Employment Cyclicality and Firm Quality\textsuperscript{1,2}

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Abstract

Who fares worse in an economic downturn, low- or high-paying firms? Different answers to this question imply very different consequences for the costs of recessions. Using linked employer-employee data from the LEHD program at the U.S. Census, we find that employment growth at low-paying firms is less sensitive to the current unemployment rate. High-paying firms grow more quickly in booms and shrink more quickly in busts. We show that the growth rate effect is accounted for by a greater reduction in gross separations at low-paying firms in busts, compared to high-paying firms, and is true despite a commensurate greater reduction in gross hires. That is, jobs at low-paying firms become stickier in recessions, relative to jobs at high-paying firms. We discuss our results in the context of a number of possible explanations and provide additional results to distinguish among these. Our findings are inconsistent with cleansing. We also show these effects are not driven by differential downward wage rigidities over the business cycle, and are unlikely to be driven by differential business cycle sensitivity. Instead, labor supply driven explanations are more likely. Our findings imply that job composition can potentially account for some of the lasting negative labor market impacts on workers forced to search for a job in a downturn.
1 Introduction

Worker sorting across firms has long been thought to play a central role in labor market efficiency. Despite frictions that can inhibit this sorting process, such as search costs or imperfect learning, workers are thought to gradually move towards jobs of better overall- or match-specific quality.\footnote{This idea goes at least as far back as the canonical work of Jovanovic (1979) and for empirical work on job mobility see Farber’s 1999 survey.} At the same time, recessions may impede worker sorting. Several papers have noted a marked decline in worker churning and job-to-job mobility in recent recessions, with a particularly sharp downturn in job change during the Great Recession.\footnote{See in particular Lazear and Spletzer (2012), Hyatt and McEntarfer (2012).} This suggests that a worker’s ability to move on from poor job matches or bad jobs is curtailed in times of high unemployment. A natural question, then, is in what types of jobs are workers at least temporarily saddled? If the business cycle has differential employment impacts on jobs or firms of varying quality, the consequences of reduced mobility could be very different. In this paper, we ask how firm quality interacts with the business cycle. We investigate whether the employment effects of the business cycle are heterogeneous across high- and low-paying firms.

If resources are reallocated to more productive firms in recessions (the classic Schumpeter 1939 cleansing effect), and more productive firms are also higher paying, then we might see a commensurate flow of workers to good firms. However, the cyclical upgrading literature (Okun 1973, Bils and McLaughlin 2001) suggests that high-paying jobs may be more sensitive to the business cycle, with opportunities to move into these jobs relatively more prevalent in expansions. Further, Barlevy (2002) shows that the decline in job-to-job transitions seen in recessions has a quantitatively important effect on overall match quality, terming this the “sullying effect” of recessions. If low-paying firms see relatively less job destruction in downturns, then we would have a further sullying effect; jobs in busts would be both lower quality matches and in lower absolute quality of firms. In this paper we analyze the differential impact of economic conditions on employment, both net and gross worker flows, as a function of average firm pay.

We use data from the Longitudinal Employer Household Dynamics (LEHD) program; a U.S. employer-employee matched database drawn from the state unemployment insurance systems. This data set allows us to match detailed worker job histories with a rich set of firm-level characteristics. We classify establishments based on average pay over their lifetime in the sample, dividing them into quintiles relative to other establishments in the same state and industry.\footnote{We use the terms establishment and firm interchangeably. In our context both refer to workers working for a firm with the same state employer identification number (SEIN) who can also be matched, based on an algorithm designed by the LEHD, to the same unit within the SEIN.} The LEHD is advantageous since it not only allows us to characterize and compare firms at this level, it also allows us to track individual workers. We can therefore analyze gross, as well as net, worker flows across firms. We analyze quarterly employment growth
rates, as well as gross hire and separation rates, as a function of the state unemployment rate in that quarter and pay quintile from 1998 to 2011. This time period allows us to capture the 2001 and 2007-09 recessions.

We find that net employment growth at high-paying establishments is more responsive to the business cycle than that of low-paying establishments, both in levels and in percent changes. This effect is symmetric across booms, when high-paying establishments grow more quickly, and busts, when they shrink more quickly than low-paying establishments. To explain these findings, we analyze gross worker flows. In contrast to their more-responsive growth rates, we find that at high-paying establishments, gross worker flows are less responsive to the business cycle; separation and hire rates both decline by less in high-, compared to low-, paying firms when the unemployment rate increases. Therefore, the relatively higher growth rates seen in low-, compared to high-, paying firms in economic downturns is accounted for by a larger decline in separation rates. The general adherent effect on jobs, typically seen in recessions, is relatively stronger among jobs at low-paying establishments.

Our finding that, relatively speaking, workers flow to low-paying firms in times of high unemployment is counter to intuition that recessions have a cleansing effect. We use our body of evidence to disentangle macroeconomic models with predictions of worker mobility over the business cycle and draw on these models for additional empirical predictions. For example, high-paying firms may be more sensitive to the business cycle due to a greater sensitivity in demand for the products they sell. To test this, we use Compustat data to measure revenue changes over the business cycle. However, we do not find any evidence that high-paying firms are in sub-sectors with more cyclically sensitive revenue. It could instead be that high-paying firms have a greater need to cut workers because they have more difficulty lowering workers’ earnings. If earnings are more downwardly rigid at high-paying firms, then they would be more likely to respond to a negative demand shock by laying off workers. However, following a similar methodology to (Dickens, et al., 2007) we find the opposite: earnings at high-paying firms become relatively less rigid in times of higher unemployment.

These tests point us toward labor supply driven explanations for our findings. In particular, the poaching model outlined in Moscarini and Postel-Vinay (2012a) is a plausible explanation: High-quality firms have an easier time attracting workers in booms, so they grow relative to low-quality firms and inflate in size. During the bust they must then shed some of these workers. At the same time, low-quality firms have an easier time retaining workers in a bust, since high-quality firms are less likely to poach workers then.

Our results are broadly consistent with a recent body of work examining growth rates over the business cycle as a function of firm size. Moscarini and Postel-Vinay (2012b, hereafter MPV), show in a number of countries including the U.S. that differential growth rates of small-, compared to large-, firms are positively related to the unemployment rate. Fort, Haltiwanger, Jarmin and Miranda (2012) analyze firm growth over the business cycle as a
function of firm age and size, using U.S. data. They find that small, young, firms typically fare relatively better in cyclical contractions, although this relationship reversed in the 2007-09 recession. Our results are consistent with this literature since pay and size are negatively correlated. And, our effects hold conditional and unconditional on firm size. For our purposes, pay is a more important dimension of job quality, allowing us to better characterize the composition of jobs over the business cycle in terms of job quality. In addition, the added dimension of gross worker flows allows us to paint a richer picture of labor market dynamics over the business cycle, that is not possible in the other data sets used to study growth rates. Furthermore, we contribute to this literature with additional empirical tests to disentangle macroeconomic models with predictions of worker mobility over the business cycle.

