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**Studying the Labor Market with the Job Openings and
Labor Turnover Survey**

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Abstract:

The Job Openings and Labor Turnover Survey (JOLTS) is a new data source of the Bureau of Labor Statistics that estimates monthly vacancies, hires, and separations. It has quickly become a useful tool for studying the labor market. This chapter summarizes its aggregate and micro-level evidence, including the relations of vacancies and worker flows to unemployment and other measures of labor market conditions. The chapter also discusses the implications of this evidence and the potential of the data for future research.

Keywords: vacancies, Beveridge curve, labor turnover, labor market search
JEL Codes: E24, E32, J63

1. Introduction

In recent years, the Bureau of Labor Statistics (BLS) has released several new data products that describe the dynamics of the labor market. One of these is the Job Openings and Labor Turnover Survey (JOLTS). The survey is the only existing data source to measure vacancies, hires, and separations at the establishment level at a regular (monthly) frequency in the US. This survey already adds to the understanding of the role firm behavior plays in job posting and worker turnover.

This chapter details the characteristics of the JOLTS data and provides descriptive evidence at both the aggregate and micro levels. The discussion is primarily for researchers wishing to use the data for their own studies. As such, it characterizes the data scope, composition, measurement and estimation, and the research potential these data have. The chapter also presents some basic evidence on the aggregate and micro-level relations of vacancy postings and labor turnover to unemployment and other labor market conditions.

The survey is an evolution of earlier data series (notably the BLS Labor Turnover Survey[1]), as well as research on vacancies, job turnover, and unemployment done by Abraham (1987), Blanchard and Diamond (1989, 1990), and others and theories of labor market search like those developed by Mortensen and Pissarides (1994). This work, and the wide literature that followed, underscores the importance of understanding the process of matching workers to firms and highlights the rich heterogeneity surrounding this process. As such, the BLS designed JOLTS to capture these facets. The result is a

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[1] The Labor Turnover Survey measured vacancies, ascensions, and separations for the manufacturing industry; the BLS discontinued the survey in 1982. See Davis and Haltiwanger (1998) and Clark and Hyson (2001) for more on this survey.

high-frequency, timely survey with several major advantages over previous data. The first is its reporting of hires and separations directly by the firm. Other sources (e.g., administrative wage records) forced researchers to infer these flows from observed changes in the employer of a worker. The second is its reporting of job openings, or vacancies, which are reported directly by the firm. Previously, researchers had to rely on indexes (such has the Help Wanted Index) for a measure of vacancies. These indexes, in addition to potential selection and measurement issues, did not lend themselves to studying vacancy postings at the micro level. This is particularly important since theories of labor market search and matching often model behavior at the level of workers and firms, not at the aggregate level. The final advantage is its distinction between quits and layoffs. The two types of separations have differing cyclical patterns, and separately measure voluntary and involuntary severances, respectively.

Existing research using JOLTS is sparse. Clark (2004) summarizes the aggregate evidence since the survey's inception. Hall (2005) and Shimer (2005a) use the JOLTS data to study the volatility of vacancies over the business cycle and its relation to theories of labor market search. Besides this chapter, Davis, Faberman, and Haltiwanger (2005, 2006) are the first to present analyses of the micro-level JOLTS data. The data have also become popular with the press and various industry and policy groups. Research into the theory and evidence of labor dynamics has ballooned in recent years, and the estimates JOLTS provides are related to several facets of this research. Davis and Haltiwanger (1999) and Mortensen and Pissarides (1999), provide complete review of the empirical and theoretical literature, respectively, related to worker and job flows and labor market search. In all, the JOLTS data complement existing data, such as matched employer-

employee data and workers' gross flows, and can only add to our understanding of labor market dynamics.

The following section defines the concepts and terminology used throughout the paper, discusses the data sample and estimation process, and highlights the survey's research strengths and limitations. The next section explores the relation between vacancies and unemployment at both the aggregate and micro levels. An exploration of the relations between labor turnover and aggregate and local labor market conditions comes next. The final section concludes and discusses potential avenues of future research.

2. Data and Measurement

2.A. Source Data

The JOLTS program publishes monthly estimates of vacancies, hires, and separations, with separations broken out into quits, layoffs and discharges, and other separations (e.g., retirements). The data start in December 2000 and are updated monthly, with the latest estimates available within two months of a month's end. The current time series spans over four years. The aggregate estimates are available nationally and for four major regions by 2-digit North American Industry Classification System (NAICS) sector.[2] The BLS reports JOLTS estimates in levels and as rates (which are percentages of employment).

The primary unit of observation for the JOLTS survey is the *establishment*, which covers the operations of a firm at a single physical location. *Firms* can have one or more

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[2] The NAICS replaces the older Standard Industrial Classification (SIC) system. The most notable change in NAICS is its classification of the service sector into several separate sectors, such as information, professional and business services, education and health, and travel and hospitality. In general, two-digit NAICS sectors correspond to major SIC industry sectors (e.g., manufacturing, services. etc.)

establishments. The JOLTS data cover nonfarm payrolls, which implies that employment

estimates generally exclude self-employed individuals and non-profit organizations not

covered under a state unemployment insurance program. The JOLTS data are a sample of

roughly 16,000 establishments surveyed each month. Establishments report their

employment, hires, separations (broken out by type), and job openings for the month

within the framework of the survey definitions. The survey is made up of overlapping

panels that are each sampled for 18 months, and is weighted so that its employment

estimates match those of the Current Employment Statistics (CES) survey.[3] The survey

also has each respondent's state and industry codes, plus an identifier that allows a match

to its corresponding record in the BLS Quarterly Census of Employment and Wages

(QCEW, also known as ES-202) data.

