker was laid off. This follows from the assumption that unemployed workers take all offers that they receive. I denote as $G(\alpha, \gamma)$ to the distribution of all job positions in the data.

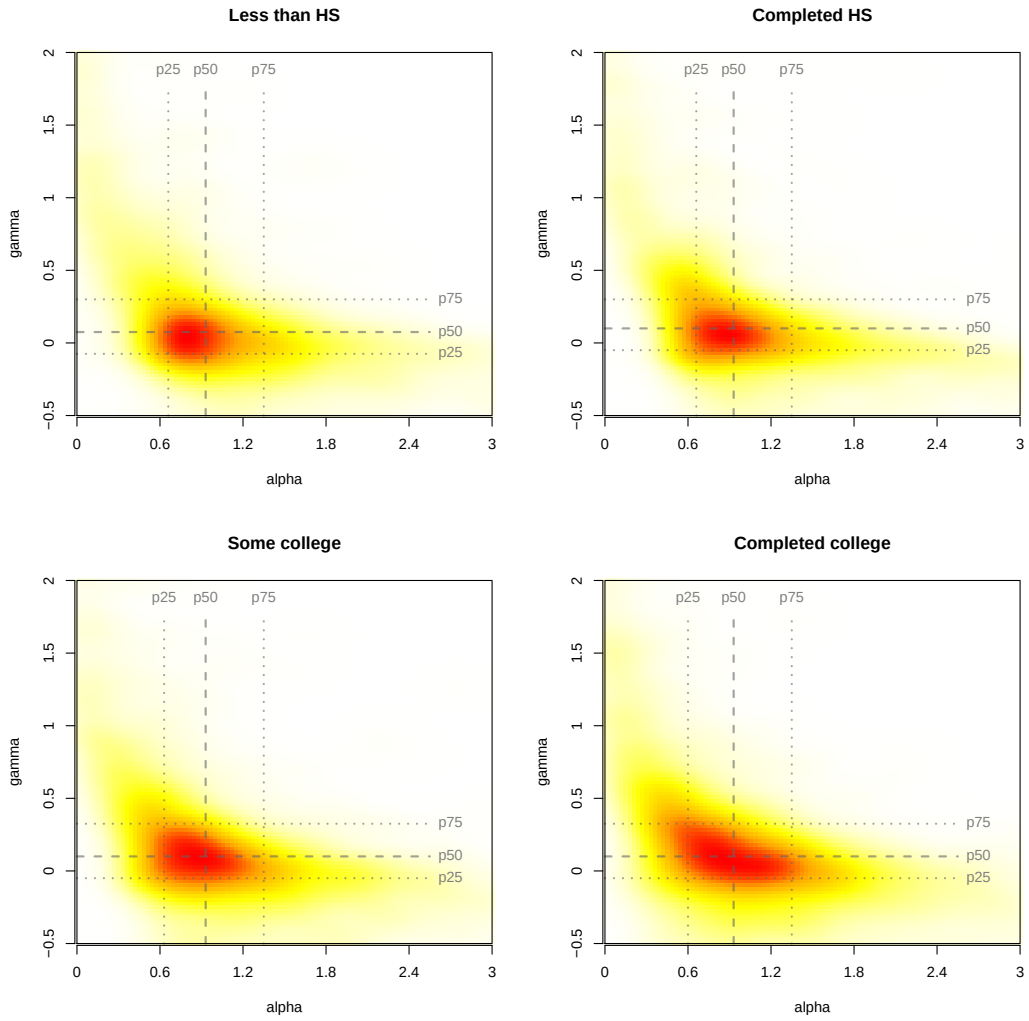
Figure 5 presents the estimated bivariate density of job positions $g(\alpha, \gamma)$, where $\alpha$ is obtained by dividing $\alpha\pi_i$ by the education level scalar productivity $\pi_i$. The bivariate density is estimated on a grid. The chart presents a density based on 100 points for $\alpha$ and for $\gamma$, spaced evenly in the intervals depicted in the axis. For the estimation procedure, I chose a 25x25 grid, as it proved to provide the best trade-off between collapsing too much heterogeneity and being of a sensible size to compute in the iteration of the maximum likelihood estimation.

Two facts stand out. First, the density is similar for all four levels of education, something that evidently does not occur for the unscaled distribution $g(\alpha\pi_i, \gamma)$, which has density tilted toward higher values of $\alpha\pi_i$ for the more educated workers, as expected. Second, the estimated empirical density is not degenerate, nor is there a perfect correlation between the intercept and the growth rate parameters. As a matter of fact, there is a negative correlation between $\alpha$ and $\gamma$ of -0.244 across jobs.

For all four categories, there is a sizable share of jobs with estimated growth parameters below 0, which indicates a wage loss as tenure increases. The median job position, however has a slightly positive parameter, reflecting a wage that increases

with tenure but with decreasing returns. Jobs held for more years in the data present, on average, higher values of both $\alpha$ and $\gamma$, reflecting generally more desirable positions. The model helps explain this through a lower probability of leaving the job voluntarily when the job is more desirable. However, separation and reallocation are assumed to be uncorrelated with the job characteristics.