Our results are very much in the spirit of Barlevy (2002) where workers are stuck in low-quality matches in recessions. In addition to any effects on match quality, our results indicate that downturns cause workers to stay in worse overall quality firms. This has important implications for the long-lasting consequences of recessions on workers. A growing body of evidence suggests that recessions have vastly different impacts on workers over the long run, depending on what stage of their career the recession hits them in. First, labor market conditions at the beginning of a worker’s career have long-lasting scarring effects (Kahn 2010, Oreopoulos, von Wachter and Heisz 2012, Altonji, Kahn and Speer 2013). Second, the consequences of job displacement have been shown to be much larger when displacement occurs in a recession (Davis and von Wachter 2011). It therefore seems that being forced to search and match during an economic downturn can be incredibly damaging to a worker’s career. Our finding that, relatively speaking, low-paying firms grow faster in economic downturns (or shrink less quickly) can potentially account for these findings. It suggests that matches occurring in downturns will be relatively stickier at low-paying firms than at high-paying firms.

The remainder of the paper proceeds as follows. Section 2 discusses potential mechanisms for why employment at low- and high-paying firms might be differentially impacted by the businesses cycle. Section 3 describes the data and presents some aggregate trends. Section 4 describes our methodology for studying net and gross worker flows. Section 5 presents our regression results. Section 6 provides additional evidence to help disentangle among the models described in section 2. Section 7 concludes.

2 Mechanisms

First, since at least as far back as Schumpeter (1939), economists advanced the notion that recessions serve a “cleansing” mechanism, reallocating resources from least to most productive. Pay and productivity are likely positively correlated (see for example Serafinelli

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4 Many theoretical papers seek to explain this pattern by exploiting a friction that inhibits resources from being allocated optimally. In recessions, productivity falls for all firms, thus making the least productive
(2012) for evidence on this from Italian administrative data). Thus we might expect some jobs at low-paying firms to be cleansed and reallocated to high-paying firms. That is, a cleansing model would likely predict that high-paying firms be less sensitive to negative economic shocks.

In this section, we explore additional mechanisms that could generate differential impacts of economic downturns across different types of firms. We divide the discussion into mechanism that would generate differences in involuntary separations and those that would generate differences in voluntary separations. These forces will obviously interact, but we keep them separated to hopefully make the discussion clearer.

2.1 Explanations Impacting Involuntary Mobility

The cyclical upgrading literature (e.g., Okun 1973 or Bils and McLaughlin 2001) finds that high-paying industries have more cyclical employment; in expansions, workers move from low-wage to high-wage industries, working their way up a quality ladder. This literature is sparse on the underlying mechanisms, and instead could be a function of the time periods studied with aggregate shocks that may have favored low-paying industries, which need not be the case over time. For example, the fact that non-durable goods manufacturing has less cyclically sensitive product demand and is also lower paying, relative to durable goods, could have generated a cyclical upgrading in employment when manufacturing was a larger share of U.S. employment.\(^5\) Our analysis compares establishments in the same two-digit NAICS industry and state, however, it is certainly possible that the same dynamics could occur within our aggregated industry categories.\(^6\) For example, consider an inexpensive chain restaurant and a five-star restaurant. The latter most likely pays their employees more and also might have more cyclical demand. Indeed, cheaper products may have less cyclical demand. If there is a positive correlation between worker salary and product price then we would expect products from higher paying firms to be more sensitive to business cycle fluctuations.

For a given need to cut the labor bill, firms may also differ in their ability to do so without resorting to layoffs. A long-standing literature (see for example Shimer (2004) or Hall (2005a) among many others) points to nominal wage rigidities as an explanation.

\(^{5}\)Okun (1973) proposes a model where high-quality pay rents and therefore have a queue of workers waiting to fill vacancies. In response to a positive productivity shock, high-quality firms can then expand employment without raising wages. This expansion puts upward wage pressure on low-quality firms, who then cannot expand as much. This model does well in predicting greater cyclicity of employment in high-quality firms compared to low-quality firms during expansions but less well in rationalizing the same pattern in contractions.

\(^{6}\)Holmes and Stevens (2012), for example, argue that within manufacturing, small firms are less impacted by trade-driven competition in the product market since they produce to a more niche, local market.
for larger employment fluctuations than fluctuations in other market fundamentals. After experiencing an aggregate negative productivity shock, firms cannot afford to hire or keep workers if they cannot lower wages by a commensurate amount. The degree to which nominal wages are downwardly rigid remains a completely open empirical question with evidence on all sides (see Pissarides 2009 for a survey). To our knowledge no one has examined pay rigidity as a function of average firm pay. On the one hand, low-wage firms likely pay more of their workforce on an hourly basis, so may have an easier time cutting take-home pay through hours reductions. At the same time, high-paying firms may pay a higher share of salaries in the form of bonuses, which are likely much easier to adjust. So earnings rigidities could really cut either way.

Managerial practices could also differ across high- and low-paying firms, in ways which generate differential responses to the business cycle. For example, the “pit stop” model of management (e.g., Koenders and Rogerson (2005)) says that in booms managers are focused on growth and in busts must focus on efficiency and cut workers. Given positive correlations between pay, productivity, and size, it could be that low-paying firms are always closer to the margin of survival and therefore always focused on efficiency. This would result in a relatively greater need for high-paying firms to separate workers in downturns. Such a theory suggests the counter-intuitive notion that low-paying firms manage more efficiently. In contrast, one might suppose that given their lower productivity, smaller size, and likely lower probability of survival, low-paying firms manage inefficiently. While, high-paying firms lay off workers in economic downturns, low-paying firms do less of this, even though they should. This model would suggest that low-paying firms are less likely to survive during an aggregate downturn since they do not manage it well.

2.2 Explanations Impacting Voluntary Mobility

A labor supply driven explanation is very much in the spirit of Barlevy (2002) who shows that declining job-to-job transitions in recessions has a quantitatively important "sullying" effect on match quality. A small empirical literature further supports the idea that match quality declines in recessions (e.g., Bowls (1993), Davis, Haltiwanger and Schuh (1996)). This literature focuses on match quality, rather than overall firm quality, but we view our analysis as still very much in line with this literature.