For the analyses in this paper, I use the sample of JOLTS establishments pooled

over the December 2000 – January 2005 period. For most aggregate statistics, I use the

unrestricted sample of all observations. For the micro-level analyses, I use a restricted

JOLTS sample of all observations that have positive employment reported in two

consecutive months. This minimizes the potential spurious effects of outliers and

inconsistent data reporters. The resulting sample contains 372,288 observations, which

represent 92.8 percent of the pooled observations (and 92.3 percent of the pooled

employment) used in aggregate estimation and, due to the requirement of continuous

reported employment, exclude the December 2000 observations.[4] The average month in

the restricted sample has about 7,600 observations. Results in my analyses are all sample-

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[3] Consequently, if one wanted to replicate the JOLTS worker flow and vacancy rate estimates, they would use the appropriate CES employment estimate in the denominator.
[4] Even with the noted restrictions, aggregate estimates from the unrestricted and restricted samples match each other very closely.

weighted, and often (where noted) also employment-weighted. Estimates are not seasonally adjusted, unless otherwise noted.

2.B. Concepts and Definitions

The JOLTS survey form has four major data elements: employment, hires, separations, and job openings, with separations broken into three subcategories. Elements differ in their timing, and their definitions are succinct in what they do (and do not) capture. These definitions are created so that BLS can optimize its measurement of changes in the worker-firm match and to minimize respondent confusion in reporting.

(1) **Employment**. Establishments report their employment for the pay period that includes the 12th of the month. As such, it is a point-in-time measure of the employment level. An individual is counted as employed if they are on payroll with an establishment. The reference period and definition are standard for all federal statistical establishment surveys and allows the BLS to benchmark the survey to the CES estimates.

(2) **Hires**. Hires are new additions to the workforce of an establishment. They include new hires, re-hires, seasonal and short-term hires, recalls after a layoff, and transfers from other worksites. Hires are a flow measure, and capture all occurrences between the first and end of a month.

(3) **Separations.** Separations are removals from the workforce of an establishment. These removals include quits, layoffs lasting more than 7 days, firings and other discharges, terminations of short-term and seasonal workers, retirements, and transfers to other worksites. Separations are also a flow measure, and capture all occurrences between the first and end of a month.

(4) **Quits.** Quits are the subset of separations initiated by an employee.

(5) **Layoffs and Discharges**. Layoffs and discharges are the subset of separations initiated by the employer, which include all layoffs lasting more than 7 days, firings and other discharges, and terminations of short-term and seasonal workers.

(6) **Other Separations**. Other separations include retirements, transfers, and all other separations not covered by the previous two categories.

(7) **Job Openings (or Vacancies)**. These are all unfilled, posted positions available at an establishment on the last day of the month. The vacancy must be for a specific position that can start within 30 days, and an active recruiting process must be underway for the position. Vacancies are a point-in-time estimate, and its definition has two notable measurement implications. First, JOLTS does not capture vacancies for hires that start more than a month after their posting. Second, JOLTS does not capture vacancies that are both posted and filled within the month. Note that the unemployment measure from the Current Population Survey (CPS), which is also a point-in-time measure, has a similar feature, since it must deal with individuals who both enter and leave unemployment between survey periods.

Unlike hires and separations rates, which use employment in the denominator, the vacancy rate uses the *sum* of vacancies and employment in its denominator, which is analogous to the sum of all available jobs. This is similar to the unemployment rate, which uses the labor force as its denominator (i.e., the sum of employed and unemployed labor).

Note that, given the definitions of employment and labor turnover, an individual who stops receiving a paycheck may not count as part of employment, but also may not count as a separation. Examples of this occurrence include teachers, temporary help

workers retained but not assigned to a particular job (i.e., "on call"), and layoffs of less than 7 days.

2.C. Some Notes on Research with the JOLTS Data

The available JOLTS data already provide interesting evidence about the labor market, yet it remains a relatively new and evolving survey. The passage of time will lengthen the time series, making the survey even more useful in understanding the cyclical behavior of vacancies and labor turnover. Researchers should be aware that the JOLTS sample is only representative nationwide, by major industry, and by region. With a sample size of 16,000 establishments, exploiting the data at finer industrial or geographic detail will likely face issues of precision and selection. The multiple reference periods for different data elements can complicate some research studies. The survey does not have data on wages or other establishment characteristics, though the possibility exists for linking JOLTS data to other microdata sources (like the QCEW) to obtain this information.

A significant issue for JOLTS is the measurement of hires and separations. Wohlford et al. (2003) and Faberman (2005) have BLS research aimed at understanding and improving their measurement. An important finding from their research is that the measurement of hires and separations is not as simple as theory would dictate. As noted earlier, the relation between hires, separations and the level of employment is complicated by the fact that employed workers can exist empirically in one of *two* states: employed and working, or employed but not working (where "working" is defined as on the payroll.) Other complications also exist—for instance, hires may occur months prior

to the start of work.[5] These nuances make measuring hires and separations more difficult to measure than a point-in-time count of employees on payroll.

