Job Durations, Match Quality and the Business Cycle: What We Can Learn from Firm Fixed Effects*

Lisa B. Kahn†
Harvard University

May 8, 2008

Abstract

This paper seeks to determine how employer-employee match quality varies with economic conditions at the start of the employment relationship. During a recession, workers have fewer outside options so may be willing to accept worse matches. Conversely, firms make fewer hires so may feel pressure to only hire in cases of very good matches. A confounding factor is firm heterogeneity; the types of firms that hire in recessions may differ from the average firm. In this paper, I exploit a unique, proprietary dataset consisting of pay records for the universe of employees for each of 150 firms for a five-year period. These firms are large, mainly Fortune 500 companies with a wide degree of variation across industry and geographic location. As a proxy for match quality, I use length of the employment relationship. I find that employment relationships end earlier when workers enter firms in worse economies. However, once firm heterogeneity is taken into account, the effect of entering in a recession reverses; the employment relationship lasts longer. I find that this effect can largely be accounted for by the fact that firms with higher turnover rates hire relatively more in recessions.

*I am grateful to David Baitcher (deceased), Shibani Patnaik and especially Larry Katz, Claudia Goldin and Caroline Hoxby for helpful comments and guidance.

†Correspondence: Lisa Kahn, NBER, 1050 Massachusetts Ave, Cambridge, MA 02138. Email: lisakahn@fas.harvard.edu

1 Introduction

Why is it that long-term employment relationships are common yet most jobs end early and the probability of leaving a firm falls with tenure? Several theories have been put forth to explain these facts, which are ubiquitous in the job mobility literature, e.g., worker or firm heterogeneity, human capital investment, learning about general ability.[1] Jovanovic (1979) presents a model whereby firms and workers learn about their match-specific component of productivity, which yields the empirical predictions described above. Match quality has since become extremely important in the literature on both job mobility and compensation. However, since match quality is difficult to observe, we know little about its nature or importance in explaining the above findings.

One potential source of variation in match quality is the business cycle, i.e., economic conditions at the beginning of an employment relationship, though the direction of the effect on match quality is theoretically ambiguous. Since fewer jobs are available during recessions, it is likely that a worker's threshold for accepting a job will fall. This force could lead to worse matches. In addition, the work on vacancy chains by Akerlof et. al. (1988) also predicts better matches in good economies; an increase in voluntary quits implies more openings in coveted jobs and therefore better sorting.

On the other side, fewer hires occur during recessions (Hall 2005). Firms might feel pressure to raise the threshold value over which they are willing to hire workers, only hiring the most valuable. This force could result in better matches during recessions. Also, firms may be able to take advantage of the larger queue of potential employees seen in recessions,

[1] See Farber (1999) for an excellent survey of this literature.

to hire better workers.[2] These could be better matches or simply workers of higher general ability.[3] In the latter case, we might expect shorter matches because the best workers will leave as soon as better opportunities arise.

In an earlier study, Bowlus (1995) used the National Longitudinal Survey of Youth to show that workers who enter firms in recessions have shorter employment spells, on average, and hypothesizes that this is an indicator of worse match quality. However, due to data limitations, she could not take into account firm heterogeneity. In particular, one might worry about selection issues involving the types of firms hiring in different economies. Davis and Haltiwanger (1999) establish vast heterogeneity in worker flows across firms. In addition, there is a substantial literature on the effects of firm size on turnover (Rebitzer 1986).

This firm heterogeneity could be quite important in understanding match quality and turnover patterns more broadly. For example, suppose there exist high- and low-turnover firms. High-turnover firms may be disproportionately represented among firms hiring in recessions (their hiring patterns should be less affected by the business cycle because they need to hire more at all times). Without taking this into account, one would find a correlation between hiring in a recession and shorter employment relationships, but would spuriously attribute this to worse matches.

In this paper, I exploit a unique, proprietary data set consisting of personnel records for 150 firms over a five-year period. These firms, 88% of which are publicly-traded compa-

[2]The notion that firms screen for workers when there is excess supply is standard in the job queue literature (see for example Weiss 1980)

[3]Prior research suggests that workers seeking employment in recessions are actually negatively selected on average (Blundell 2003, Kahn 2007b). However, as long as recessions imply larger numbers of job seekers at all points along the ability distribution, there would be more mass at the upper tail of the ability distribution (in addition to a longer lower tail). Firms could plausibly take advantage of this to screen for the better workers.

nies, range in size from 100 workers to 120 million and span a wide variety of industries and geographic locations. I thus exploit three types of economic fluctuations: monthly unemployment rates at the national level, state-level unemployment rates and industry-level employment. Because I observe all workers at all firms for potentially a five-year period, I am able to identify firm fixed effects, which should clarify the above discussion.

I find, using all three economic indicators, that entering a firm in a worse economy implies significantly shorter employment relationships. For example, the probability of staying at a firm for at least a year falls by approximately 2.0 percentage points (relative to a 40% base rate) in response to a one-percentage point increase in the national unemployment rate. However, once I allow for heterogeneity across firms, the results uniformly reverse, and are usually statistically significant in the opposite direction. The effect of staying at least a year *rises* by almost 5.0 percentage points in response to a one-percentage point increase in the national rate, significant at the 1% level. The initial effects and their reversal are similar in magnitude and significance when using industry employment, while using state unemployment rates yields smaller effects in the same direction.

The importance of firm heterogeneity suggests that different types of firms are more likely to hire in recessions. In order to characterize these firms, I directly examine three dimensions along which firms differ: average salary, turnover rate and firm size. I find that firms hiring relatively more in worse economies pay lower salaries, have higher turnover (regardless of when the worker was hired) and are larger.

I then look to see whether any of these attributes can explain the sign reversal on economic conditions when firm fixed effects are included in the initial regression. I find controlling for average firm salary has no effect, while controlling for firm size reduces the correlation

between a weak economy and shorter tenure by about half (or, in the case of the national rate, to zero). Controlling for firm turnover has by far the biggest effect. In the national results, the coefficient on the national unemployment rate reverses in sign and is statistically significantly positive. The industry and state coefficients fall in magnitude all the way to zero. This suggests that in other datasets, an econometrician could go a long way towards understanding match quality by knowing firm aggregate turnover rates, even if firm fixed effects cannot be identified.

Finally, I examine whether all firms are sensitive to the business cycle in this particular way. It could instead be that tenure in high-quality firms is unaffected, either because workers always want to stay there or because the firms are better at screening workers. I investigate one dimension of firm quality: pay. I find that workers in low-paying firms are sensitive to the business cycle; jobs end earlier when workers enter in recessions. However, I find no affect on job durations in high-paying firms. It could be that when high-quality workers are unlucky and match to low-paying firms in recessions, they leave as soon as possible, while high-quality workers who match to high-paying firms are more stable.

This paper contributes to several literatures, in addition to the job mobility and match-quality literatures mentioned above. It adds to the literature on firm-level data in that many previous studies (e.g., Baker, Gibbs, Holmstrom 1994a) have data on only a single firm, while I have 150 large firms and can thus say more about external validity. In addition, a growing literature finds persistent, negative consequences to entering the workplace (Kahn 2007a, Oreopoulos, von Wachter and Heisz 2007, Oyer 2006a and 2006b) or a given firm (Baker, Gibbs and Holmstrom 1994b, Beaudry and DiNardo 1991) in a recession. Investigating the effects of match-quality during recessions could shed some light on the mechanism driving

these results.

The remainder of the paper proceeds as follows. Section 2 describes the data while section 3 explains the empirical methodology. Section 4 presents the results, first on the importance of firm fixed effects, then on identifying which firm characteristics predict more hiring in recessions, then on how controlling for these characteristics affects the initial results and finally on the heterogeneity of the economic conditions effect with respect to firm pay. Section 5 concludes.