Any notion of a job ladder would suggest that jobs in low-wage firms are easier to obtain,
while workers seek to move on to high-paying firms. There is likely a higher degree of voluntary exit from jobs on lower rungs of the ladder. Economic downturns typically have a sizable, depressing effect on voluntary mobility (e.g., Shimer 2005, Hall 2005b). Thus we might expect the decline in voluntary mobility seen in recessions to have a larger impact on low-paying firms.

Moscarini and Postel-Vinay (2012a) formalize the job ladder model. They develop a search model in which firms compete for worker talent. High-quality firms can offer more generous contracts and are therefore more successful at attracting workers. In fact, a key element of this model is the "poaching" of workers away from low-quality firms that high-quality firms will engage in during boom times. High-quality firms thus spend the boom inflating in size. In busts, they have become too large and stop poaching from bad firms (they might also make layoffs). Low-quality firms, on the other hand, can finally retain their workforce since their employees have nowhere to upgrade to.

In fact, a simple compensating differentials framework can also yield this result. High-quality firms are better places to work, thus in equilibrium, they might also be more volatile, in order for the marginal worker to be indifferent between working there and a low-quality firm. We find this plausible, and the Moscarini Postel-Vinay model provides a candidate mechanism driving this increased volatility.

3 Data

We analyze employment changes within firms and over the business cycle using data from the U.S. Census Bureau’s Longitudinal Employer-Household Dynamics (LEHD) program. The LEHD program maintains a variety of survey and administrative data from several state and federal agencies. For this paper, we chiefly use state unemployment insurance (UI) wage records and the Quarterly Census of Employment and Wages (QCEW) data. Both UI and QCEW data are available for states in partnership with the LEHD program, currently all 50 states and the District of Columbia. A thorough discussion of the LEHD data is provided in Abowd et. al. (2006); a brief description follows.

State-level unemployment insurance (UI) data contain quarterly earnings for employees covered by state unemployment insurance systems, over 96% of private sector employment. A firm, as defined in this analysis, is a collection of workers who share a common unemployment insurance system identifier (SEIN). A set of workers can be matched to a given establishment within an SEIN based on an algorithm designed by the LEHD. Individual wage records can be linked across quarters to create individual work histories, worker flows, and earnings dynamics. The firm identifier on the UI records is used to link to information on the firm available in the QCEW data (we principally use employment size and industry). Worker demographics, namely sex and date of birth, are available from links to the Census administrative and survey data. For this paper we restrict attention to the 33 states that
have UI and QCEW data for every quarter of our sample period 1998:Q1-2011:Q4. This sample period was chosen to maximize the number of states for which a balanced panel of data exists over a reasonably long time period.

These data are advantageous in that they allow us to observe both gross and net worker flows for a substantial fraction of firms in the U.S. labor market. Furthermore, we can create a rich set of firm characteristics to measure employer quality. Finally, the time period over which we can exploit a balanced panel consisting of a large number of states allows us to capture both the 2001 and 2007-09 recessions.

We categorize establishments in this sample based on average pay. Since one goal of this paper is to better understand the experiences of workers in recessions, we would ultimately like our quality measure to correlate with firms workers would like to be in. Obviously pay is an important dimension of worker satisfaction. Furthermore, firms that can pay higher wages are likely more productive. Serafinelli (2012), for example, presents evidence using detailed administrative data in Italy that high paying firms are indeed more productive. Our exercise in this paper is to analyze how firms of different qualities are impacted by the business cycle. We therefore construct time-invariant pay measures by taking average wage within an establishment over our entire sample period (1998-2011). This avoids the well-known reclassification bias problem (discussed, for example, in MPV), though our results are robust to other measures.8

Figure 1 shows an employment-weighted kernel density of average monthly earnings (for employees who work an entire quarter, in 2008 dollars). This distribution has a long right tail and to avoid potential data disclosure issues, we cap earnings at $12,000. As can be seen, we have substantial variation across establishments over this time period in all measures. In our subsequent analysis we divide establishments into employment-weighted quintiles, based on this measure. We use state-industry-specific cut points (measured at the two-digit NAICS level). Our categories thus define establishments as high- or low-paying relative to other establishments in the same state and industry.

The key dependent variables in this paper are net employment growth rates as well as gross flow rates. To calculate these rates, we aggregate our establishment-level data to the state-year-quarter-industry-wage quintile category, by summing employment and worker flows in each cell.9 This level of aggregation allows us to control for industry, while still enabling us to capture employment dynamics driven from firm births and deaths.10

8In particular, we have experimented with using a two-quarter moving average as in Fort et al. (2012) and we will also check robustness to using average quality in an initial period of measurement (as in MPV).
9We aggregate to the three-digit NAICS industry level here so that we can both control for two-digit industry fixed effects, and experiment with other controls at a more disaggregated level.
10While in principle, we could conduct our analysis at the individual firm level, that would produce growth, hire and separations rates that are quite a bit noisier. These rates are misleadingly large in the period in which a firm starts or closes and outliers can be generated by seasonal employers or non-reporting events (or in principle mergers and acquisitions, though the LEHD use an algorithm to exclude these events). At the individual firm level, these outliers create problems for our estimation, so we prefer the slightly aggregated analysis presented here. This aggregation is particularly important given an LEHD data limitation: that it
Specifically, the quarterly growth rate in a given quarter, $t$, for a firm pay type, $q$, is defined in equation 1, where $B$ is beginning of quarter employment, $E$, is end of quarter employment, in an establishment, $f$. The growth rate is the net employment change among all establishments, $f$, of type $q$ (establishments indexed 1 to $F_q$) divided by average employment over the quarter, $t$, among these establishments.

$$\text{growth rate}_{tq} = \frac{\sum_{f=1}^{F_q} (E_{tf} - B_{tf})}{.5 \sum_{f=1}^{F_q} (E_{tf} + B_{tf})}$$

Hire and separation rates are defined in equations 2 and 3, respectively, as the total number of hires ($A$) or separations ($S$) in quarter, $t$, at firms of quality, $q$, divided by average employment over the quarter. Our results are robust to an alternative denominator, total employment over the quarter, which is sometimes used in the literature. However, our definitions are convenient because the common denominator across the three rates means that the hire rate minus the separation rate must add up to the growth rate (see Lazear and Spletzer 2012). These gross worker flows are not available in most data sets, even those containing measures of net employment growth, and herein lies much of our contribution.

$$\text{hire rate}_{tq} = \frac{\sum_{f=1}^{F_q} A_{tf}}{.5 \sum_{f=1}^{F_q} (E_{tf} + B_{tf})}$$

$$\text{separation rate}_{tq} = \frac{\sum_{f=1}^{F_q} S_{tf}}{.5 \sum_{f=1}^{F_q} (E_{tf} + B_{tf})}$$

Table 1 presents employment-weighted summary statistics by firm category for our rates of interest. Again, the unit of observation here is a date-industry-state-wage quintile cell. Growth rates are fairly similar across pay quintiles, ranging from 0.002 to 0.003. Hire and separation rates are highly correlated within firm category, reflecting the fact that most hiring serves to replace workers who have separated. In addition, these rates vary widely across firm category. For example, gross flow rates in the lowest pay quintile establishments are, on average, over double the rates in the highest pay quintile establishments.