Figure 1 illustrates the possible transitions a worker can undertake and the relative difficulty of measuring each, based on internal analysis by BLS program staff. As one might expect, the easiest flows to measure are those where an employed and working individual is either hired or separated. Flows that deal with employed individuals not currently on payroll are where measurement difficulties arise, with the greatest difficulties occurring where an individual separates from a job match during a period of non-work. Wohlford et al. (2003) find that separations are disproportionately harder to measure, creating an asymmetry between the measurement issues of hires and separations. Faberman (2005) further finds that contracting establishments are less likely than other establishments to report any hires or separations. This asymmetry in turn results in a disparity between the CES employment trend and the cumulative difference between JOLTS hires and separations in the aggregate data.

The BLS has taken steps (such as the creation of separate survey forms for schools and temporary help firms) to improve worker flow measurement. The BLS also continues research on JOLTS data measurement, which is obviously important for improving data quality, but can also prove useful in understanding the interaction between firms' reporting of labor turnover and economists' ability to measure such statistics.

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[5] The JOLTS defines a hire when the work is actually started, and asks respondents to not to count a hire until that time.

3. Vacancies and the Beveridge Curve

3.A. Aggregate Relations

The publicly available JOLTS estimates present a wealth of new evidence for the aggregate labor market. While the times series is short, it spans a recession and slow labor market recovery, allowing researchers a glimpse of the cyclical behavior of vacancies and labor turnover. The National Bureau of Economic Research (NBER) dates a recession during this period as starting in March and ending in November of 2001, though losses in payroll employment (based on CES estimates) continue through July 2003. Figure 2 illustrates the aggregate behavior of vacancies and unemployment between December 2000 and January 2005. The unemployment rate estimates come from the CPS. Throughout the period, the two move in opposite directions. In 2001, unemployment rises while vacancies fall. Unemployment rates hover around 6 percent and vacancy rates remain near 2 percent for most of 2002 and 2003. Beginning in mid-2003, the unemployment rate begins to fall while the vacancy rate starts to rise; these patterns continue into the beginning of 2005. These patterns are consistent with the behavior of employment growth during this period.

An important relation in the theory of worker search and matching is the Beveridge Curve, which relates the cyclical movements of vacancies to those of unemployment. Figure 4 plots the aggregate Beveridge Curve with the vacancy rate on the vertical axis and the unemployment rate on the horizontal axis. The solid line represents the quadratic trend of the monthly vacancy-unemployment relation over the sample period. The dotted line charts the path of the vacancy-unemployment relation. The labor market begins the period relatively tight, with a ratio of vacancies to

unemployment of 0.85. Vacancies then fall as unemployment rises, leading to a

movement downward along the trend line. This pattern continues until mid-2003, when

the unemployment rate peaks the vacancy rate reaches a trough. At this point, the ratio of

vacancies to unemployment is at a low of 0.38. The relation then "loops" around and

moves back up along the trend line, with labor market tightness increasing as a result.

Given the economic downturn and recovery during this period, the evidence is consistent

with the theoretical inverse relation of vacancies and unemployment predicted by the

Beveridge Curve.

The aggregate estimates also illustrate the more basic evidence on the magnitude,

volatility, and comovement of these variables. Table 1 presents the aggregate means,

standard deviations, and correlations (contemporaneous and dynamic) with relevant labor

market variables of vacancies, hires and separations. Vacancy statistics are in the first

column. The vacancy rate averages 2.4 percent, and exhibits relatively little volatility and

high persistence. It is strongly negatively correlated with unemployment, strongly

positively correlated with hires, and to a lesser extent, positively correlated with

employment growth. The dynamic correlations of vacancies to unemployment remain

persistently high for both lagging and leading values, with the contemporaneous

correlation being the strongest. Theory would predict (as noted by Blanchard and

Diamond, 1989) that vacancies should be more responsive than unemployment, which

contrasts with this evidence. Faberman (2004) and others note, however, that the study

period includes a recession that seems quite unlike previous recessions, particularly in

terms of its labor dynamics. The dynamic correlations of vacancies to net growth are

significant and positive for lagging values of net growth, but insignificant, and in some

cases negative, for leading values of net growth, implying that high (low) growth is a

good predictor of high (low) vacancies, but high (low) vacancies are not a good predictor

of high (low) growth.

Table 2 lists the summary statistics for vacancies, hires, and separations by

industry and region. Vacancy rates are again listed in the first column and vary

considerably by industry; industries with high labor turnover are not necessarily the

industries with the highest vacancy rates. Instead, vacancy rates tend to be highest in

industries with considerable expansions during the sample period, such as professional

and business services, and education and health services. Education and health has the

highest vacancy rate despite also having some of the lowest turnover rates.

Manufacturing, which underwent a large employment decline over this period, has one of

the lowest vacancy rates (along with construction and resources). To a lesser extent,

vacancies vary by region. In general, the South and West, which have relatively high

employment growth, have higher rates of vacancies.