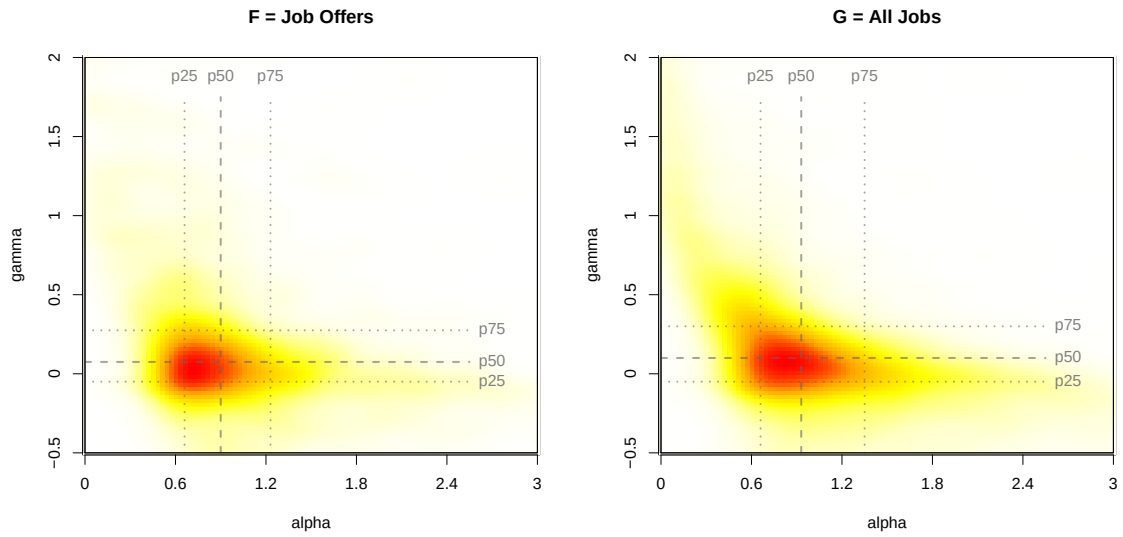
Figure 5: Density of job positions G($\alpha$,$\gamma$) by education level




Note: Cells colored in white have a lower density, while cells in yellow, orange, and red have increasingly higher density. Grey lines represent the 25th, 50th, and 75th percentile for the estimated bivariate density at each margin $\alpha$ and $\gamma$.

The distribution of job offers, which is obtained from workers transitioning from unemployment or having job-to-job transitions due to being laid off under the assumption that all offers out of unemployment are accepted, has higher density in lower values of $\alpha$ and $\gamma$. This reflects that, on average, the typical job offer has a worse value than the typical occupied job position. Figure 6 presents the bivariate densities for each case.

Figure 6: Density of job offers F($\alpha$,$\gamma$) and job positions G($\alpha$,$\gamma$)




Note: Cells colored in white have a lower density, while cells in yellow, orange, and red have increasingly higher density. Grey lines represent the 25th, 50th, and 75th percentile for the estimated bivariate density at each margin $\alpha$ and $\gamma$.

## 5.3 Value functions through backward induction

A worker value function depends on current wage $w$ and continuation value. Since a worker will only accept voluntarily a job that provides higher utility upon receiving an offer, which occurs at rate $\lambda^e$, the probability that he accepts the job is $1-H_\tau(U^j(\Omega^e_{it}))$.

Workers retire at age $\bar{\tau}$, at which point they receive a lifetime utility, which I assume does not depend on previous wage and, as such, can be excluded from utility without

affecting the probability of transitioning from one job to another.

At age $\bar{\tau} - 1$, workers utility is exactly equal to their wages, which depend on $\alpha_j$, $\gamma_j$ and $\tilde{\tau}_{ijt}$.

$$U^j(\pi_i, \bar{\tau} - 1, \alpha_j, \gamma_j, \tilde{\tau}_{ijt}) = \pi_i \alpha_j \ (\tilde{\tau}_{ijt} + 1)^{\gamma_j}$$

From this, the values function at previous ages can be obtained recursively:

$$\begin{aligned} U^j(\pi_i, \tau_{it}, \alpha_j, \gamma_j, \tilde{\tau}_{ijt}) = \pi_i \alpha_j (\tilde{\tau}_{ijt} + 1)^{\gamma_j} + \beta \Bigg( & \delta(U^u(\pi_i, \tau_{it} + 1)) \\ & \cdots + (1 - \delta)\lambda^r \int \int U^j(\pi_i, \tau_{it}, \alpha_{j'}, \gamma_{j'}, 0) dF(\alpha_{j'}, \gamma_{j'}) \\ & \cdots + (1 - \delta)(1 - \lambda^r)\lambda^e \times \\ & \int \int \max(U^j(\pi_i, \tau_{it} + 1, \alpha_{j'}, \gamma_{j'}, 0), \\ & U^j(\pi_i, \tau_{it} + 1, \alpha_j, \gamma_j, \tilde{\tau}_{ijt} + 1)) dF(\alpha_{j'}, \gamma_{j'}) \Bigg) \\ & + \ldots (1 - \delta)(1 - \lambda^r - (1 - \lambda^r)\lambda^e) \times U^j(\pi_i, \tau_{it} + 1, \alpha_j, \gamma_j, \tilde{\tau}_{ijt} + 1) \end{aligned}$$

And similarly, for the unemployed worker:

$$U^u(\pi_i, \tau_{it}) = b + \beta \left( \lambda^u \int \int U^j(\pi_i, \tau_{it} + 1, \alpha_{j'}, \gamma_{j'}, 0) dF(\alpha_{j'}, \gamma_{j'}) + (1 - \lambda^u) U^u(\pi_i, \tau_{it} + 1) \right)$$

Instead of finding closed-form solutions for the value function, they will be solved using a grid of values for $\alpha_j$ and $\gamma_j$ consistent with the support of $F(\cdot)$ and $G(\cdot)$.