In these data, pay is highly correlated with excess churn: low-paying firms have much larger gross hire and separation rates than do high-paying firms. Equation 4 defines the

is difficult to link firms consistently over time due to periodically changing SEIN’s.
excess churn rate in a given time period, \( t \), as hires and separations in excess of the net employment change in the period \((E - B)\), divided by average employment in the period. A firm with a high-churn rate has a high number of worker flows in excess of job flows. We take this definition, which is now standard in the literature, from Burgess, Lane, & Stevens (2000). Cambell et al. (2005) show that high churn is associated with lower productivity and lower survival rates for a select set of industries.

\[
churn_{tf} = \frac{A_{tf} + S_{tf} - |E_{tf} - B_{tf}|}{.5 \times (E_{tf} + B_{tf})}
\]

We place establishments into quintiles based on the average excess churn rate over the entire sample period, and report this distribution for each pay quintile. From column 1 of table 1, about a third of establishments in the lowest pay quintile are in the highest churn quintile, while only a tenth are in the lowest churn quartile. These ratios are almost exactly reversed in column 5, the highest pay quintile. In some specifications we will control for the churn distribution within pay quintiles.

Table 1 also shows the firm size distribution in each pay quintile. Firm size is defined as the number of employees in the SEIN on the 12th day of the first month of the quarter, averaged over the life of the SEIN.\(^{11}\) Larger firms have been shown to have higher pay, better working conditions, a greater degree of benefits provision, increased productivity, and increased probability of firm survival (Brown and Medoff 1989, Hurst and Pugsley 2011). In our data, the lowest paying firms are predominantly found in either the smallest (less than 20) or largest (500+) size categories. The majority of higher paying establishments are in firms with at least 500 employees. Again, in some specifications, we will control for the firm size distribution underlying the pay quintile.

To gain a general sense of hiring over the business cycle, we first look at differential growth, hire and separation rates across our lowest and highest quality firm quintiles. We simply subtract the rate in the highest quality bucket from that in the lowest. MPV do a similar exercise comparing growth rates at large and small firms. These differential growth rates are plotted in figure 2 along with the national unemployment rate (dashed line). Both lines have been detrended using a Hodrick-Prescott filter, and seasonally adjusted by residualizing on quarter dummies (therefore the levels are not that meaningful).

The top left graph shows the differential growth rate across low- and high-wage firms. Though noisy, this differential growth rate very closely tracks the national unemployment rate. That is, when unemployment is high, low-wage firms grow relatively more quickly (or

\(^{11}\)Both Fort et al. (2012) and MPV use firm size data from the BDS, which contains information on both establishment-level employment and national employment. Our measure of firm size is correlated with the national size of the firm (0.75) but is not an exact match, more closely approximating the size of the firm in the state. BDS measures of firm size are newly available in the LEHD data but were not yet available at the time of this analysis. Though the unit of observation is an establishment, we here categorize establishments by the size of the firm.
shrink less quickly) than high-wage firms, while when unemployment is low, low-wage firms grow relatively less quickly. Note these effects are symmetric across booms and busts.

The bottom two panels show differential hire and separation rates, respectively. These gross flow rates exhibit very different patterns than the differential net growth rate. Differential separation and hire rates look roughly procyclical; when the unemployment rate is low, low-quality firms hire and separate at greater rates than high-quality firms, while the opposite is true in times of high unemployment.

Figure 2 already foreshadows the main findings of this paper. First, employment at high-paying firms is more cyclical; they benefit more from booms and are more harmed by busts. Second, gross employment flows are less responsive at high-paying firms; their hire and separation rates do not fall by as much in busts or increase by as much in booms. Therefore the differential growth rate effect is driven by the separations margin, and is true despite offsetting effects on the hires margin. Low-paying firms have relatively more separations in booms and therefore do not grow as quickly, while they have relatively fewer separations in busts and then do not shrink as quickly.

4 Methodology

In the next section we investigate the patterns exhibited in figure 2 in a regression framework where we can control for many potentially confounding factors. Specifically, we estimate regressions of the form specified in equation 5.

\[
rate_{stq} = \alpha_0 + \alpha_1 st\_unemp_{st} + W_q \alpha_2 [st\_unemp_{st} \times W_q] \alpha_3 + f(t) + I^{industry} + I^{state} + \varepsilon_{stq}
\]

We regress \(rate_{stq}\), a growth, separation, or hire rate among establishments of quality, \(q\), in state, \(s\), in industry (three-digit NAICS), \(I\), in time period, \(t\), on the state unemployment rate \((st\_unemp_{st})\), a vector of firm quality indicators \((W_q)\) corresponding to wage quintiles and their interactions. We omit the lowest pay bucket. We additionally control for industry fixed effects at the two-digit NAICS level, and state fixed effects. We subsequently control for the average distribution of size and churn within a wage-quality bucket. All regressions are weighted by average employment over the quarter.

We include flexible controls for time period, \(f(t)\), in two forms. First we control for quarter fixed effects and a linear time trend. These allow us to control for seasonality and secular changes over this time period (for example, the marked decline in churn during the 2000s), while still exploiting time-series variation in economic conditions at both the national and state levels. However, since we only have a short time period we would like to ensure that our results are not driven by spurious correlations due to anomalies that coincided with business cycle movements. Therefore, in an alternative specification, we control for date fixed effects, absorbing all variation in the national time series and identifying purely off of
cross-sectional variation in economic conditions. Finally, we cluster our standard errors by state-date-wage quintile, since this is the level of variation underlying our key explanatory variables.