3.B. Vacancy Postings and the Local Labor Market

The JOLTS data are especially powerful in allowing a micro-level study of

vacancies and their relation to the labor market. Most theories of labor market search

model the relation of vacancies to unemployment as a firm-level decision whether to post

a vacancy in response to current labor market conditions. Theory dictates that, controlling

for outside factors, the negative aggregate relation should also hold at the micro level.

Consequently, I estimate the relation of establishment vacancy rates to local (i.e., state)

unemployment rates.[6] This approach identifies the establishment response to local labor

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[6] Note that there is a timing difference in the reporting of vacancies and unemployment for a given month. Reported vacancies are those posted at the end of the month, while the unemployed are those who actively

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market conditions, illustrates whether a micro-level Beveridge Curve exists, and if it does, what shape the curve takes.

It is useful to begin with the basic statistical properties of establishment-level vacancies, particularly since empirical evidence on them is sparse. Table 3 lists these properties for the pooled estimates of vacancy rates for establishment i in state j at month t (V_{ijt}). The table lists separate vacancy rate statistics for all observations and for the subsample of observations with positive vacancies reported. Statistics are employment-weighted. Only 12 percent of establishment-month observations (representing 53 percent of employment, however) have a vacancy posted at the end of the month. This statistic is somewhat misleading, however, since at the monthly frequency many establishments have no net change in employment (79 percent) or hires (81 percent), and hence likely do not need a vacancy posting. Nevertheless, conditional on changing employment levels, only 34 percent of establishment-month observations (representing 67 percent of employment) have a vacancy posted at the end of the month. The vacancy rate for these observations is nearly double the rate for all observations. When looking at these statistics, remember that the JOLTS vacancy definition does not capture long-term vacancy postings or vacancies that are posted and filled within the month. Nevertheless, the statistics may reflect the fact that establishments use less formal hiring practices than vacancies with some frequency, or that some establishments may have relatively short vacancy durations. Davis, Faberman, and Haltiwanger (2006) explore these conjectures.

Table 3 also shows that state and month effects explain little of the vacancy variation. These effects account for less than 1 percent of the establishment vacancy

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looked for work in the four weeks prior to the week of the 19th. This is true for both national and state-level unemployment. Thus, the vacancy rates used in this study will lead unemployment rates by about two weeks.

variation. Instead, establishment effects account for 41 percent of the variation of all vacancies and 66 percent of the variation conditional on an establishment's posting of at least one vacancy. This suggests that much of the micro-level variation stems from different vacancy-posting behaviors among establishments rather than varying behaviors within local labor markets or during certain points in the business cycle.

I explore the relation between establishment vacancy postings and state unemployment by using my pooled sample to regress establishment vacancy rates on state unemployment rates. The unemployment rates come from the BLS Local Area Unemployment Statistics (LAUS) data, which use CPS and other data sources to produce estimates. In terms of magnitudes, unemployment rates for many states are similar to the national rate, though the average rates for several states are several percentage points higher or lower than the national rate. The cyclical volatility of unemployment for some states also tends to be higher than volatility at the national level. I expect the state-level relation of vacancies to unemployment to be nonlinear, and use a fourth-order polynomial of unemployment in my regressions as a result. Nonparametric analyses of the data (not reported here) suggest that a polynomial of this order fits the data well.[7] I weight the regressions by employment and run separate regressions that include state and establishment fixed effects.

I plot the predicted relations of vacancies to unemployment from these regressions in Figure 4. There are separate predicted trends for the unconditional relation, the relation with state effects removed, and the relation with establishment effects removed. As expected, vacancy postings are inversely related to the local unemployment

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[7] These nonparametric tests include measures of average vacancies along the unemployment rate distribution, and local regression estimation of the same distribution. Both approaches give similar, albeit less smooth, trends in the data.

rate. The polynomial coefficients for each regression are all jointly significant at the 5 percent level. The relation is steeper once I control for state or establishment effects. This is likely due to the large variation in trend unemployment across states.[8] This suggests that not controlling for this trend variation tends to understate the responsiveness of vacancies to unemployment. It also suggests that the covariation of vacancies and unemployment occurs more from time-variation within states than from level differences across states. Controlling for establishment rather than state effects, however, makes little difference for the results. This suggests that much of the between-establishment variation in the relation is between states, and not necessarily between establishments within states. Overall, the results suggest that a Beveridge Curve relation in fact exists at both the micro and aggregate levels.

4. Labor Turnover and the Labor Market

4.A. Aggregate Evidence

The JOLTS data also track labor turnover. Figure 5 plots the time series of aggregate hires and separations rates over the sample period. Their patterns reflect the downturn and recovery during this time. Hires decline during the recession and remain low through mid-2003. The hiring rate then begins a gradual, steady increase though the start of 2005. Separations are high throughout most of 2001. They then decrease in early 2002, and reach a low in mid-2003. Separations then increase gradually through the end of the sample period, even though net growth is strong during this time; evidence not reported here shows that movements in the quits rate drive this increase. In addition, the

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[8] Note that state fixed effects are a subset of establishment fixed effects, in the sense that establishments cannot change their location in the data. Consequently, establishment effects will identify both state trend variations and between-establishment variations within a state.