## 5.4 Transition parameters

Finally, transition parameters are estimated through maximum likelihood, using the likelihood associated with the transitions between jobs and between employment and unemployment and follow Bonhomme and Jolivet (2009).

Since workers will only accept voluntarily offers that are of higher utility, the probability of changing jobs voluntarily upon receiving an offer is $1 - H_\tau(U^j(\Omega_i^E))$. The probability of going from employment to unemployment is given by $\delta$, and the probability of going from unemployment to employment is given by $\lambda^u$. Workers incur constrained mobility from year $t$ to $t+1$ when they receive a reallocation shock with probability $\lambda^r$, which corresponds with situations in which workers report being laid off from the previous job or they report a voluntary resignation but the transition results in a position with a lower value. Transitions from and into inactivity or self-employment are not used.

I define the following dummies:

- $uu_{it}$: Unemployed worker $i$ in $t-1$ stays unemployed
- $uj_{it}$: Unemployed worker $i$ in $t-1$ becomes employed
- $ju_{it}$: Employed worker $i$ in year $t-1$ becomes unemployed
- $s_{it}$: Employed worker $i$ does not change job from year $t-1$ to $t$
- $q_{it}$: Employed worker $i$ change job from year $t-1$ to $t$, reporting a resignation
- $l_{it}$: Employed worker $i$ change job from year $t-1$ to $t$, reporting being laid off

The contribution to likelihood from each individual from year $t-1$ to $t$ then is:

$$(\delta)^{ju_{it}} \times (\lambda^u)^{uj_{it}} \times (1-\lambda^u)^{uu_{it}} \times (1-\delta-(1-\delta)(\lambda^r+(1-\lambda^r)\lambda^e(H_u(\cdot))))^{s_{it}} \times$$
$$((1-\delta)\lambda^r)^{l_{it}} \times \Big( (1-\delta)\lambda^r(1-H_u(\pi_i,\tau_{it},\alpha_{j'},\gamma_{j'},0)) +$$
$$(1-\delta)(1-\lambda^r)\lambda^e(1-H_u(\pi_i,\tau_{it},\alpha_j,\gamma_j,\tilde{\tau}_{jt}))$$
$$\mathbb{1}\{U^j(\pi_i,\tau_{it},\alpha_{j'},\gamma_{j'},0) > U^j(\pi_i,\tau_{it},\alpha_j,\gamma_j,\tilde{\tau}_\tau jt)\} \Big)^{q_t}$$

Where each term in the product reflects the probability of the listed dummies above being equal to 1.

# 6 Results

## 6.1 Estimation results

Table 7 shows the estimated parameters from the maximum likelihood estimation described in subsection 5.4 against the estimated parameters of the standard model in which a spot wage is posted, in which the decision rule of the workers for voluntary transitions is based solely on whether the wage of the job offer is higher than that of the current position the worker holds. Under both models, all transitions that occur due to a worker being laid off from the previous position contribute to the likelihood through the reallocation parameter $\lambda^r$. At the same time, those transitions that are presented as quits but do not result in value increases also contribute to the likelihood through $\lambda^r$.

The estimation of $\lambda^u$ works equivalently in both likelihood functions, as $\lambda^u$ is exactly estimated as the proportion of workers unemployed in $t$ that are no longer unemployed in $t+1$. While $\lambda^u$ enters in the value functions defined in subsection 5.3 it does so as a location parameter that affects every cell in the grid in the same way -for given values

of age and tenure-, and thus does not affect transition probabilities upon receiving an offer.

In the case of $\delta$, its estimation is affected firstly by the proportion of workers employed at year $t$ that are unemployed in year $t+1$, but the parameter also enters into the transition probability upon receiving an offer in the wage-tenure model. A higher value of $\delta$ decreases the appeal of jobs with a low value of $\alpha_j$ and a high value of $\gamma_j$, as it is less likely that the worker will be able to see the benefit of the steeper wage profile if the chance of separation is high. Notwithstanding this, the estimation for $\delta$ is similar in both models.

The parameters for reallocation of offers are quite similar for the wage-tenure and spot wage models, and in both models, it is higher than the parameter for regular job offers, which reflects that a large share of transitions occur due to layoffs. The estimated parameter for regular job offers are also very close, which is not necessarily expected by construction, since the correlation between what is a good job offer in the wage-tenure and the spot wage model is not complete.

Table 7: Estimated parameters

| | Wage-tenure model | Spot wage model |
|---|---|---|
| $\delta$ | 0.0423 | 0.0427 |
| | (0.0008) | (0.0008) |
| $\lambda^e$ | 0.0787 | 0.0788 |
| | (0.0022) | (0.0029) |
| $\lambda^r$ | 0.0950 | 0.0989 |
| | (0.0013) | (0.0014) |
| $\lambda^u$ | 0.5462 | 0.5462 |
| | (0.0073) | (0.0073) |

Compared to the literature, the value of the reallocation job offer probability relative to normal job offers is somewhat high. In contrast, the separation rate and the job offers out of unemployment are generally similar. One aspect affecting my estimation, and

possibly biasing the estimation for the probability of regular job offers downwards, is that many of the job transitions reported as quits in the data occur from jobs held just one year before the switch. While it is possible to estimate the final wage before leaving the position in many cases, and hence estimating the $\alpha_j$ and $\gamma_j$ parameters, this information is not always available.