5 Regression Results on Growth, Hire, and Separation Rates

Growth Rate

Table 2 presents regression results for the growth rate, summarizing coefficients on the state unemployment rate and its interactions with firm characteristics. The dependent variable is the growth rate (net change in employment divided by average employment over the quarter) in the state-date-industry-wage quintile. Column I reports results from the regression specification in equation 5, and controlling for time period with quarter fixed effects and a time trend. The main effect of the unemployment rate, shown in the top row, is negative, though very small in magnitude (-0.000037) and not statistically significant. This coefficient can be interpreted as the impact of the unemployment rate on the growth rate for the lowest pay quintile establishments—the omitted category in each regression. This regression suggests, then, that the employment growth rate at low paying firms is not impacted by aggregate economic conditions.

The interaction terms show the differential impact of the state unemployment rate on the growth rate at higher paying establishments. They are all negative and statistically significant at the 1% level. This means the state unemployment rate has a larger, negative impact on the growth rate at higher paying establishments. For example, a coefficient of $-0.0011$ among the highest paying firms, indicates that for each percentage point increase in the unemployment rate, these firms shrink by 0.0011 more than the tiny effect seen in the lowest paying establishments. This effect is quite large considering the mean growth rate for this group was roughly 0.003. Coefficients are fairly similar for the 3rd through 5th wage quintiles, while smaller in magnitude for the 2nd quintile.

These effects are almost identical across the four specifications in this table. Column 2 additionally controls for the size and churn distributions. These do not impact the coefficients, likely because churn and size are highly correlated with wage so the main effect of wage quintile subsumes most of these effects. Column three controls for date fixed effects, rather than quarter effects and a time trend (and does not include churn and size controls). The main effect of the unemployment rate is even smaller in magnitude here, suggesting that any effects seen there were driven by national aggregate conditions. However, the coefficients on the interactions terms are nearly identical. This is comforting since the time series is short and anything occurring over this time period that coincides with fluctuations in the unemployment rate would drive spurious correlations between the unemployment rate
and firm growth rates. In columns III and IV (which additionally controls for the churn and size distributions), we do not use any national time series variation and purely identify off of the differential impacts of the business cycle across states.

**Hire and Separation Rates**

The regressions in table 2 show that growth rates at higher paying firms are more negatively impacted by the unemployment rate. By definition, the growth rate effect can be decomposed into effects on gross hire and separation rates. Table 3 presents regression results for hire and separation rates. Columns labeled I report the specification in equation 5, and controlling for time period with quarter fixed effects and a time trend, while columns labeled III instead control for date fixed effects. Columns labeled II and IV augment the preceding specification with controls for the churn and size distributions.

Beginning with column I on separation rates, the main effect of the unemployment rate is negative and statistically significant at the 1% level. Among the lowest paying establishments, separation rates decline by 0.01 in response to a one percentage point increase in the state unemployment rate. That separation rates decline in times of higher unemployment might be surprising given we expect firms to make more layoffs in a worse economy. However, this finding is consistent with a more-than-offsetting decline in voluntary quits (e.g., Shimer 2005, Hall 2005b). Interestingly, the positive, significant interaction effects show that the response of separation rates to the business cycle is less negative in higher quality firms. For example, the interaction effect of 0.008 for the highest paying establishments implies their reduction in separation rates is only a fifth the magnitude of that for the lowest paying establishments. These coefficients are all significant at the 1%-level and increase in magnitude for higher wage quintiles, as would be expected since these yield the sharpest contrast. Furthermore, effects are similar regardless of controls included in columns I-IV. The main effect of the unemployment rate does decline in magnitude (by about a fifth) when we control for both date fixed effects and the churn and size distributions.

The second set of columns in table 3 report results from hire rate regressions. These are virtually identical to the separation rate results. The unemployment rate significantly reduces hire rates, but by markedly less in high quality firms. Effects are similar regardless of controls included in columns I-IV. It is also interesting to note that the main effect of the unemployment rate, reflecting the impact on the lowest paying firms, is identical in magnitude for hire rates and separations rates, but the interaction effects are larger in magnitude for separation rates.

**Magnitudes and Interpretation**

Figure 3 provides an easier comparison of the effects reported in tables 2 and 3. Here we plot the total impact of a one percentage point increase in the unemployment rate on
growth (solid blue), hire (dashed red), and separation (dotted green) rates across firm wage quintile. The growth rate effect is negative, but close to zero for the lowest wage quintile, and exhibits a shallow decline (increase in magnitude) across higher wage quintiles, before leveling off at the last quintiles. In contrast, the separation and hire rate impacts are large in magnitude and negative for the lowest wage quintile and steadily increase (decrease in magnitude) across higher wage quintiles. The separation rate effect is very close to zero for the highest paying firms. Thus, while net employment changes are more cyclical at high-wage firms, gross worker flows are more cyclical at low-wage firms.

The growth rate effect is, by definition, the difference between the hire and separation rate effects. Figure 3 makes clear that the gap between the separation and hire rate effects is largest among highest paying firms. The impact of the business cycle on hire rates does not decline in magnitude with firm quality as much as that of separation rates. Relatively speaking, low-paying firms grow during times of high unemployment because they experience a larger reduction in separations. This is true despite their larger reduction in hires. High-paying firms, in contrast, experience a larger reduction in hire rates than in separation rates.

Our regression specifications yield the impact of the unemployment rate on growth, separation and hire rates in terms of levels. However, table 1 indicates that firms differ substantially in their average gross flow rates; on average, low-paying firms have hire and separation rates that are more than double those at high-paying firms. A 0.01 reduction in one of these rates is going to have a much smaller impact on worker flows at lower paying firms. Perhaps high-paying firms experience commensurate impacts of the business cycle, but as a percentage of their existing rates. To check this, we convert our estimates into elasticities and report these in table 5. As in figure 3, we present the total effect of a 1% increase in the unemployment rate on the outcome of interest (adding an interaction term to the main effect of the unemployment rate for higher paying firms).

The first column reports elasticities for the growth rate. In response to a 1% increase in the state unemployment rate, the growth rate among the highest paying firms declines by 2.1%. Elasticities are substantially larger in magnitude for the 2nd-4th pay quintiles, declining by 3.6%, 4.9%, and 4.8%, respectively, while there is still no impact on growth rates at the lowest paying firms. Column 2 presents elasticities for separation rates. Highest paying firms have the smallest elasticities, decreasing their separation rates by 1.2% in response to a 1% increase in the state unemployment rate. Elasticities increase in magnitude, with the largest effect (15.8%) for the lowest paying firms. Column 3 shows that elasticities for hire rates, where the highest paying firms also experience the smallest impacts and effects increase in magnitude for lower paying firms. However, with effects ranging from 6.3% to

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12 Using the specification from columns labeled IV (which control for date fixed effects and size and churn distributions), we take the main effect of the unemployment rate as the impact for the lowest wage firm. We then add this coefficient to the interaction terms for wage quintiles 2-5.