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patterns of hires and separations closely follow the patterns of gross job gains and gross

job losses estimates, respectively, from the Business Employment Dynamics (BED)

program.[9]

As with vacancies, the aggregate time-series and industry estimates of labor

turnover are summarized in Tables 1 and 2, respectively. Table 1 shows that over this

period the hires rate averages 3.3 percent while the separations rate averages 3.2 percent.

More than half (54 percent) of separations, on average, are quits. Hires and separations

are both negatively correlated with unemployment—the latter correlation comes

primarily from a negative correlation of quits with unemployment. Layoffs are

uncorrelated with unemployment, but strongly negatively correlated with employment

growth, leading to a negative correlation between growth and total separations. Hires are

positively correlated with growth, but quits are essentially uncorrelated with growth.

Hires, quits, and vacancies are all strongly positively correlated with each other. Hires

and quits exhibit considerable persistence, while layoffs exhibit little to no persistence.

The latter is consistent with the notion that layoffs tend to be episodic events rather than

persistent dynamic processes. The dynamic correlations suggest that hires are a leading

factor for lower future unemployment. The contemporaneous correlation between quits

and unemployment is stronger than either the lagging or leading dynamic correlations.

The same can be said of the contemporaneous correlation between layoffs and

employment growth and their dynamic correlations.

Because of the short sample period, one should interpret the time-series

correlations with caution. Nevertheless, the patterns illustrated, particularly by quits and

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[9] For further aggregate evidence, see Spletzer et al. (2004), Clark (2004), and Davis, Faberman, and
Haltiwanger (2005).

layoffs, shed some light on the cyclical behavior of labor turnover. Hires and quits are clearly procyclical, though the latter are more related to unemployment than job growth. Layoffs, on the other hand, are countercyclical, but only with respect to job growth—they seem to have little relation to the stock of unemployment. This evidence has implications for the recent debate on the cyclicality of separations and the job-finding rate of workers discussed by Hall (2006) and Shimer (2005b). They argue that the job-finding rate, and not necessarily the separations rate, drives cyclical movements in unemployment. The correlations in Table 1 support that claim, but only to the extent that movements in the *quits* rate drives the relationship between separations and unemployment. This suggests that a) separations and the job-finding rate are not mutually exclusive and b) the relative importance of separations versus the job-finding rate may depend critically on the cyclical behavior of employer-to-employer flows (described by Fallick and Fleishmann, 2004), since quits tend to make up a large fraction of these flows.

Table 2 illustrates that labor turnover patterns vary widely by industry and, to a lesser extent, by region. The industry evidence is consistent with the findings of Anderson and Meyer (1994) and Burgess, Lane, and Stevens (2000). Turnover is highest in seasonal industries, such as construction and leisure and hospitality, and low in other industries, such as manufacturing and government. Turnover is also slightly higher in the South and West than in the Northeast and Midwest. Industries and regions also vary widely in the share of their separations accounted for by quits. Goods-producing industries (resources, construction, manufacturing) tend to have most separations come from layoffs, while service and retail industries tend to have most separations come from

quits. The Northeast and Midwest, which have relatively higher shares of goods-producing industries, have relatively high shares of separations due to layoffs.

The across-industry correlations suggest that both vacancies and growth are positively related to the share of separations made up by quits. Intuitively, expanding industries should have less layoffs, all else equal. The correlations also illustrate that high-turnover industries tend to have high rates of hires, quits, *and* layoffs.

4.B. Labor Turnover and Establishment Growth

Hires, quits, and layoffs are the result of continuous, dynamic interactions between workers and firms. In any period, a worker with a better job offer may choose to quit a successful, expanding firm at the same time a declining firm looks to hire new employees as it restructures its workforce. Anecdotal evidence of such occurrences is quite common. Yet, even with aggregate data on labor turnover, it is difficult to know what role, if any, such interactions play in the cyclical behavior of hires and separations.

Luckily, the JOLTS microdata allow an analysis that can relate the behavior of labor turnover to the behavior of establishments. When, how, and to what extent establishments create or destroy jobs has been a topic of research for nearly two decades (e.g., Dunne, Roberts, and Samuelson, 1989a, 1989b; Davis and Haltiwanger, 1990, 1992). Evidence from this research shows that each period, many establishments simultaneously expand, contract, start up, and shut down, but the evidence says little about the relation between these firm-level decisions and patterns of labor turnover. To explore this relation, I split the sample of JOLTS microdata into three groups: establishments with expanding employment (i.e., more hires than separations), those with contracting employment (i.e., more separations than hires), and those with constant

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employment (i.e., offsetting hires and separations). I then calculate the aggregate monthly labor turnover estimates for each group, using factors calculated from the public JOLTS estimates to seasonally adjust the data.