The spot wage model requires less information since each job is characterized just by the current wage, so it is possible to estimate this model using said data that is not usable in obtaining the likelihood in the wage-tenure model. Table 11 reports the different estimations obtained when using the same data available for the wage-tenure model (as shown in Table 7) and when using all the data. From there, it is clear that the probability of receiving a regular job offer is estimated as much higher than in the setting with constrained data, which suggests that the actual parameter for $\lambda^e$ could also be higher in estimation on complete data was feasible.

Table 8 reports the results when running the model for different samples, where the distribution of job offers $F()$ are also calculated using the respective population. The estimated parameters using only males closely resembles that of the general population, which partially reflects the fact that 75% of the observations are males. When analyzing the results by educational level some differences arise. As education level increases, the esimated separation and reallocation shock decreases, which suggests that less educated workers are generally more likely to undertake unwanted job losses and transitions.

Conversely, the parameter for probability of receiving a normal job offer increases with education level, as do job offers while unemployed. This results indicate that it is useful to consider the job market as segmented by education level, and possibly among other dimensions, and that the scaling of wages by the median value within each education level is not enough to address the heterogeneity between the populations.

Table 8: Estimated parameters for different samples

| | Males | Less than HS | Completed HS | Some college | Completed college |
|---|---|---|---|---|---|
| $\delta$ | 0.0390 | 0.0753 | 0.0452 | 0.0326 | 0.0148 |
| | (0.0009) | (0.0018) | (0.0013) | (0.0012) | (0.001) |
| $\lambda^e$ | 0.0768 | 0.0503 | 0.0793 | 0.0915 | 0.1101 |
| | (0.0022) | (0.0020) | (0.0023) | (0.0021) | (0.0021) |
| $\lambda^r$ | 0.0957 | 0.1077 | 0.0925 | 0.0967 | 0.0783 |
| | (0.0016) | (0.002) | (0.0018) | (0.0015) | (0.0016) |
| $\lambda^u$ | 0.5834 | 0.4583 | 0.5642 | 0.6497 | 0.7891 |
| | (0.0088) | (0.0111) | (0.0124) | (0.0170) | (0.0246) |

## 6.2 Probability of transitions over life cycle

Given the estimated coefficients, I can compute the value function through the aforementioned grid and evaluate how the probability of accepting a new job upon receiving a random job offer varies by age and, tenure, and characteristics of the current job. Figure 7 shows how the probability of accepting a job offer depends on age and tenure for three jobs with different characteristics: a job with median parameters for initial wage and growth, a job with low initial wage and high growth, and a job with high initial wage and low growth.

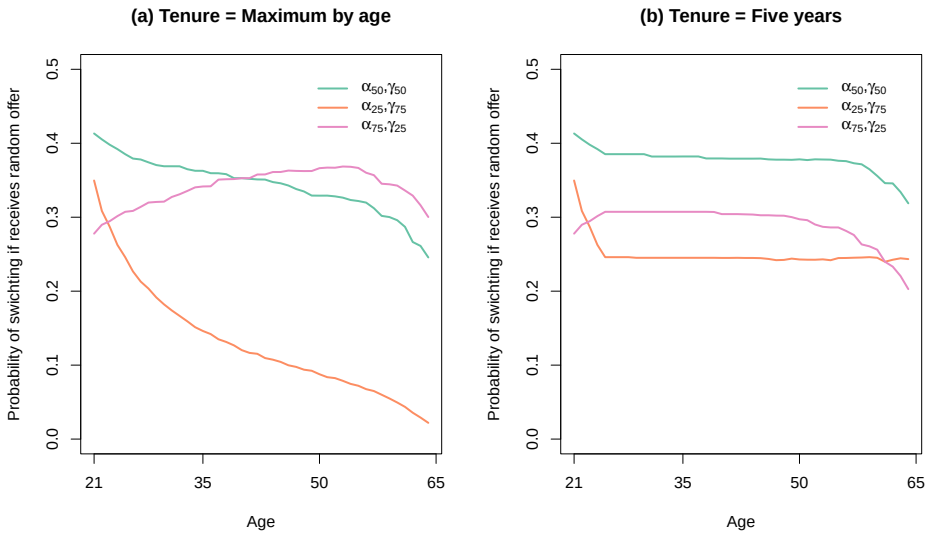
Panel (a) shows the probability of switching when the tenure in the job is equal to the maximum value allowed in the model by that level of age[2]. For the median and the high-growth jobs, this probability decreases with age, doing so steeply for the high-growth job. This occurs because of two effects operating in the same direction: when tenure in the job increases, so does the wage and the returns to staying in the job rather than switching to a new job in which tenure goes back to zero, at the same time as workers age potential jobs with positive growth rate lose their appeal because there is not enough time for workers to reap this benefits. For the low-growth job, which presents slightly negative growth with tenure, there is a period in which the

[2]Workers are assumed to enter the work pool at age 21 and retire at age 65.

probability of switching increases as the wage becomes smaller, but over the final years of the work-life, the decision rule becomes similar to that of a wage-posting model, and there are not many jobs that offer an immediate gain in wages (even when the wage of the current job has been declining slowly).