13 We take coefficients from columns labeled IV and multiply and divide by the mean unemployment rate and flow rate, respectively, for the relevant wage quintile, shown in table 1.
15.7\%, differences across firms in hire rate elasticities are smaller in magnitude, than those for separation rate elasticities. For higher paying firms, the hire rate effect is substantially more negative than the separation rate effect, while for the lowest paying firms these two effects are identical.

Thus in percentage terms, effects on hire and separation rates mirror the regression analysis. The growth rates show similar effects; lowest paying firms exhibit the smallest effects. Though in percentage terms, highest paying firms also experience smaller effects compared to the 2nd through 4th quintiles.

6 Discussion

We have shown that high-paying firms are more sensitive to the business cycle in terms of their net changes in employment. In contrast, gross worker flows (hire and separation rates) are more sensitive at low-paying firms. Therefore, high-paying firms shrink more quickly in busts because of declines in their separation rates, and despite the fact that they also see smaller declines in hire rates. Analogously, high-paying firms grow more quickly in booms because of a smaller increase in separation rates, and despite a smaller increase in hire rates. We now attempt to interpret this rich set of patterns, in light of the theories of labor market dynamics described in section 2.

First, our results are inconsistent with cleansing since we find that, relatively speaking, resources flow to low-quality firms in busts. Instead, it looks as though low-paying firms have an easier time retaining their workforce in busts, while high-paying firms may have a greater need to cut workers. In the following subsections, we explore the mechanisms outlined in section 2, following the same structure. We first present evidence and discuss mechanisms that would result in differential involuntary separations across high- and low-paying firms. We then discuss mechanisms related to differential voluntary separations.

6.1 Explanations Impacting Involuntary Mobility

In section 2, we discussed theories that could generate differential responses to the business cycle in terms of layoffs across high- and low-paying firms. We mentioned differential sensitivity in the product market, differential wage rigidities, and managerial practices as potential explanations. We discuss each next and conclude that there is little support for any of these factors.

Differential Business Cycle Sensitivity

High-paying firms may face a greater need to cut workers because demand for their products is more sensitive to the business cycle. In section 2, we mentioned the example of an inexpensive chain restaurant and a five-star restaurant. Both are in the same two-digit NAICS

16
industry, but the latter is higher paying and may suffer a larger drop-off in clientele when aggregate economic conditions deteriorate.

To investigate this issue, we need information on firm performance other than employment changes. The LEHD has a measure of revenue at the firm level but it is unreliable. Instead, we turn to Compustat North America by Standard & Poors, the most complete database of U.S. accounting data.\footnote{\textsuperscript{14}We obtain these data via Wharton Research Data Services.} Compustat has high-quality balance sheet data for publicly-traded firms. We can therefore ask whether fundamental accounting data are more sensitive to the business cycle at high-quality firms, among those that are publicly traded.

The disadvantage of Compustat data is that it is made up of publicly traded firms, all of whom may be considered reasonably high-quality. The low-paying firms in Compustat may be a poor representation of low-paying firms in the LEHD and the economy as a whole. We therefore first present evidence on whether the patterns presented above that exist in the LEHD also exist in Compustat firms. Though Compustat does not have comparable earnings or gross worker flows data, it does have annual employment. We can therefore perform our net growth rate analysis using firm size as a proxy for firm pay.\footnote{\textsuperscript{15}Size is a common proxy for pay since the two variables are highly correlated. MPV show in a large number of countries that small firms grow relative to large firms in slack labor markets, while the opposite is true in tight labor markets.}

We define size based on average employment in the firm over its lifetime in Compustat (analogous to our pay measures). We then divide firms by size quintile, where the cutpoints are within industry.\footnote{\textsuperscript{16}Since most firms in Compustat have a larger, national presence, we do not use geographic location information.} Figure 4 presents the differential net growth rate (blue line) of the lowest minus highest size quintile, by year, analogous to those presented in figure 2. The national unemployment rate is also shown (red dashed line). As can be seen the lines track each other very closely; when the unemployment rate increases, small firms grow relative to large firms, and vice versa when the unemployment rate decreases. Figure 4 is useful since it shows that even among firms within Compustat, all of whom must be reasonably high quality, the same basic dynamics hold. We hope, then, that analyzing the balance sheet data in Compustat can tell us something about the financial pressures high- and low-paying firms face over the business cycle.\footnote{\textsuperscript{17}Though not shown here, in regression analysis, the relationship between net employment changes and the national unemployment rate is statically significantly larger at firms in the largest size quintile compared to the smallest.}

The variable we explore here is the rate of change in quarterly revenue. Profit maximizing firms will set employment such that marginal cost equals marginal revenue product. Here we take changes in average revenue as a proxy for a firm’s incentive to hire. Presumably firms with more cyclical product demand will experience accompanying revenue declines. We can link the Compustat revenue change data to the LEHD by aggregating quarterly revenue change to the three-digit NAICS level. This noisy link allows us to ask whether
LEHD wage quintiles are made up of firms in sub-sectors which typically experience more or less business cycle volatility, as measured by Compustat.\footnote{We are unable to link Compustat data to the LEHD at the firm level.} Figure 5 plots these percent revenue changes for firms in the lowest wage quintile (dashed red line), firms in the highest wage quintile (dash-dot green line), and the average for firms in the 2nd through 4th wage quintiles (solid blue line). We also include recession bars. Reassuringly, revenue change has a strongly cyclical pattern, falling in recessions and rising in booms. However, the graph shows little differences across low- and high-paying firms over the business cycle. If anything, low-paying firms experienced a larger decline in revenue during the 2001 recession.\footnote{We could have also shown a plot of the differential revenue change across low- and high-quality firms, analogous to our figure 2. Here we also find no systematic relationship between the differential revenue change rate and the unemployment rate.} This figure is therefore inconsistent with the notion that high-paying firms are more sensitive to the business cycle.

Based on the evidence presented here, we think it unlikely that differential business cycle sensitivity in the product market is driving our results. The sub-sectors where low- and high-paying firms are typically found do not experience differential sensitivities, as reported by Compustat. Though we should caution that this exercise needs to be taken with a grain of salt, since it is based on an unrepresentative set of firms.