2 Data Description

The data used in this paper were provided by an anonymous compensation consulting company. They contain pay records for the universe of employees for each of their 150 clients. Firms enter the system at any point between 2001 and 2006. Once a firm enters the system, any worker earning a wage between the starting year for that firm and 2006 is observed, regardless of when the worker started at the firm. The data include information on each worker including gender, month and year of birth, start date, end date[4] and geographic location (the first three digits of the zipcode).[5] I exclude all workers outside the United State (<0.5%). For the 88% of firms which are publicly traded, I use Compustat to link firms to NAICS two-digit industry codes. I then match these with an internal industry code to obtain industry for the rest of the sample.

[4] A small amount if information is given for reason for termination if the worker has left. In some cases, I can observe deaths, retirements, leaving due to disability, etc. However, these are not consistent across companies. I restrict the sample to workers whose employment status is either "ACTIVE" or "TERM", which make up 94% of the data.

[5] The data are encrypted so that I cannot discern the identity of any given individual, though workers can be tracked anonymously.

When interpreting the results, it will be important to keep in mind what types of firms are represented in the data. First, figure 1 shows a histogram of firm size, i.e., the total number of employees divided by the number of years the firm was observed in the panel. For presentational ease, the four largest firms (which range in size from 100,000 to over 170,000 employees per year) are omitted from this graph, though included in the analysis. This sample therefore overrepresents large firms.

Second, table 1 shows the distribution of workers and firms by industry. As can be seen, there are substantial sample sizes for a wide range of industries. The far-right column compares this distribution to the national distribution of workers in 2006, obtained from the Bureau of Labor Statistics (BLS). There are some discrepancies: Manufacturing is overrepresented in these data, as is Information, while Construction and Administrative Support are underrepresented.

Third, table 2 shows the distribution of workers and firms by census division and reveals ample geographic variation. The table also compares the geographic distribution in these data to the overall distribution reported by the BLS in 2006. As can be seen, these data line up remarkably well with total geographic variation.

To characterize turnover behavior in these firms, I create a job separation rate for each firm, equal to the number of workers who left the firm between 2001 and 2006 divided by the total number of workers ever employed at the firm in that period (not just new hires). Figure 3 shows a histogram of these separation rates. As can be seen, there is substantial variation in this measure across firms, suggesting that firm heterogeneity in job durations could be quite important the analysis.

For the purposes of this study, I restrict the sample to those who began work after the

firm entered the database to avoid problems of left censoring. I conduct a survival analysis for workers who entered firms between 2001 and 2005 (since workers who entered in 2006 are often only observed at date of entry) and for only workers who were aged 16-65 when they entered a firm. Since I know nothing about hours worked, the sample includes both full-time and part-time workers. Of the original 150 firms, I drop observations from the three of them that have fewer than 50 employees entering during the sample period.

Figure 2 shows a Kaplan-Meier survival plot for workers entering firms between 2001 and 2005. This picture is similar to previous work on turnover, even though the data are not nationally representative. For example, as in Farber (1999), approximately half of all employment relationships end within the first 12 months. These data are not well-suited for an analysis of long-term employment relationships, since workers are observed for a maximum of only five years. However, figure 2 is comforting in that much of the action in turnover occurs in the first few years of an employment relationship.

I exploit three sources of economic fluctuations. The first is national monthly unemployment rates. Figure 4 shows a histogram of sample sizes by entry month and year as well as the national unemployment rate.[6] As can be seen, there is substantial variation in the unemployment rate throughout the period and, for the most part, large sample sizes. However, in 2001 only 15 firms had entered the database and a small number of workers began employment relationships. These firms are not representative, being mainly large retailers with low pay, and could be considered less desirable places to work. In order to avoid a spurious correlation between entering in a strong economy (most of 2001) and a short

[6] Clearly the histogram and unemployment rate exhibit seasonal fluctuations. In the regressions below, I control for this variation with calendar fixed effects.

employment spell, I drop the 2001 entry cohorts from the national analysis.[7]

In addition to time-series variation in the unemployment rate, I also exploit two forms of cross-sectional variation: state-level monthly unemployment rates and industry-level monthly employment. Industry employment is the total number of workers employed in that NAICS two-digit industry, nationwide, in a particular month.[8] Both measures are useful in that they yield business-cycle variation, independent of the national economy, if I control for year effects in the analysis.

Appendix tables A1 and A2 show sample sizes of entry-cohorts by industry and state (aggregated to region), summarizing entry for each year (though monthly entry cohorts are used in the analysis). As can be seen, there is substantial variation across these measures as well. Since these analyses control for year effects, I include the 2001 entry cohorts to gain more variation, however results are not sensitive to their exclusion.

State and industry also provide substantial variation in economic conditions over this time period, independent of the national rate. I plot annual averages of industry employment and state unemployment rates (aggregated to region) in appendix figures A1 and A2. To better reflect the variation used in the regressions, these rates have been adjusted for year fixed effects, as well as industry or state fixed effects. For presentational ease, I plot only the five largest industries and five largest census divisions. As can be seen, there is ample variation in these measures.

Table 3 shows summary statistics for the variables used in this analysis. The sample

[7]Results are qualitatively similar when 2001 entry cohorts are included in the national analysis, though smaller in magnitude and signficance.

[8]The industry analysis excludes one agricultural company and one conglomerate because employment levels are not available for these industries.

is all workers who entered firms between the time the firm entered the database (starting in 2001) and 2005. Average tenure is 13 months and 40% of workers stay more than one year. Average entry age is 30 which is substantially younger than the national average in 2006 (approximately 41 according to the BLS). This seems reasonable since this sample is all recent hires. 51% of the workforce is female, whereas, according to the BLS, 46.3% of the civilian workforce was female in 2006. To compute starting salary, I take the first pay observation on each worker and annualize it based on how often the worker is paid. Due to various intricacies of the data, I have reason to think that this method underestimates true annual salary. To compute firm-level average salary I use annualized pay (based on the first month of pay) for all workers in 2006. The starting salary is adjusted to 2006 dollars using the consumer price index.

3 Methodology

For an individual, i, in entry cohort, c (defined by month of entry into a firm, month-industry or month-state), and firm, f, I estimate regressions of the following form. Equation 1 is the baseline specification where some measure of job duration (*dependent*) is regressed on an employment measure (Emp) representing economic conditions at time of entry into the firm and a series of control variables (including a cubic in age at time of entry, a female dummy and calendar month of entry dummy variables). The industry-level analysis also includes industry dummy variables and calendar year dummies. The state-level analysis includes state dummies and year dummies. These year dummies ensure that the fluctuations

exploited are independent of the national economy.[9] In the second specification, equation 2, I also include firm fixed effects.

$$dependent_{icf} = \alpha_0 + \alpha_1 Emp_c + \alpha_1 f(Age_{icf}) + \alpha_2 I_{icf}^{female} + I_c^{month} + \epsilon_{icf} \quad (1)$$

$$dependent_{icf} = \alpha_0 + \alpha_1 Emp_c + \alpha_1 f(Age_{icf}) + \alpha_2 I_{icf}^{female} + I_c^{month} + I_f^{firm} + \epsilon_{icf} \quad (2)$$

Approximately 40% of the data are censored in that those employees have not left their jobs yet. To correct for this, I use three different measures to analyze job duration: the probability that the employment relationship lasts at least one year, the probability it lasts at least six months and a Cox proportional hazard model with time-invariant controls.[10] With only five years of data, it is difficult to separate the effect of entering toward the beginning of the sample from the effect of economic fluctuations on the probability of leaving a firm (workers who enter toward the beginning of the sample are more likely to leave because they can be observed for longer). The first two measures make the data comparable in that I essentially censor the window of observation for everyone.

The hazard model provides complementary evidence, allowing me to exploit all information in the data, without restricting the window of observation. Following Lancaster (1979), I adopt the hazard function shown in equation 3 where the X variables are those described in equation 1 and are time-invariant. Analogous to the firm fixed effects specification in

[9] In order to pick up the full effect of a recession (which could last an entire year, say), I do not want to control for year effects in the national rates analysis.