Figures 6 and 7 show the patterns of hires and separations, respectively, by type of employment change. The figures show analogous pictures. Expanding establishments have high hires rates, while contracting establishments have high separations rates. These rates are also considerably more volatile than the other labor turnover series, with standard deviations that are between 1.5 and 3.6 times greater than those for the other groups. Second, separation rates at expanding establishments and hiring rates at contracting establishments are both higher than the rates at stable establishments. Stable establishments also have the least volatile turnover rates, suggesting that they are stable in both their employment levels and their within-establishment churning. This evidence suggests that the relation of establishment-level hires and separations to net growth is nonlinear and nonmonotonic—contracting establishments have more hires than those with no net growth and expanding establishments have more separations than those with no net growth. Finally, even though Figure 5 shows a long, persistent drop in hiring during the downturn and a mild pickup in separations during the recession, the series depicted in Figures 6 and 7 show little to no cyclical variation—the only exception is a moderate movement of the separations rate among contracting establishments during the 2001 recession and during the 2003-04 recovery period. How can the evidence in the two figures be reconciled? As Davis, Faberman, and Haltiwanger (2005) illustrate, cyclical shifts in the distribution of establishment growth account for the differences between the

figures.[10] In other words, as the aggregate labor turnover rates change over the business cycle, it is not the case that all establishments are increasing or decreasing their own hires and separations. Rather, the *shares* of establishments that are expanding, contracting or remaining the same adjust over the business cycle, while labor turnover rates within each group remain essentially unchanged.

Figures 8 and 9 show two notable caveats for quits and layoffs. In Figure 8, the quits rate indeed mimics its aggregate behavior among contracting establishments and, to a lesser extent, expanding establishments. In Figure 9, layoffs among contracting establishments exhibit a mild spike in late 2001, but are otherwise acyclical. The cyclical behavior of employer-to-employer flows and episodic layoff events may account for these patterns, though further research is needed on the topic.

Table 4 summarizes the labor turnover rates for different growth rate intervals. The results underscore the patterns observed in the previous figures with several notable observations. First, quit rates exceed layoff rates for all but the largest contractions among establishments. Second, quit rates are relatively high for all contracting establishments—it is not the case that job losses at contracting establishments stem primarily from layoffs. Finally, there is an asymmetry between the two extremes of the growth rate distribution: separations at expanding establishments are considerably higher than hires at contracting establishments. This may be suggestive of a shakeout process within the hiring patterns of expanding establishments, though further research on the topic is warranted.

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[10] Davis et al. also note that the patterns illustrated are robust to size, industry and establishment controls.

4.C. Worker Flow Relations to the Local Labor Market

Understanding how labor turnover relates to *local* labor market conditions can be an important aspect of understanding aggregate movements in labor turnover. With its ability to distinguish between quits and layoffs and its identification of an establishment's state, the JOLTS data provide a unique opportunity to study local labor turnover. One basic yet important question is how local labor turnover relates to local unemployment. In particular, it would be useful to know whether hires, quits, and layoff rates have the same relations to unemployment at the local level that they do at the aggregate level.

Table 5 reports the basic relations of pooled establishment-month observations of hires (H_{ijt}), quits (Q_{ijt}), and layoffs and discharges (L_{ijt}) to state labor market statistics. These statistics include the state unemployment rate (obtained from LAUS data), its change from the previous month (ΔU_{jt}), and the state employment growth rate (N_{jt}). The last statistic uses estimates from the CES. Note that the reported correlations seem very weak, yet nearly all are significant at the 5 percent level. This is a consequence of using pooled establishment observations, which tend to have large idiosyncratic components to their variation regardless of the variable examined.[11] Even establishment fixed effects only explain between 21 and 29 percent of the variations of these flows (state-month effects explain 1 to 2 percent). The most relevant characteristics of these correlations are their sign and their magnitudes relative to each other. The evidence suggests a procyclical pattern for establishment hires and quits and a countercyclical pattern for layoffs at the state level—higher growth, lower unemployment, and decreases in unemployment are related to more hires and less quits. Layoffs are negatively related to growth and

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[11] Ideally, I would calculate state level estimates of labor turnover and use them to estimate the reported correlations. Unfortunately, the JOLTS sample size and weighting structure do not allow for reliable estimates below the detail of its four geographic regions.

positively related to increases in unemployment, but they are essentially uncorrelated with the unemployment level—this is no surprise given the national evidence.

I also estimate the micro-level relations of hires, quits, and layoffs to the change in the state unemployment rate. I focus on the change in unemployment rather than the unemployment level since it is akin to a flow measure—the unemployment rate is a stock measure, which makes it comparable to the vacancy rate (which is a point-in-time estimate), but less comparable to the labor turnover measures (which are flow estimates).[12] I regress each establishment-month observation on a fourth-order polynomial of ΔU_{jt}, weighting the regressions by employment, separately for each of the three labor turnover rates.[13] As before, I perform separate regressions for the unconditional relation, and the relations with state and establishment effects removed.

Figures 10, 11 and 12 plot the results for hires, quits, and layoffs, respectively. Figure 10 shows that establishments hire less when the local unemployment rate is rising. The relation is nonlinear, with hires most responsive to large decreases in unemployment. Figure 11 shows that quits also decrease as unemployment rises. This relationship is also nonlinear, with quits most responsive to large *increases* in unemployment. In Figure 12, layoffs increase with increases in local unemployment. The relationship is close to linear. This micro-level evidence parallels the patterns in the aggregate evidence. Controlling for state or establishment fixed effects does not alter these results.

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[12] Note that the change in unemployment is the net effect of the flows into unemployment and flows out of unemployment.

[13] As with the regressions of the previous section, the fourth-order polynomial results are consistent with similar nonparametric fits of the data (see note 7).