**Differential Earnings Rigidities**

Even if firms do not differ in their demand sensitivity over the business cycle, they could still differ in their ability to cut costs. If high-paying firms suffer more from downward earnings rigidities then they will need to cut costs by cutting workers. This would be consistent with our finding that they are relatively more likely to make separations in downturns compared to low-paying firms. Also, our finding that high-paying firms are more likely to make hires (their gross hire rates fall by less in a downturn compared to low-paying firms) is consistent with the literature finding that starting wages are more procyclical than incumbent wages (Martins, Solon and Thomas 2010).

To our knowledge no one has examined wage rigidity as a function of firm quality. In our data, we can measure quarterly earnings for each worker in a firm. We can therefore estimate the degree to which there are downward nominal rigidities in quarterly earnings. This measure has both advantages and disadvantages. On the one hand, we cannot measure whether there exist nominal reductions in pay \textit{rates}, the variable most discussed in the literature. However, our measure incorporates a number of dimensions along which a firm can adjust labor costs besides lowering the base rate of pay, for example hours, overtime and bonuses. This is certainly the more relevant measure for our purposes, since we are trying to explain whether some firms have a greater need to cut labor costs by firing workers rather than by lowering pay.
To test whether the strength of downward pay rigidities vary with firm quality, we follow a similar methodology to Dickens et al. (2007). We measure nominal annual pay changes in earnings, $\Delta p_{it}$, for job stayers.\(^{20}\) For a firm, \(f\), in time period \(t\), we then estimate the nominal pay rigidity as per equation 6. That is, for a firm with \(N\) workers who have a valid pay change measure, we take the number whose annual pay change was equal to 0 and divide that by the number whose pay change was less than or equal to 0. In practice, we define a pay change to be equal to 0 if it is within ±1%, to allow for some noise, and results are robust to larger bounds.

\[
\text{nominal pay rigidity } f_t = \frac{\sum_{i=1}^{N} 1(\Delta p_{it} = 0)}{\sum_{i=1}^{N} 1(\Delta p_{it} \leq 0)}
\]

This measure proxies for the following: Among workers who were at risk for receiving a nominal pay decrease, what share did NOT receive one? We find that on average over our time period, this share is roughly 0.25. We then average these within our firm-pay buckets, weighting by average employment at a given date, to gain a sense of whether firms of varying quality experience differential pay rigidities.

Figure 6 plots these estimates over time for firms in the lowest wage quintile (dashed red line), firms in the highest wage quintile (dash-dot green line), and for the average of firms in the 2nd through 4th quintiles (solid blue line). We also include recession bars. As can be seen, pay rigidity has a cyclical pattern, falling in recessions and rising in booms. However, the graph very clearly shows that high-wage firms have a much larger drop in rigidities in recessions. Also, the middle-quintile firms seem to be a bit more cyclical themselves with earnings rigidities increasing during the boom years between the two recessions. It seems as though high-paying firms can reduce their labor costs by adjusting downwards worker pay.

This measure of downward nominal pay rigidities is far from perfect. For example, we can only estimate the rigidity among stayers at a firm, while we have already shown that high- and low-paying firms differ in their gross separation rates over the business cycle. However, this evidence accompanied with the fact that high-paying firms experience relatively more gross separations in times of higher unemployment suggests that high-quality firms are able to adjust labor costs in recessions; they do so using both pay reductions and increased separations, relative to low-paying firms. Therefore, we do not believe differential wage rigidities can be driving our results.

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\(^{20}\)A worker must have 10 continuous quarters of earnings to be included in the sample. At the quarterly level, issues arise such as differences in the number of pay cycles within a quarter that vary across firm and across calendar year. To avoid additional noisiness, we measure annual pay changes. We also trim the distribution of earnings changes to those who had more than ±50% changes, since these presumably represent errors in reporting.
Managerial Practices

Managerial practices at high- and low-paying firms surely differ along a variety of dimensions. We mentioned in section 2 the possibility that low-paying firms always manage more efficiently and therefore do not have to trim the fat in downturns, while high-paying firms take a more “pit stop” managerial style (Koender and Rogers 2005). While it seems on the surface unlikely that low-paying firms are better managed, since they are on average smaller, have higher churn, are probably overall less likely to survive, and are probably less productive.

We also mentioned in section 2 the opposite theory, that low-paying firms are managed poorly; they should be cutting workers in recessions but they do not. This seems unlikely for a couple of reasons. First, such poor management should result in relatively more firm deaths in bad times at low-paying firms. While we do not analyze firm deaths directly, our employment measures do include firm deaths. On average, low-paying firms grow relative to high-paying firms in busts, including any shrinkage from firm deaths. Second, reinspecting figure 3, and noting the larger adjustment in gross flows at low-quality firms, it does seem as though managers at low-paying firms respond. Though we cannot measure whether mobility was voluntary or involuntary, it seems to us the most likely explanation for figure 3 is the following: Low-quality firms experience an exogenous decline in separations in a downturn and they respond with a commensurate decline in hiring. The vast majority of hiring that low-paying firms do is replacement hiring. With fewer workers leaving, they can make far fewer replacement hires. Thus it does seem as though managers at low-paying firms respond to their the business environment.

Thus we do not believe that differential managerial practices are driving differential response by high- and low-paying firms in terms of involuntary separations. However, we do acknowledge that this issue is difficult to gain any empirical traction on.

6.2 Explanations Impacting Voluntary Mobility

Barlevy (2002) showed in a search framework that declining voluntary mobility results in a quantitatively important decline in match quality. Moscarini and Postel-Vinay (2013) coupled this concept with the notion of a job ladder, which then gives differential impacts of the business cycle, in the form of worker mobility, across firms. Firms lower down on the job ladder typically suffer more from voluntary worker exits to firms higher up on the ladder. In booms, high-quality firms grow more quickly because they can more easily attract workers. In contrast, high-quality firms do not attempt to poach away workers from low-quality firms in busts. These low-quality firms would then see a commensurate decline in voluntary mobility and see relative growth. At the same time high-quality firms might face a greater need to cut workers in busts, if they had gotten quite large during the preceding boomtime.
Given the evidence presented above, we believe it more likely that our results are driven by differential impacts on voluntary mobility over the business cycle across low- and high-paying firms. We see our results as having a conceptually important link to the Barlevy work, and very likely driven by a job ladder search model such as that written down by Moscarini and Postel-Vinay. For example, our finding that low-wage firms grow because of relatively fewer separations, and despite their relatively fewer hires is consistent with this theory.