[10] Linear probability models are used for the first two dependent variables, though results are similar with probits. By excluding the 2006 entry cohorts, I ensure that the first two measures are not censured. That is, all workers can potentially be observed working for at least one year.

equation 2, I estimate hazard models allowing each firm to have its own baseline hazard, λ_0.

$$\lambda(t|X) = \lambda_0 \exp(X_{icf}\beta) \tag{3}$$

Because my key explanatory variables vary at the group level, I cluster the standard errors in all analyses based on the level of variation. When using national rates, I cluster by month of entry; when using state rates, I cluster by state-month; when using industry employment, I cluster by industry-month.

4 Results

4.1 Job Durations and Firm Fixed Effects

Table 4 shows results from three types of survival analyses and three different employment measures. I look at the probability of remaining at the firm for at least one year, the probability of remaining for a least six months and a cox proportional hazard rate. Given that previous literature has found that half of all new jobs end within a year (Farber 1999), and that result is confirmed in these data, the first two margins should be most important. All coefficients in this table are from separate regressions. Panel A shows results for a baseline specification outlined in equation 1. Panel B allows for firm heterogeneity either in the form of firm fixed effects in the first two rows or by allowing each firm to have its own baseline hazard rate. The three columns of table 4 report results using national unemployment rates, industry employment and state unemployment rates, respectively.

Consistent with Bowlus (1995), the probability of staying at a firm falls with economic

conditions at entry into the firm. In response to a one-percentage point increase in the national unemployment rate, the probability of staying at least one year falls by 2.1 percentage points, statistically significant at the 5% level. The probability of staying six months also falls by a similar amount (2.5 percentage points) and is significant at the 1% level. Lastly the hazard of leaving the firm increases by 0.037, though this is not statistically significant.[11]

Both the industry and state results are quite consistent with the national rate. I find that in response to an increase in industry employment of one million workers, the probability of staying increases by almost 3 percentage points, significant at the 1% level. The probability of staying six months also rises and the hazard rate of leaving falls by 0.067. The state results are smaller in magnitude, which might be expected. Since these are disproportionately large firms, they may be less affected by local labor market conditions and more subject to national trends. However, the probability of staying one year falls by almost half a percentage point in response to a one-percentage point increase in the state unemployment rate, significant at the 5% level. The probability of staying 6 months looks unaffected while the hazard of leaving rises by almost 0.02, significant at the 1% level.

Thus panel A of table 4 paints a consistent picture that workers who enter firms in worse economies leave earlier. This finding is both statistically and economically significant. (The average probability of staying a year is 0.40.) However, several factors could be driving this result. In addition to the match-quality explanation, firm or worker heterogeneity could be important. With this unique data set, I can control for firm heterogeneity and this is done in Panel B. Here, the results uniformly reverse and are usually statistically significant

[11] Bowlus (1995) finds that the harzard increases by 0.0497 which is somewhat larger than the findings of this paper. She is however analyzing a different time period, the 1980's, which saw larger fluctuations in the national economy than in my sample period.

in the opposite direction. For example, controlling for firm fixed effects, the probability of staying one year *rises* by almost 5.0 percentage points in response to a one-percentage point increase in the national unemployment rate, significant at the 1% level. Similarly, when industry employment increases by one million workers, the probability of staying one year falls by almost 2.5 percentage points. The effect of the entry state unemployment rate on job duration looks to have fallen in magnitude to zero.

One factor correlated with entering firms in recessions is lower pay. Workers accept lower wage offers in the short run and there is much evidence to suggest that these negative wage effects persist in the long run, either within the firm (Baker, Gibbs and Holmstrom 1994b, Beaudry and DiNardo 1991) or more generally (Kahn 2007a, Oreopoulos, von Wachter and Heisz 2007, Oyer 2006a and 2006b). Pay could affect turnover independent of the match-quality effect. As a robustness check, I have performed the above analysis additionally controlling for starting salary. I find that this inclusion does not change the coefficient on the employment measures in any of the regressions reported in table 4. Though, as expected, starting salary does have its own negative effect on turnover: workers with lower salaries are more likely to leave. I therefore conclude that salary is not a confounding factor.

4.2 Which Firms Hire When

The following story is consistent with the above findings. The types of firms that are more likely to hire in recessions have more turnover regardless of economic conditions. Not controlling for this makes match quality look worse in recessions because job durations are shorter. However, once this is taken into account, match quality is actually better.

Perhaps when firms do make hires in recessions, they give extra scrutiny to these decisions and, controlling for the baseline tenure effects, actually create more successful employment relationships.

To more directly test this story, I look to whether high-turnover firms are more likely to hire in recessions. I also look at average pay and firm size to better characterize which firms are associated with more hiring in recessions. Details of these variables are described in the data section.

I perform a cohort-level analysis (based on month of entry, month-industry or month-state) and relate economic conditions at time of entry to the characteristics if firms hiring in that cohort. Table 5 regresses an economic conditions measure on each of the characteristics described above, separately. Since the left-hand-side variable varies at the month-year, month-year-industry or month-year-state level, I collapse the data to cells corresponding to this variation. The key explanatory variables are therefore averages across all firms hiring in those cells, weighted by the number of hires. The other regressors are averages for the base set of controls as well as various fixed effects as specified in the table. Analytical weights based on cell-size I are used.

The first column in each set of results shows that when economic conditions are worse, hiring firms have lower pay, on average. The effect on the national rate is insignificant while the effects on industry and state are significant at the 1% level. An increase in average salary of one log point (approximately one standard deviation and 10% of the average for this variable) is associated with 0.64 rise in industry employment (or 640,000 workers) and a decrease in the state unemployment rate of almost 0.45.

The second column in each set of results looks at the relationship between economic

conditions and firm turnover in the average firm hiring. Here, the effects are sizeable and statistically significant at the 1% level in all three cases. The coefficient on firm turnover in the national analysis is 6.2 points. In other words, an increase in turnover by one standard deviation (0.21) is associated with a rise in the national unemployment rate of 1.3. The effects are about a third the size using state or industry. These results show that the average firm hiring in worse economies indeed has a higher turnover rate, which is constant with the story described above.

Lastly, columns labelled III look at firm size. These regressions reveal that in worse economies the average firm hiring is larger. An natural way to interpret the coefficient is an increase in average firm size of 10,000 workers is associated with an increase in the national unemployment rate of almost 0.60. The state and industry effects are smaller in magnitude though all are statistically significant at the 1% level.

One might worry that the variation in average firm characteristics is driven by different firms hiring at different times. If this were the case than the regressions presented in this section might be seen as simply the reverse of those presented in the previous section, because individual tenure would be highly correlated with firm turnover rates. However, even if some types of firms are more likely to hire in recessions, there is still substantial variation in economic conditions at time of hire *within* firm. To ensure this is the case, I looked at the distribution of the number of months each firm was observed hiring in. The median firm hired at least one worker in every month during the six-year sample period and almost 95% of firms hired in at least 50 months. Thus average firm characteristics provide additional information and making this a useful exercise.

4.3 Firm Characteristics

I showed in section 4.1 that being hired in a worse economy is associated with shorter employment relationships but controlling for firm fixed effects reverses this result. I then established in section 4.2 that firms hiring in worse economies differ in observable characteristics. I now investigate whether any of these firm-level characteristics can account for the firm fixed effect result. That is, when controlling for either average salary, the turnover rate or firm size, does the sign on economic conditions reverse, even without controlling for firm fixed effects?

Table 6 shows a series of regressions where the dependent variable is the probability of staying at least one year. Results are similar when using the probability of staying six months or estimating a hazard rate. The columns labeled I replicate the first result from table 4 without firm fixed effects. The regressions summarized in columns labeled II additionally control for average pay within each firm. In all three specifications, the coefficient on average log salary is positive and significant, implying that at higher paying firms, workers are more likely to stay at least one year. However, controlling for this effect does not change the coefficient on economic conditions at time of entry into the firm. This is true for national, industry and state economic fluctuations. Thus differences in firm pay does not appear to drive the firm fixed-effects result.