Panel (b) shows how the probability of accepting the offer changes over time for the same three types of jobs, leaving tenure fixed at five years. Here, the decline in the probability of accepting a job plateaus after the first few years, only declining near retirement age. This shows that in the model, the tenure effect is more prevalent than the age effect in keeping workers in their current positions.

Figure 7: Probability of accepting a job offer when holding different jobs



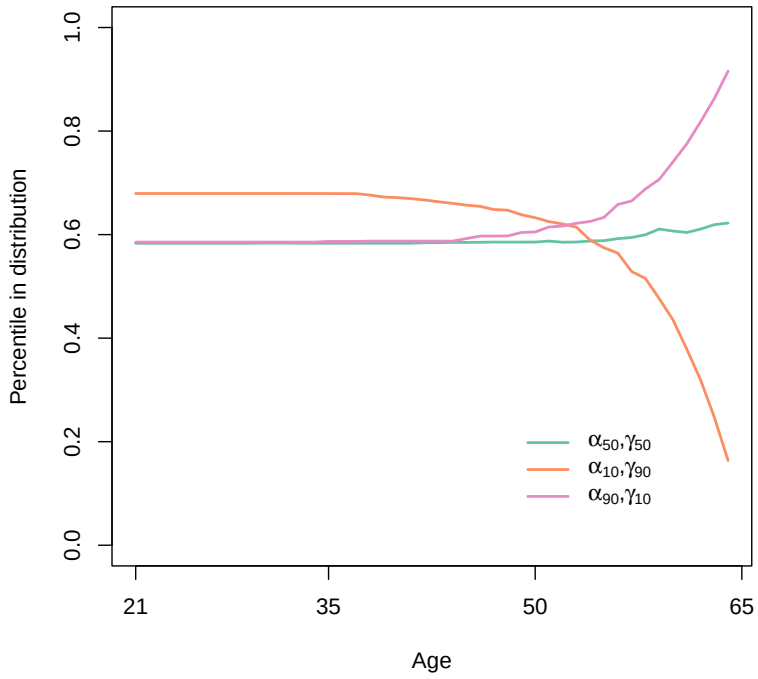

Note: Values of $\alpha$ and $\gamma$ are 25th, 50th, and 75th percentiles from the marginals of the empirical bivariate distribution of job offers.

Another interesting result to examine is how the value of different job offers changes with age. When accepting each job offer, the worker starts with 0 years of tenure in the new position, so naturally, jobs with higher growth rates are more desirable at a younger age, when there is more time to accrue tenure until retirement. Figure 8 shows

the place in the utility ladder distribution (accounting for the density of jobs depending on $\alpha$ and $\gamma$) of three different job offers over the life cycle.

A job that has a median value of both $\alpha$ and $\gamma$ hovers around 0.6[3] in the utility ladder from younger ages to retirement. A job with a very low initial wage but a very high growth rate starts as being very good on the utility ladder and decreases markedly with age. Conversely, a job with a high initial wage and very low growth rate goes from being a good job offer to one of the best as workers near retirement age.

Figure 8: Position of new offer in pct. of utility ladder



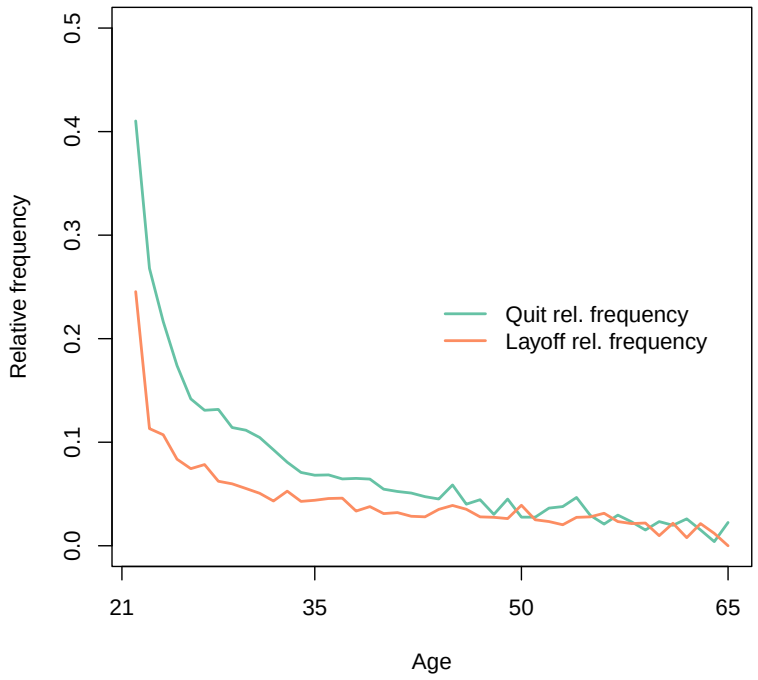

Note: Values of $\alpha$ and $\gamma$ are 10th, 50th, and 90th percentiles from the marginals of the empirical bivariate distribution of job offers.

The true probability of switching upon receiving an offer is clearly not possible to estimate with the data since offers are not observable. However, it is interesting to note

[3]Since it is a median offer based in the distribution of job positions, not job offers, and that distribution shows generally more desirable jobs, the position in the utility ladder is above 0.5. A median offer from the job distribution would appear near 0.5 through time.

that the probability of switching jobs -unconditional on receiving an offer- through quits is declining steeply with age in the data as well, as seen Figure 9. While the relative frequency decreases with age for both quits and layoffs, the decline is more marked for the former.