7 Conclusion

In this paper, we use employer-employee matched U.S. data to study net and gross worker flows over the business cycle as a function of firm pay. We find that low-paying firms fare relatively better in downturns; their growth rates shrink by less. This is because of a larger decline in separation rates at low-wage firms compared to high-paying firms. It looks as though high-quality firms are more likely to make layoffs in an economic downturn, while still keeping up a modest amount of hiring. This set of results is consistent with a need for low-quality firms to continually replenish their stock of workers in boom times when they lose their workforce to high-quality firms, while in busts they can grow through retention and need not make replacement hires. In contrast, high-quality firms grow relatively faster in boom times and experience relatively more separation in busts. As we have said, these findings are consistent with the Moscarini Postel-Vinay poaching model described above, while we provide ancillary evidence that differential impacts on involuntary separation are unlikely to be driving our results.

While previous research has emphasized that match quality may decline in recessions due to a lack of workforce reallocation (Barlevy 2002), our evidence here suggests an additional sullying effect. The types of jobs workers get stuck in are more likely to be low-quality. One interpretation of our results is that the reduced ability to move on to better matches caused by a recession has a greater impact on workers in low-quality firms compared to those in high-quality firms. These results have implications then for the costs of recessions, both in the short- and long-run.

These results also have important implications for the literature on the differential impact of recessions on workers. The literature has shown that either entering the labor market in a recession (Kahn 2010, Oreopoulos, von Wachter and Heisz 2010) or being displaced from a long-term job in a recession (Davis and von Wachter 2010) has a particularly long-lasting, negative wage impact. Both groups were forced to search for, and likely accept, a job in a downturn. Our results indicate that workers matching in recessions are more likely to go to a low-paying firm, but that if they end up at one, they will be more likely to stay there. These findings could then potentially be explained by a greater tendency for these unlucky workers to spend time at low-paying firms. It could also be low-quality firms have
an easier time attracting and retaining high-quality workers in a recession. In our data, we can quantify both of these effects directly and we do so in Kahn and McEntarfer (2014).

References


Figure 1:

- Kernel Density for Wage

Figure 2: Differential Rates: Low-High Wage Firms
All Firms

- Growth Rate
- Hire Rate
- Separation Rate

HP Filtered and Seasonally Adjusted

- growth/hire/sep rate
- unemployment rate
Figure 3: Impact of State U Rate on Worker Flows by Wage Quintile

Plots interaction of U*quintile (rel to worst quintile) plus main effect of U
Includes controls for industry fe’s, ave churn and size distribution, and date fe’s

Figure 4: Differential Growth Rates for Big and Small Firms

Compustat: 1975-2011
Figure 5: Revenue Change over the Business Cycle, by Firm Quality
Figure 6: Nominal Earnings Rigidity, by Firm Quality
### Table 1: Summary Statistics by Pay Quintile

<table>
<thead>
<tr>
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<th>Wage Quintile</th>
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<tbody>
<tr>
<td></td>
<td>Lowest</td>
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Notes: Weighted by average employment over the quarter. Quintile cutpoints are state-industry (two-digit NAICS) specific.
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<td>Date FE's</td>
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+ significant at 10%; * significant at 5%; ** significant at 1%

Notes: Regressions weighted by average employment over the quarter. All regressions control for wage quintile fixed effects, as well as state and two-digit NAICS industry fixed effects. Wage quintiles are obtained by averaging quarterly pay over the lifetime of the firm and fitting into the two-digit NAICS industry-state distribution weighted by employment. Standard errors in brackets are clustered at the state-date-wage quintile level.
| Table 3: Hire and Separation Rates as a Function of Economic Conditions and Firm Characteristics |
|-----------------------------------------------|-----------------------------------------------|
|                                               | Separation Rate                               | Dependent Variable: |
|                                               | I     | II    | III   | IV    | I     | II    | III   | IV    |
| State Unemp Rate (U)                          | -0.0103 | -0.0099 | -0.0096 | -0.0080 | -0.0103 | -0.0099 | -0.0096 | -0.0080 |
|                                               | [0.00038]** | [0.00033]** | [0.00047]** | [0.00040]** | [0.00043]** | [0.00038]** | [0.00049]** | [0.00042]** |
| U * 5th quintile wage                         | 0.0084 | 0.0077 | 0.0084 | 0.0077 | 0.0073 | 0.0065 | 0.0073 | 0.0065 |
|                                               | [0.00044]** | [0.00037]** | [0.00041]** | [0.00033]** | [0.00050]** | [0.00043]** | [0.00043]** | [0.00036]** |
| U * 4th quintile wage                         | 0.0073 | 0.0070 | 0.0073 | 0.0070 | 0.0060 | 0.0056 | 0.0060 | 0.0057 |
|                                               | [0.00046]** | [0.00039]** | [0.00042]** | [0.00035]** | [0.00051]** | [0.00043]** | [0.00044]** | [0.00036]** |
| U * 3rd quintile wage                         | 0.0049 | 0.0052 | 0.0049 | 0.0052 | 0.0037 | 0.0040 | 0.0037 | 0.0041 |
|                                               | [0.00045]** | [0.00039]** | [0.00041]** | [0.00035]** | [0.00050]** | [0.00044]** | [0.00042]** | [0.00036]** |
| U * 2nd quintile wage                         | 0.0018 | 0.0026 | 0.0018 | 0.0026 | 0.0008 | 0.0017 | 0.0009 | 0.0017 |
|                                               | [0.00045]** | [0.00040]** | [0.00042]** | [0.00036]** | [0.00051]** | [0.00045]** | [0.00043]** | [0.00038]** |
| Quarter FE's + time trend                     | X     | X     |       |       | X     | X     |       |       |
| Churn and size controls                       | X     |       | X     |       |       |       | X     |       |
| Date FE's                                    | X     | X     |       |       |       |       | X     | X     |

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

Notes: Regressions weighted by average employment over the quarter. All regressions control for wage quintile fixed effects, as well as state and two-digit NAICS industry fixed effects. Wage quintiles are obtained by averaging quarterly pay over the lifetime of the firm and fitting into the two-digit NAICS industry-state distribution weighted by employment. Standard errors in brackets are clustered at the state-date-wage quintile level.
<table>
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<th>Separation Rate</th>
<th>Hire Rate</th>
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<td>5th</td>
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<td>2nd</td>
<td>-3.624</td>
<td>-0.142</td>
<td>-0.164</td>
</tr>
<tr>
<td>1st</td>
<td>0.006</td>
<td>-0.158</td>
<td>-0.157</td>
</tr>
<tr>
<td>Date FE's</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Churn and size controls</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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

Notes: Elasticities generated from regression results in columns labelled II of tables 2 and 4. We add the main effect of the unemployment rate to the interaction term for each firm quality quintile. We then multiply by