As shown above, firms that hire in recessions have higher separation rates all the time. The regressions summarized in columns labeled III control for firm turnover to test whether it could be driving the firm fixed-effects results. As expected, the coefficient on the turnover rate is negative and strongly significant. Workers in firms with higher turnover are more

likely to leave. Also, in the national results, the inclusion of firm turnover reverses the sign on the national unemployment rate to a significant 0.06. Thus firm turnover can entirely explain the firm fixed effects result in the national case. Using industry or state economic conditions shows that the inclusion of firm turnover reduces the coefficient on economic conditions essentially to zero, though does not reverse the sign. This provides evidence that differences in turnover across firms are extremely important in explaining the reversal of the initial results on job durations and the economy when firm fixed effects are included.

Lastly, the regressions summarized in columns labeled IV include firm size. In all three specifications, workers in larger firms are less likely to stay a full year, significant at the 1% level in all cases.[12] Above I showed that larger firms are more likely to hire in recessions so firm size might explain some of the sign reversal on the economic conditions coefficient. It turns out that in the national results, the coefficient on the unemployment rate falls in magnitude to zero, though does not reverse in sign. The coefficients on industry employment and state unemployment fall by about half.

Though not shown here, I have also looked at the effects of industry in the national and state results. Including industry fixed effects moves the sign on the national unemployment rate essentially to zero and leaves the state unemployment rate coefficient unaffected. Thus the firm fixed effects result is not purely an artifact of industry.

[12]This is seemingly contradictory to the classic finding that tenure is higher in larger firms (see e.g., Rebizter 1986). I think this can be reconciled by the fact that in these particular data, all firms are "large". The largest are retailers and fast food restaurants which may not be the most desirable places to work. This could be one artifact of the nonrepresentativeness of the data.

4.4 High- and Low-Paying Firms

Given the importance of firm heterogeneity exhibited above, it is interesting to know whether the recession effect on tenure differs for different types of firms. One could imagine the standard match-quality argument: During a recession, sorting could be less efficient, since fewer firms are hiring. Thus, an unlucky high-quality worker could end up in a low-quality firm (a bad match), but leave quickly for a better match when the economy picks up. Conversely, when a worker enters a low-quality firm in a good economy, he or she most likely belongs there, since there should have been many options available. However, on the other side, any worker lucky enough to get into a high-quality firm might want to stay, regardless of when he or she entered. If this is the case, there would be no business-cycle effect for high-quality firms.

One dimension along which firms may differ is in salary. All else equal, higher-paying firms are better places to work. To investigate this matter, I split the sample into firms whose average pay in 2006 is above median and firms whose average pay is below. I then estimate survival rates as a function of economic conditions at time of entry into the firm and a dummy variable for being in a high-paying firm. I can then interact these two variables to see investigate the above story.

Table 7 shows regression results using the probability of staying for at least a year as the dependent variable. Results are similar when the other dependent variables are used. The columns labeled I again show the original result from the baseline specification without firm fixed effects. The columns labeled II additionally control for being in a high-paying firm and show that these workers are more likely to stay. This effect is large and statistically

significant.

The third column in each set of results allows the pay measure to interact with economic conditions at time of entry. For all three types of economic fluctuation, the interaction effect is in the opposite sign and, in the national and state cases, equal in magnitude to the economic conditions main effect. This implies that in low-paying firms, workers are more likely to turn over when they enter in worse economies but there is no relationship between entering conditions and tenure at high-paying firms.

That high-paying firms are not sensitive to the economy in this way is consistent with the idea that high-quality workers who end up there simply stay, while high-quality workers who unluckily match to low-paying firms when better opportunities arise. However, I cannot distinguish this explanation from the idea that high-paying firms are better at screening and always have better matches.

5 Conclusion

In this paper I first establish a negative correlation between entering a job in a weak economy and the duration of that job. Previous literature has attributed this correlation to worse match quality. However, an alternative explanation is firm heterogeneity; different types of firms hire in recessions. Exploiting a unique, proprietary dataset of 150 firms, I show that controlling for firm fixed effects reverses the sign on job durations. That is, entering firms in a recession is associated with *longer* employment relationships, once firm heterogeneity is taken into account. This suggests that match quality is actually better in worse economies.

I then characterize the firms that are more likely to hire in recessions. They are larger,

lower paying firms and have higher overall turnover rates (not just among workers hired in worse economies). These firm-level characteristics can account for some of the previous result that the sign on economic conditions reverses when controlling for firm fixed effects. When controlled for separately, average salary and firm size each drive the coefficient on economic conditions to zero, though do not reverse the sign. Controlling for firm turnover, however, does cause the sign reversal on the national economy. It is therefore the most important driver of the firm fixed effects result.

Finally, I show that the business-cycle effect varies across firms. In particular, tenure at low-paying firms is lower when workers enter in recessions. In contrast, there is no gradient in the effect of economic conditions on tenure for high-paying firms. This might be because high-paying firms are better places to work so once employed there, workers just want to stay. Alternatively, it could be that high-paying firms are simply better at screening workers and always find good matches.

Before concluding that match quality is actually better when workers enter in worse economies, once firm heterogeneity is accounted for, several alternative explanations must be addressed. First, these results could be entirely driven by some form of worker heterogeneity. These data do not allow me to control for worker fixed effects. Second, future economies are correlated with past economies. A worker entering in a recession may experience a bad economy six months or a year later. This would no doubt deter the worker from leaving. With a relatively short panel these data do not contain enough variation to separately control for entry labor market conditions and contemporaneous conditions. However, it is something to think about.

References

[1] Akerlof, G., Rose, A. and J. Yellen (1988): "Job Switching and Job Satisfaction in the U.S. Labor Market." *Brookings Papers on Economic Activity*, no. 2, pp. 495-582.

[2] Baker, G., M. Gibbs, and B. Holmstrom (1994a): "The Internal Economics of the Firm: Evidence from Personnel Data," *Quarterly Journal of Economics,* 109, pp. 881-919.

[3] Baker, G., M. Gibbs, and B. Holmstrom (1994b): "The Wage Policy of a Firm," *Quarterly Journal of Economics,* 109, pp. 921-955.

[4] Beaudry, Paul and John DiNardo (1991), "The Effect of Implicit Contracts on the Movement of Wages Over the Business Cycle: Evidence from Micro Data," *The Journal of Political Economy,* 99(4), August, pp. 665-668.

[5] Blundell, R., Reed, H. and T. Stoker (2003): "Interpreting Aggregate Wage Growth: The Role of Labor Market Participation," *The American Economic Review*, Vol. 93, No. 4, pp. 1114-1131.

[6] Bowlus, Audra J. (1995): "Matching Workers and Jobs: Cyclical Fluctuations in Match Quality." *Journal of Labor Economics*, Vol. 13, No. 2. pp 335-350.

[7] Farber, H.S. (1999): "Mobility and Stability: The Dynamics of Job Change in Labor Markets," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, vol. 3, North-Holland, pp. 2439-2483.

[8] Hall, R. (2005): "Job Loss, Job Finding, and Unemployment in the U.S. Economy over the Past Fifty Year," in M. Gertler and K. Rogodd, eds., *NBER Macroeconomics Annual 2005*, pp. 101-137.

[9] Jovanovic, Boyan (1979): "Job Matching and the Theory of Turnover." *Journal of Political Economy* 87 (October): 972-90.

[10] Kahn, L.B. (2007a): "The Long-Term Labor Market Consequences of Graduating from College in a Bad Economy," Harvard University, mimeo.

[11] ——————— (2007b): "Asymmetric Information between Employers," Harvard University, mimeo.

[12] Lancaster, T. (1979): "Econometric Methods for the Duration of Unemployment," *Econometrica*, Vol. 47, No. 4, pp.939-956.

[13] Oreopoulos, P., von Wachter, T. and Andrew Heisz (2006). "The Short- and Long-Term Career Effects of Graduating in a Recession: Hysteresis and Heterogeneity in the Market for College Graduates." Mimeo, Columbia University.

[14] Oyer, Paul (2006a): "The Making of an Investment Banker: Macroeconomic Shocks, Career Choice and Lifetime Income." NBER Working Paper No. 12059.

[15] Oyer, Paul (2006b): "Inital Labor Market Conditions and Long-Term Outcomes for Economists." *The Journal of Economic Perspectives*, 20(3) (Summer): pp. 143-160.