5. Conclusions and Further Research Potential

The JOLTS data provide a wealth of labor market information at both the aggregate and micro levels. The data are the most comprehensive data source for vacancies in the US, and have the timeliest, most frequent, and most direct measures of labor turnover. While the time series is short, the aggregate JOLTS estimates already present rich new evidence on the cyclical and secular behavior of its statistics. Vacancies, hires, and quits all exhibit persistent, procyclical behavior between 2001 and 2005, while layoffs exhibit an episodic, countercyclical pattern. Vacancies also exhibit a cyclical relation to unemployment consistent with the Beveridge Curve. The micro-level estimates provide several new insights into the behavior of vacancies and worker flows. Establishment-level vacancy postings are negatively related to local unemployment rates, suggesting that the Beveridge Curve relation holds even at the micro level. This result holds even though many establishments (even the ones who change employment levels) often do not post vacancies. Expanding establishments have high hiring rates while contracting establishments have high separation rates. Stable establishments, while exhibiting a steady pattern of worker churning, have the lowest rates of labor turnover. The evidence suggests nonlinear, nonmonotonic relations of hires and separations to establishment growth. Finally, the evidence suggests that hires are strongly related to changes in local unemployment rates, falling nonlinearly with increases in unemployment. Quits also fall with increases in the local unemployment rate, while layoffs rise with these increases.

These findings barely scratch the surface of what the JOLTS data can say about the labor market. I highlight three areas where the aggregate estimates and microdata can

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aid labor market research. The first is vacancy postings. Earlier works, such as Abraham (1987) and Blanchard and Diamond (1989, 1990), study vacancies and their relation to unemployment using estimates from the Help Wanted Index. The JOLTS vacancy data has a major advantage over this index (and others like it) in that it is reported directly by firms. This provides a representative, tangible measure of job openings and allows micro-level studies of firm vacancy posting behavior similar to previous work by Holzer (1994) and current work by Davis, Faberman, and Haltiwanger (2006). Evidence in this chapter already suggests that the micro-patterns of firms who post vacancies may differ from existing theories of their behavior.

The second area of potential research deals with separations. The JOLTS data can aid in further understanding separations since it differentiates between quits and layoffs. This is important for macroeconomic analyses of labor turnover, since quits tend to be procyclical, while layoffs are countercyclical. The distinction between quits in layoffs and its importance for labor market movements is highlighted by the models of Akerlof, Rose and Yellen (1988) and McLaughlin (1991). The role of separations in business cycle fluctuations is also a topic of recent debate. Namely, do separations matter much for labor market fluctuations, or are movements primarily driven by changes in the job-finding rate? This is a question recently addressed in research by Hall (2006) and Shimer (2005b). The evidence in this chapter suggests that the answer is not a straightforward "either-or", as the quits that stem from the employer-to-employer flow of workers are closely intertwined with movements in the job-finding rate.

A final area of potential research deals with labor turnover more broadly. The aggregate national, regional, and industry estimates already present many new findings.

Future work with these and the micro-level estimates can build on the earlier work of

Anderson and Meyer (1994), Burgess, Lane, and Stevens (2000), and others. The

existence of vacancy, employment, and worker flow data reported by each establishment

allows a micro-level study of their interactions that was previously impossible, but

essential for understanding labor market search and the matching of workers to firms.

Research on the relation between worker flows and firm behavior also relates naturally to

research on the relation between worker turnover and the patterns of job reallocation, as

evidenced by research by Davis, Faberman, and Haltiwanger (2005). Overall, the JOLTS

data provide many opportunities to increase our understanding of labor market dynamics.