Figure 9: Relative frequency of job switches through quits and layoffs by age.




Note: Relative frequency of quits and layoffs for workers that are employed both in year $t$ and $t+1$. The remainder by each age are workers staying in the job.

## 6.3 Wage changes vs. value changes

The primary motivation for constructing this model is to see if it helps explain workers' voluntary transitions that result in immediate wage losses. Table 9 shows the percentage of job-to-job transitions that are reported as quits, categorized by whether there is an immediate wage increase, which is the condition for a true voluntary change in the spot

wage model, and whether there is a value increase in the sense of the wage-tenure model presented here.

Under the spot wage model, 59.31% of the reported voluntary transitions are seen as benefiting the worker, while this number increases slightly to 60.65%. The proportion of transitions seen as improvements under both models is only 35.93%. Interestingly, there appears to be no difference in the age or tenure between the transitions that are seen as improvements in one or the other model, whereas one could expect that the wage-tenure model could help explain the job changes of younger workers that represent an immediate wage cut. In either model, as anticipated by 6.1, there is still the need to accommodate a large share of transitions unexplained by the proposed decision rule, either by incorporating a reallocation shock or other additions to the model.

Table 9: Proportion of voluntary job-to-job transitions

| | Wage loss | Wage increase |
|---|---|---|
| Value loss | 15.98 | 23.40 |
| Value increase | 24.72 | 35.90 |

When assessing these results only for males, the shares are mostly unchanged, and the wage-tenure model also performs marginally better than the spot wage model. This changes vastly for the different education subsamples as presented in Table 10. For all levels but completed college, more of the quitting transitions in the wage-tenure model are seen as value-increasing than under the spot wage model, and this difference is more marked for workers with less than complete high school. This may be related to the fact that the lower educational level presented higher returns to tenure on average than workers with completed college, as shown in Figure 4.

Table 10: Proportion of voluntary job-to-job transitions by educational level

| | Wage loss | Wage increase |
|---|---|---|
| Less than HS | | |
| Value loss | 16.60 | 21.20 |
| Value increase | 27.06 | 35.15 |
| Completed HS | | |
| Value loss | 16.37 | 22.21 |
| Value increase | 25.09 | 36.34 |
| Some college | | |
| Value lose | 16.80 | 22.25 |
| Value increase | 25.02 | 35.92 |
| Completed college | | |
| Value lose | 13.84 | 27.69 |
| Value increase | 22.56 | 35.91 |

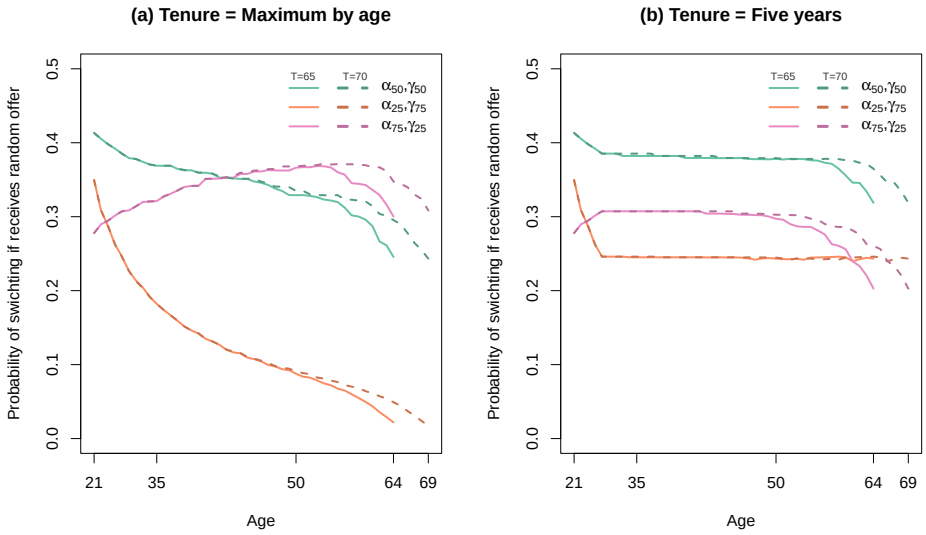
## 6.4 Counterfactual: increase of retirement age

One central component of the estimation procedure is the retirement age, which I assume to be 65 for all workers in the model. Here, I analyze the implications of a five-year increase in the retirement age through a counterfactual. While the assumption of a common retirement age for all workers is admittedly too simplistic, as it depends both on personal preferences and the institutional setting, I found that analyzing the effect of this increase in the model can be helpful in the context of discussions around increases in the statutory retirement age in the developed world.

One direct effect of increasing the retirement age in the model is to make jobs with high growth rates more enticing, as workers get more time to accrue tenure and access higher wages. Figure 10 shows that for young workers, the probability of accepting a new job is practically unchanged between the two situations, as the increase in retirement age occurs too far in the future. Starting around age 50, workers in any of the three example positions presented, become slightly more likely to accept a random job offer. Ultimately, the curves move slightly rightwards, as the probability of accepting a random offer near the new retirement age matches the probability found under the old

regime.