[16] Rebitzer, J. (1986): "Establishment Size and Job Tenure." *Industrial Relations*, Vol 25, No. 3, pp. 292-302.

[17] Weiss, A (1980): "Job Queues and Layoffs in Labor Markets with Flexible Wages," *Journal of Political Economy* 88(3): 526-538.

Figure 1:

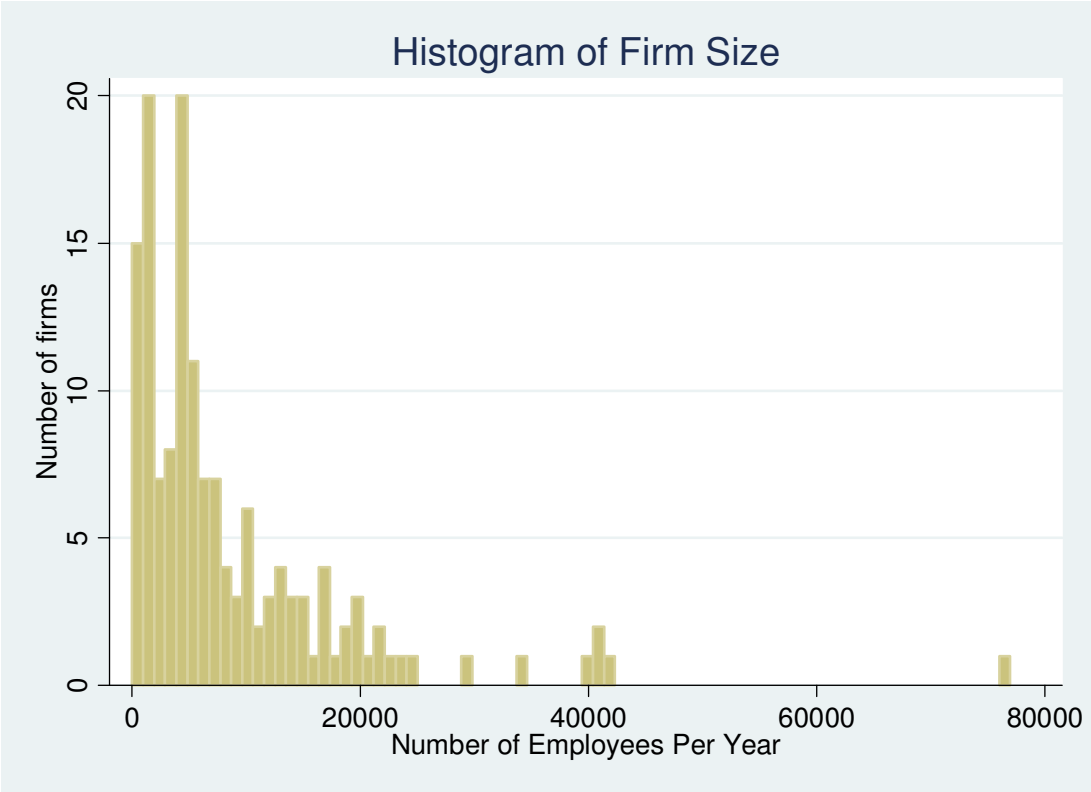


Figure 2:

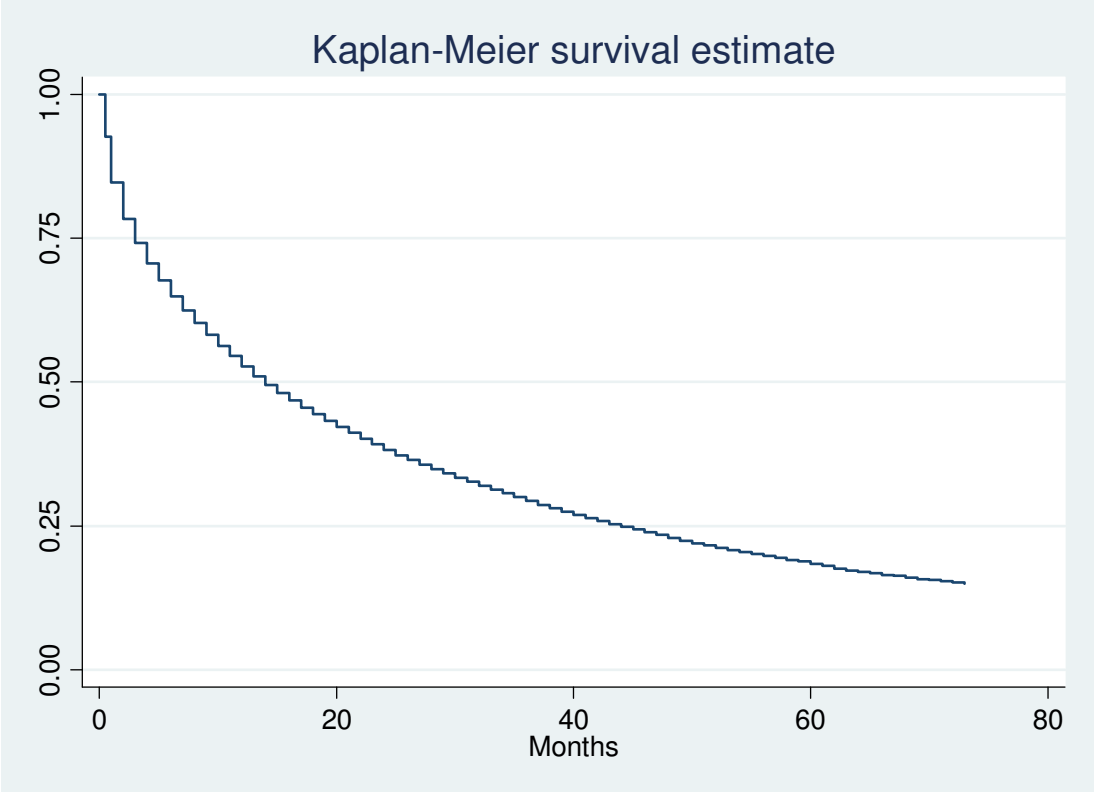


Figure 3:

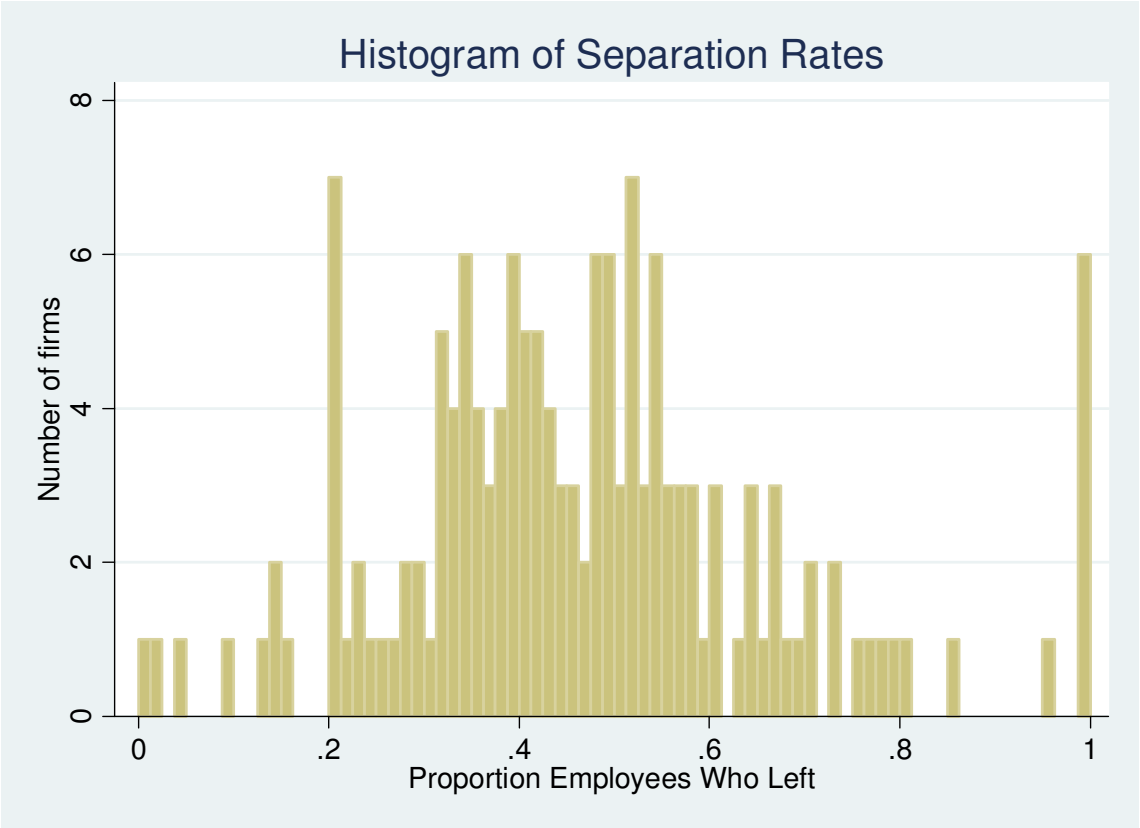


Figure 4:

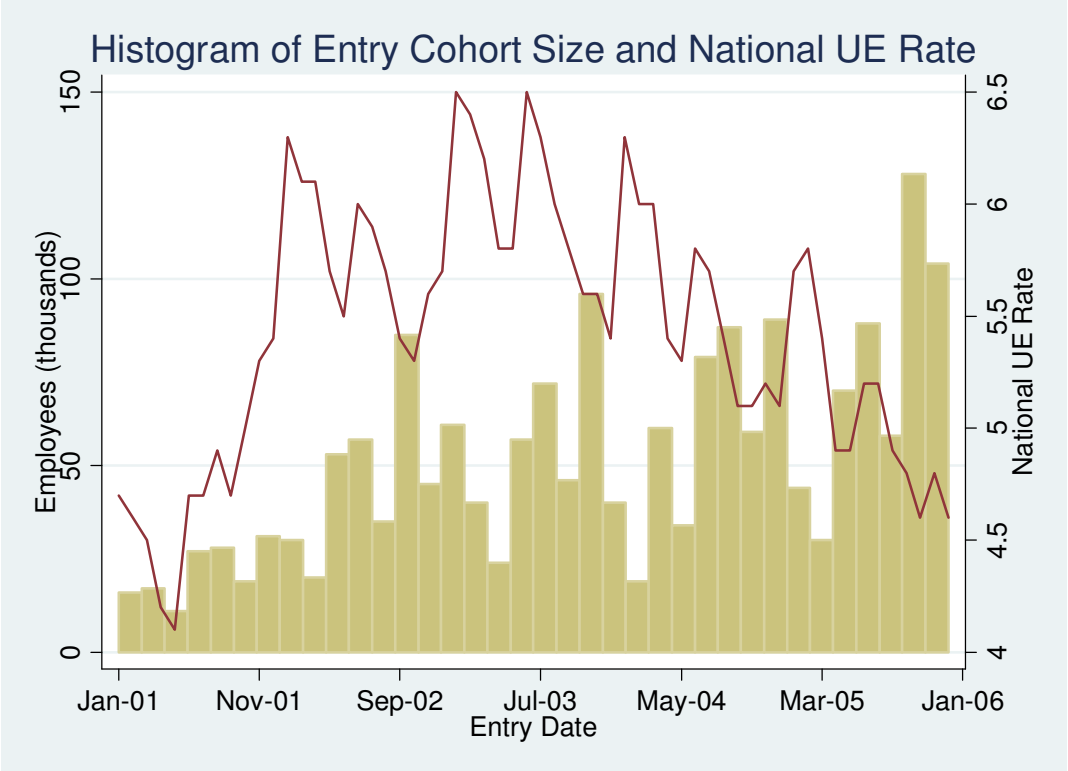


Table 1: Number of Firms and Stock of Workers, by Industry

Industry	Firms	Workers		2006 Total Employment (BLS)
		n	%	
Agriculture	1	10,900	0.11%	
Mining	4	151,525	1.51%	0.54%
Utilities	8	122,444	1.22%	0.48%
Construction	1	17,613	0.18%	6.74%
Manufacturing	59	2,144,072	21.34%	12.41%
Wholesale Trade	5	219,219	2.18%	5.18%
Retail Trade	9	3,198,598	31.84%	13.46%
Transportation and Warehousing	4	696,392	6.93%	3.92%
Information	10	1,000,493	9.96%	2.66%
Finance and Insurance	25	742,504	7.39%	5.40%
Real Estate and Rental and Leasing	1	1,042	0.01%	1.90%
Professional, Scientific, and Technical Services	5	245,313	2.44%	6.45%
Administrative and Support and Waste Management and Remediation Services	3	147,668	1.47%	7.36%
Health Care and Social Assistance	7	915,935	9.12%	13.09%
Accommodation and Food Services	5	237,227	2.36%	9.80%
Other Services (except Public Administration)	2	67,130	0.67%	4.77%
Industrial Conglomerates	1	128,540	1.28%	
	150	10,046,615		

Notes: This sample includes all workers earning a wage at any time between 2001 and 2006

Table 2: Number of Firms and Stock of Workers, by Census Division

Division	Firms	Workers		2006 Total
		n:	%	Employment (BLS)
New England	777	463,422	4.63%	5.14%
Middle Atlantic	434	1,287,532	12.85%	13.58%
East North Central	718	1,643,870	16.41%	15.86%
West North Central	914	689,228	6.88%	7.43%
South Atlantic	1,242	1,969,542	19.66%	19.31%
East South Central	562	534,576	5.34%	5.71%
West South Central	562	1,247,990	12.46%	10.79%
Mountain	1,083	663,816	6.63%	7.05%
Pacific	659	1,517,688	15.15%	15.13%
	6,951	10,017,664		

Notes: This sample includes all workers earning a wage at any time between 2001 and 2006.

Table 3: Summary Statistics

	Mean	Std Dev	Min	Max
Tenure (months)	13.23	14.46	0	73
Stay > 1 Year	0.40	0.49	0	1
Stay > 6 Months	0.57	0.50	0	1
Left the Firm	0.58	0.49	0	1
Entry Age	30.49	11.52	16	65
Female	0.51	0.50	0	1
Starting Salary (logs)	9.63	1.34	-4.63	19.68
National Entry UE Rate	5.21	0.63	4.1	6.5
State Entry UE Rate	5.18	1.05	1.8	11
Industry Employment (millions)[1]	11.70	4.83	0.49	16.99
Average Log Salary w/in Firm[2]	10.00	1.07	4.69	13.49
Turnover Rate[3]	0.56	0.21	0.01	1
Firm Size per Year[4]	84779	72314	44	177189
In Above-Median Paying Firm	0.457817	0.498218	0	1
n workers:	4473108			
n firms:	147			

Notes: This sample includes all new entrants to firms between the time the firm entered the database (as early as 2001) and 2005.

1. Industry Employment is measured as the total number of workers, in millions,
2. Computed from all workers in 2006, not just new entrants.
3. Equals the number of workers who left the firm between 2001 and 2006 divided by the total number of workers at the firm in that period.
4. Equals the total number of employees observed between 2001 and 2006

Table 4: Survival Rates by Economic Conditions at Entry Date

Coefficient on Employment Measure

	A: Baseline Specifications[1]		
	National UE Rate	Industry Employment[2]	State UE Rate[3]
Prob(Stay>1 year)	-0.0211	0.0295	-0.0042
	[0.0082]*	[0.0100]**	[0.0020]*
Prob(Stay>6 months)	-0.0248	0.0197	-0.0025
	[0.0085]**	[0.0078]*	[0.0018]
Cox Proportional Hazard	0.0368	-0.0666	0.0181
	[0.0225]	[0.0230]**	[0.0052]**
	B: Controlling for Firm Fixed Effects		
Prob(Stay>1 year)	0.0493	-0.0241	0.0012
	[0.0064]**	[0.0085]**	[0.0013]
Prob(Stay>6 months)	0.037	-0.0235	0.0022
	[0.0040]**	[0.0063]**	[0.0012]+
Cox Proportional Hazard[4]	-0.1756	0.0443	0.001
	[0.0197]**	[0.0269]+	[0.0034]
Observations	3065390	3220201	3273512

Standard errors in brackets, clustered by entry month, entry month-industry or entry month-state.
+ significant at 10%; * significant at 5%; ** significant at 1%

1. Base controls include a cubic in entry age, a female dummy and month of entry fixed effects.

2. Industry Employment is measured as the total number of workers, in millions, employed in that NAICS two-digit industry, nationwide, in the month and year of entry into the firm. These specifications also include year and two-digit industry fixed effects.

3. Specification also includes year and state fixed effects

4. In this specification, the hazard is estimating stratifying on firm. That is, it allows each firm to have its own baseline hazard.

Table 5: Employment Conditions at Time of Entry as a Function of Firm Characteristics

	Dependent Variable:								
	National UE Rate[2]			Industry Employment[3]			State UE Rate[4]		
	I	II	III	I	II	III	I	II	III
Average of Ave Log Salary	-0.2693			0.6407			-0.4492		
	[0.6189]			[0.0854]**			[0.0608]**		
Average of Turnover Rate		6.1681			-2.1889			2.1761	
		[1.4527]**			[0.2347]**			[0.3100]**	
Average of Firm Size Per			59.723			-11.850			11.412
Year (millions)			[10.210]**			[1.614]**			[1.149]**
Base Controls[1]	X	X	X	X	X	X	X	X	X
Year Fes				X	X	X	X	X	X
State FEs							X	X	X
Industry FEs				X	X	X			
Observations[5]	72	72	72	864	864	864	3672	3672	3672
R-squared	0.832	0.777	0.862	0.997	0.997	0.997	0.797	0.798	0.8

Standard errors in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

Note: Firm fixed effects are not included in any of these specifications

1. Base controls include a cubic in entry age, a female dummy and month of entry dummies.

2. In this specification, observations are collapsed to the month-year level.

3. Industry Employment is measured as the total number of workers, in millions, employed in that NAICS two-digit industry, nationwide, in the month and year of entry into the firm. Observations are collapsed to the month-year-industry level.

4. Observations are collapsed to the month-year-state level.

5. Observations analytically weighted based on cell size.

Table 6: Survival Rates by Economic Conditions at Entry Date and Firm Characteristics

Dependent Variable: Probability of Staying at Least One Year

	National UE Rates				Industry Employment[2]				State UE Rates			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Monthly Economic	-0.0211	-0.0221	0.0634	0.0053	0.0295	0.0289	0.0022	0.0191	-0.0042	-0.0037	-0.0003	-0.0017
Conditions	[0.0082]*	[0.0088]*	[0.0075]**	[0.0060]	[0.0100]**	[0.0100]**	[0.0093]	[0.0094]*	[0.0020]*	[0.0019]+	[0.0015]	[0.0017]
Ave Log Salary		0.0239				0.0085				0.031		
		[0.0049]**				[0.0047]+				[0.0015]**		
Turnover Rate			-0.9531				-0.8426				-0.9661	
			[0.0183]**				[0.0339]**				[0.0066]**	
Firm Size Per Year				-1.8608				-2.2625				-1.8753
(millions)				[0.0568]**				[0.1812]**				[0.0176]**
Base Controls[1]	X	X	X		X	X	X	X	X	X	X	X
Year Fes					X	X	X	X	X	X	X	X
State FE's									X	X	X	X
Industry FE's					X	X	X	X				
Observations	3065390	3065390	3065390	3065390	3220621	3220621	3220621	3220621	3273932	3273932	3273932	3273932
R-Squared	0.05	0.05	0.17	0.11	0.13	0.13	0.19	0.15	0.06	0.06	0.18	0.12

Standard errors in brackets, clustered by entry month, entry month-industry or entry month-state.

+ significant at 10%; * significant at 5%; ** significant at 1%

Note: Firm fixed effects are not included in any of these specifications.

1. Base controls include a cubic in entry age, a female dummy and month of entry dummies.

2. Industry Employment is measured as the total number of workers, in millions, employed in that NAICS two-digit industry, nationwide, in the month and year of entry into the firm.

Table 7: Survival Rates by Economic Conditions at Entry Date and Firm Pay

Dependent Variable: Probability of Staying at Least One Year

	National UE Rates				Industry Employment[2]				State UE Rates[3]		
	I	II	III		I	II	III		I	II	III
Monthly Unemployment	-0.0211	-0.0103	-0.031		0.0295	0.0276	0.0328		-0.0042	-0.0026	-0.0067
Measure	[0.0082]*	[0.0074]	[0.0112]**		[0.0100]**	[0.0100]**	[0.0101]**		[0.0020]*	[0.0018]	[0.0022]**
Above_med[4]		0.1753	-0.0515			0.074	0.1661			0.1822	0.1346
		[0.0102]**	[0.0982]			[0.0075]**	[0.0452]**			[0.0031]**	[0.0165]**
Monthly*above			0.0412				-0.0067				0.0088
			[0.0175]*				[0.0032]*				[0.0029]**
Base Controls[1]		X	X			X	X			X	X
Year Fes						X	X			X	X
State FEs										X	X
Industry FEs						X	X				
Observations	3065390	3065390	3065390		3220201	3220201	3220201		3273512	3273512	3273512

Standard errors in brackets, clustered by entry month, entry month-industry or entry month-state.

+ significant at 10%; * significant at 5%; ** significant at 1%

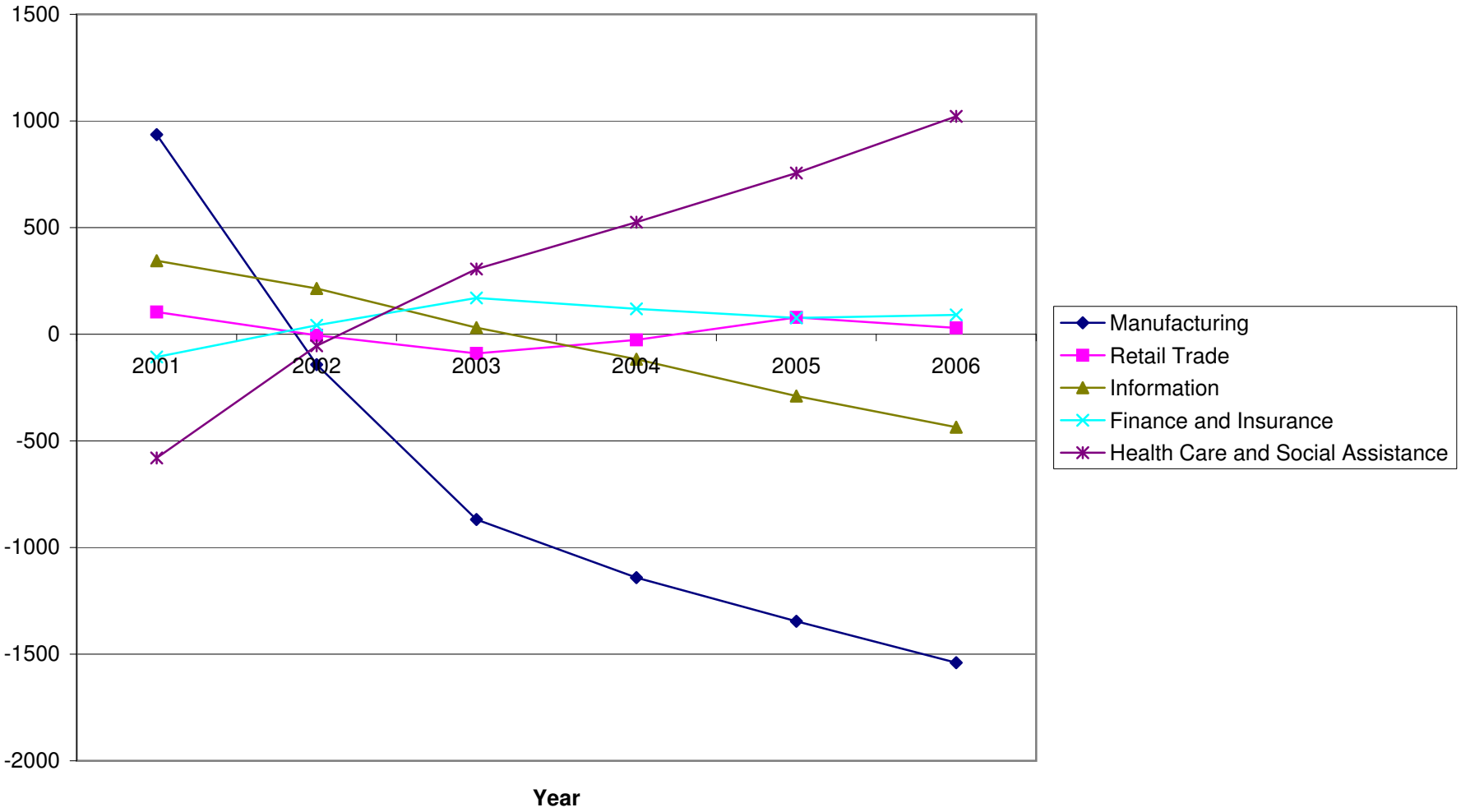
1. Base controls include a cubic in entry age, a female dummy and month of entry dummies.