Figure 10: Probability of accepting a job offer when holding different jobs for two levels of retirement age



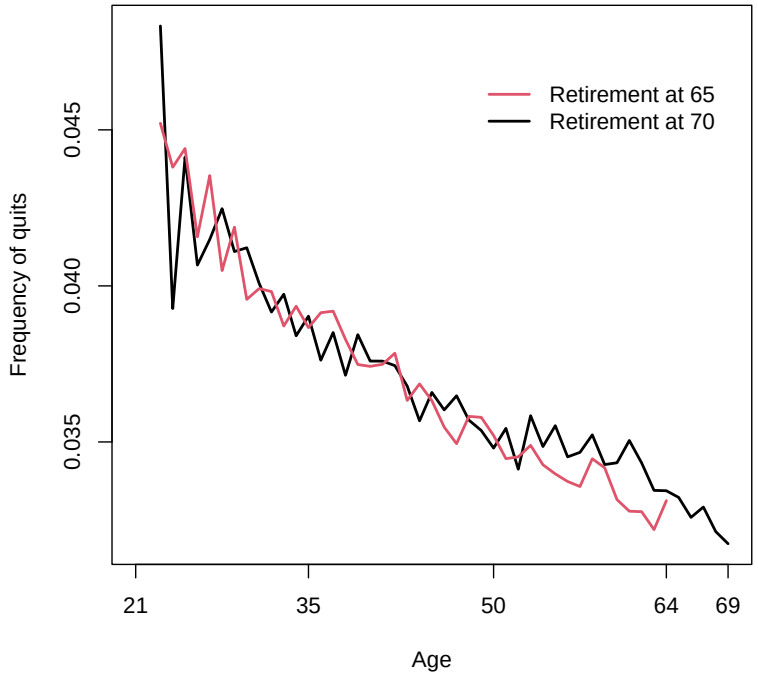

Note: Values of $\alpha$ and $\gamma$ are 25th, 50th, and 75th percentiles from the marginals of the empirical bivariate distribution of job offers. The solid line represents the scenario where the retirement age is set at 65 years old, and the dashed line when it is set at 70 years old.

To analyze how the probability of switching voluntarily changes overall, that is not conditional on having a job with specific characteristics, a simulation must be performed as workers sort themselves into better jobs as they age. For this simulation, I assume that all workers start their working life unemployed at age 21 and receive offers out of the $F()$ distribution. In each period, workers are subject to the shocks detailed above.

Figure 11 reports the frequency of quits for simulations using these two retirement ages. As expected, the frequency of quits decreases with age, which occurs both because, for most given positions, the probability of accepting a new offer decreases with age and because workers sort themselves into better jobs as they age. The decline with age is less steep than observed in the data (Figure 9), particularly for younger ages, suggesting that the model does not entirely capture the age dynamic. The difference

between quitting probability under one or the other retirement ages is quite close, and only deviates slightly more after age 50, whereas in the model with higher retirement age, workers are barely more likely to resign. Overall, the average frequency of quits before age 64 is 3.72% when the retirement age is 65 and 3.74% when the retirement age is 70.

Figure 11: Relative frequency of job switches through quits by age.




Note: Relative frequency of quits based on simulated data for workers that are employed both in year $t$ and $t+1$.

# 7 Conclusion

In this master thesis, I analyze whether expected wage growth can explain voluntary changes that result in wage cuts. I find that under a model accounting for jobs that differ in their wage growth with tenure, a marginally larger share of transitions can be

seen as value improving when compared to a standard model in which spot wages are posted. I observe that the model performs particularly better in this regard for workers with lower educational levels.

I first analyze the characteristics of workers who quit incurring in wage losses and find that they are observationally similar to workers who quit with wage increases but also more similar to workers who are laid off than to job stayers. Workers that quit are generally younger than job stayers and more likely to be women. Education is the rare variable distinguishing workers quitting for lower wages, as they are less likely to be college-educated than those quitting with improved wages.

In relation to compensating differentials, I find that when workers' jobs change along variables that could be associated with increased job security, wages also tend to increase, contrary to what could be expected if compensating differentials play a big role. On this topic, it could well be that the variables available in the data are not capturing the existence of compensating differentials, or as others have proposed, that there is substantial worker heterogeneity in preferences and match-specific amenities.

I then propose a model in which job offers consist not only of a starting wage but also of a tenure growth profile. I find substantial dispersion of these components in the jobs in the data, which allows for a trade-off to exist: jobs with higher growth rates are preferable when workers are young, and those with high starting values are preferable near retirement. At the same time, accruing tenure in most jobs increases wages and reduces the probability of switching jobs voluntarily.

Compared to a standard wage posting model, the wage-tenure approach produces only marginally better results in making sense of transitions between jobs that are reported as voluntary being value-increasing for the workers. The result is that still a large role is given to reallocation transitions, in which workers do not have a proper choice in accepting a new job.

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# A Appendix

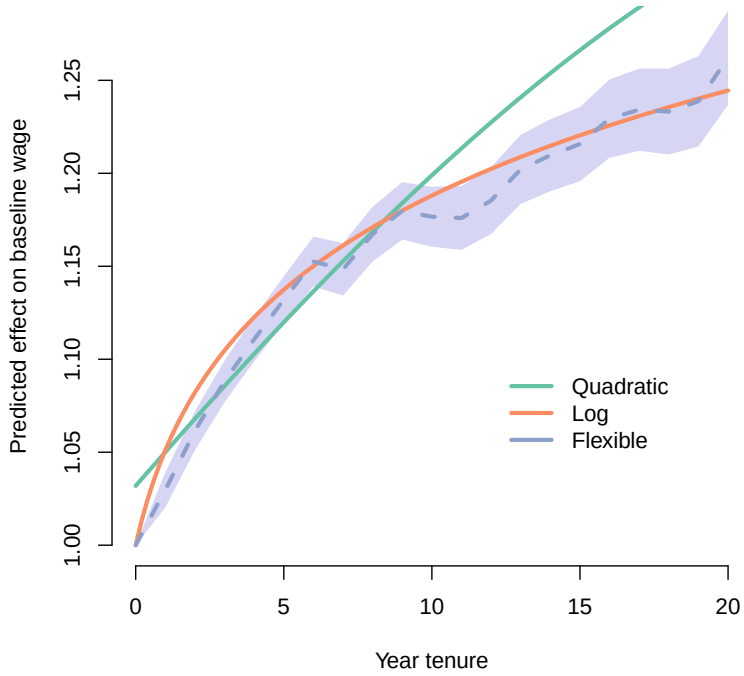
Table 11: Estimated parameters for spot wage model

| | Same data as wage tenure model | All data available for wage posting model |
|---|---|---|
| $\delta$ | 0.0427 | 0.0433 |
| | (0.0008) | (0.008) |
| $\lambda^e$ | 0.0788 | 0.1518 |
| | (0.0029) | (0.0036) |
| $\lambda^r$ | 0.0989 | 0.1299 |
| | (0.0014) | (0.0016) |
| $\lambda^u$ | 0.5462 | 0.5462 |
| | (0.0073) | (0.0073) |

Table 12: Proportion of voluntary job-to-job transitions for males

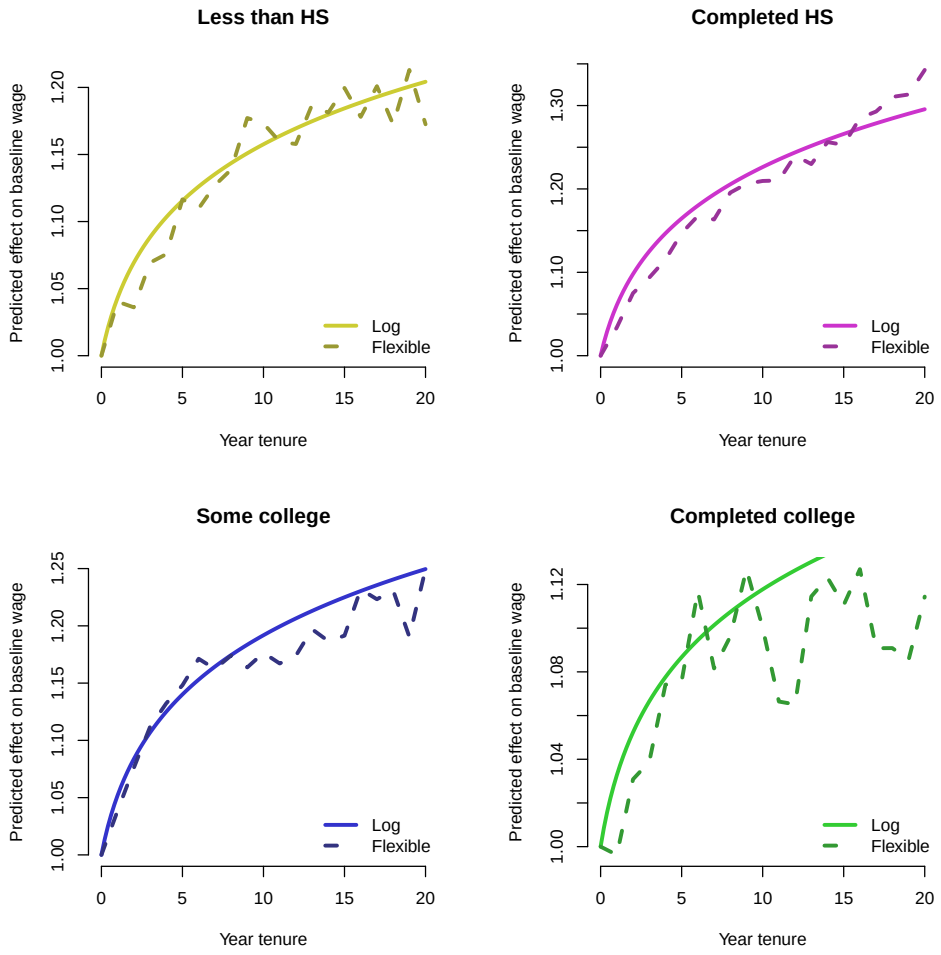
| | Wage lose | Wage increase |
|---|---|---|
| Value lose | 15.46 | 23.43 |
| Value increase | 24.83 | 36.28 |

Figure 12: Effect of tenure on wages for men




Note: Fitted estimated effect from individual-job-time fixed effects model, values in y-axis approximate the multiplier of each tenure level over a wage with 0 years of tenure. The shaded area indicates the 95% confidence interval for the flexible regression.

Figure 13: Effect of tenure on wages by educational level for men




Note: Fitted estimated effect from individual-job-time fixed effects model, values in y-axis approximate the multiplier of each tenure level over a wage with 0 years of tenure. Each panel shows the estimated effect for the group of workers with a given educational level