2. Industry Employment is measured as the total number of workers, in millions, employed in that NAICS two-digit industry, nationwide, in the month and year of entry into the firm. These specifications also include year and two-digit industry fixed effects.

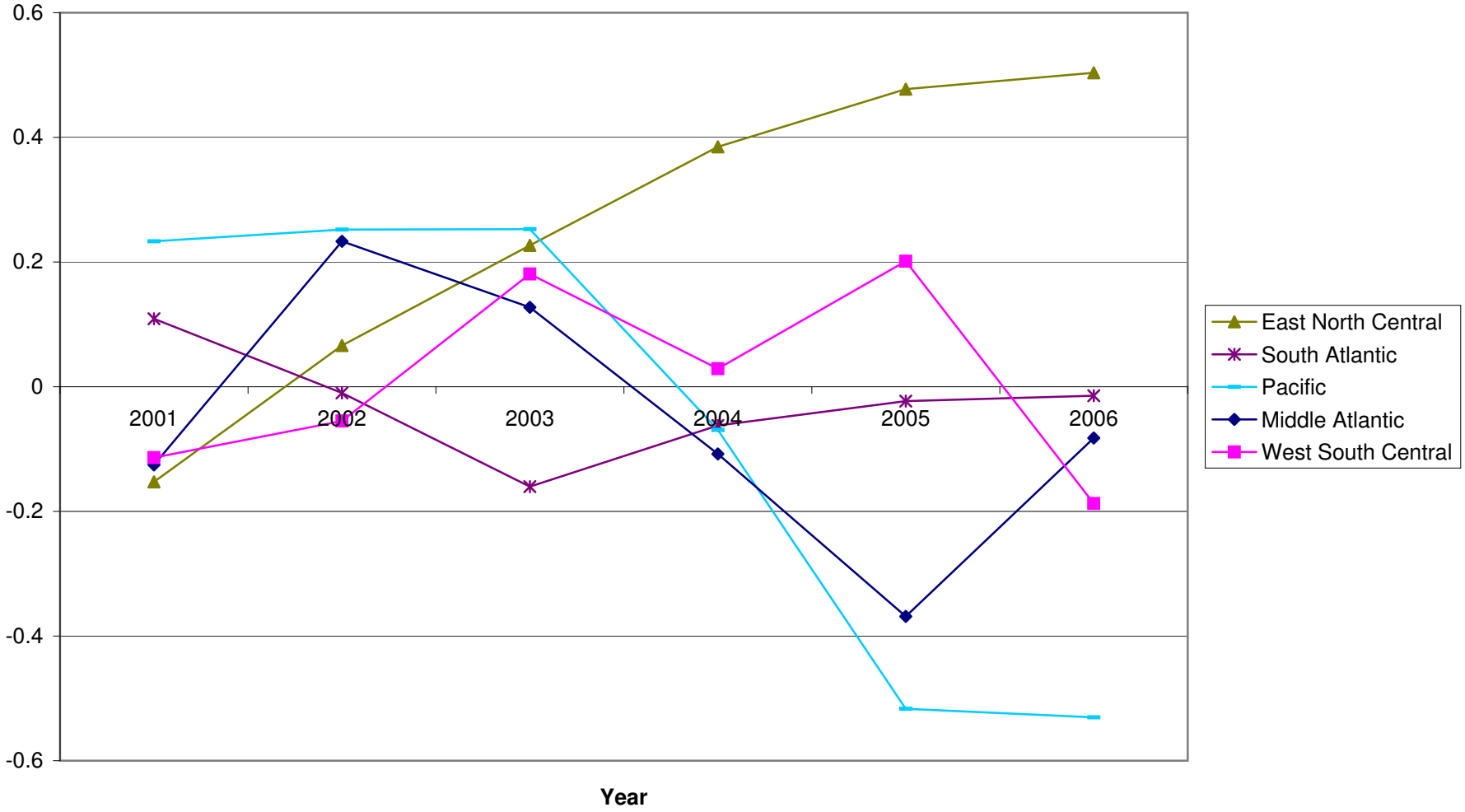
3. Specification also includes year and state fixed effects

4. Equals 1 if the firm-level average salary for all work

Appendix Figure A1: Industry Employment Levels, Adjusted for Year and Industry Fixed Effects
Data Source: BLS



Appendix Figure A2: Unemployment Rates by Census Division, Adjusted for Year and State Fixed Effects
Data Source: BLS



Appendix Table A1: Number of Workers by Start Year and Industry

	2001	2002	2003	2004	2005
Agriculture (11)		938	1,277	1,929	1,597
Mining (21)	13,588	14,713	11,972	14,718	17,501
Utilities (22)	2,672	4,574	3,325	3,600	6,365
Manufacturing (31-33)	28,238	69,903	84,576	130,891	151,592
Wholesale Trade (42)	7,318	19,099	12,409	13,564	20,811
Retail Trade (44-45)	143,215	300,260	301,213	323,461	349,085
Transportation and Warehousing (48-49)		2,021	44,502	53,061	63,521
Information (51)		44,639	60,541	69,658	70,143
Finance and Insurance (52)		33,642	49,995	64,774	66,962
Real Estate and Rental and Leasing (53)				57	66
Professional, Scientific, and Technical Services (54)	4,642	13,625	10,656	17,003	23,317
Administrative and Support and Waste Management and Remediation Services (56)			36,988	17,655	26,502
Health Care and Social Assistance (62)		64,208	72,285	73,685	80,230
Accommodation and Food Services (72)		7,649	8,618	29,122	43,497
Other Services (except Public Administration) (81)				8,941	9,333
Industrial Conglomerates (99)	8,449	8,029	6,834	7,582	16,676
	208,122	583,300	705,191	829,701	947,198

Notes: This sample includes all new entrants to firms between the time the firm entered the database (as early as 2001) and 2005.

Appendix Table A2: Number of Workers by Start Year and Census Division

	2001	2002	2003	2004	2005
New England	7,147	21,999	28,148	34,992	40,361
Middle Atlantic	32,392	79,562	91,173	101,419	113,538
East North Central	31,241	88,022	103,244	132,925	145,921
West North Central	11,816	40,333	48,614	56,835	63,525
South Atlantic	50,776	124,778	144,067	166,371	193,268
East South Central	9,785	32,616	40,981	47,810	53,726
West South Central	31,030	80,814	88,363	98,997	109,240
Mountain	11,717	43,986	53,915	62,963	74,543
Pacific	22,218	71,190	106,686	127,389	153,076
	208,122	583,300	705,191	829,701	947,198

Notes: This sample includes all new entrants to firms between the time the firm entered the database (as early as 2001) and 2005.