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Figure 1.
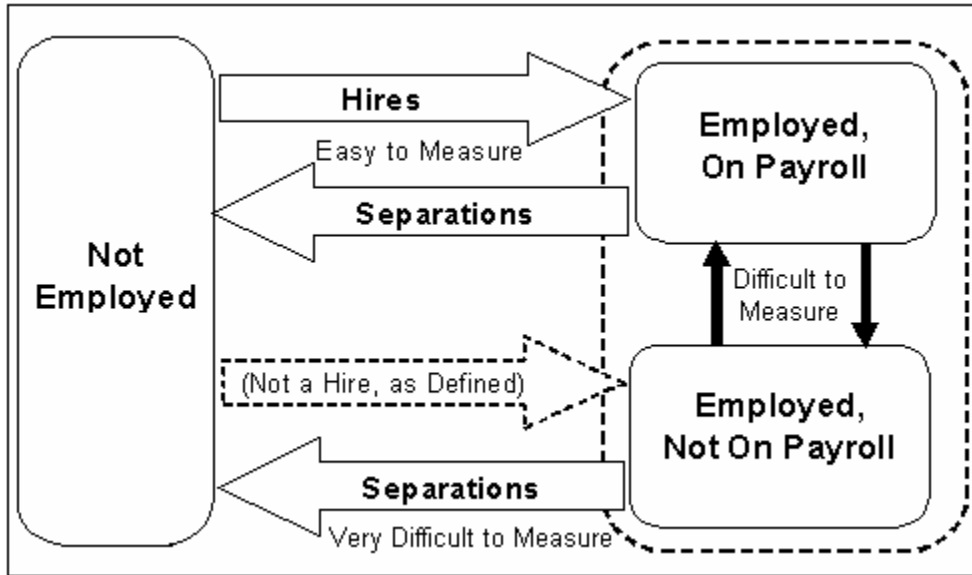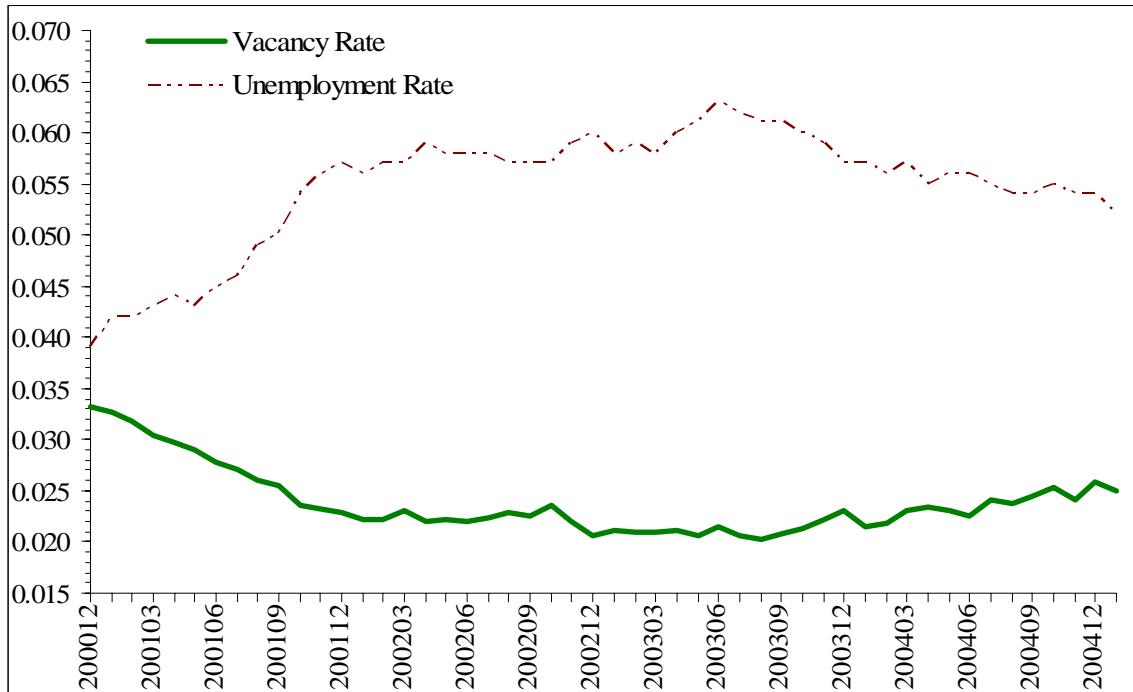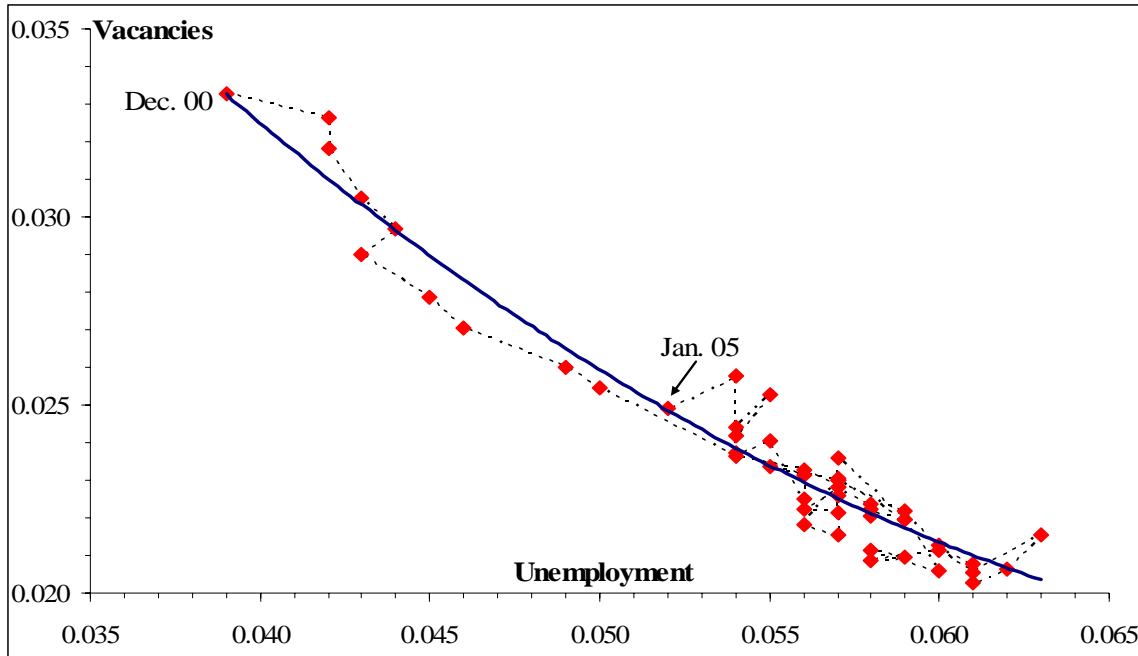**Measurement Issues with Labor Turnover and Employment**

Figure 2.
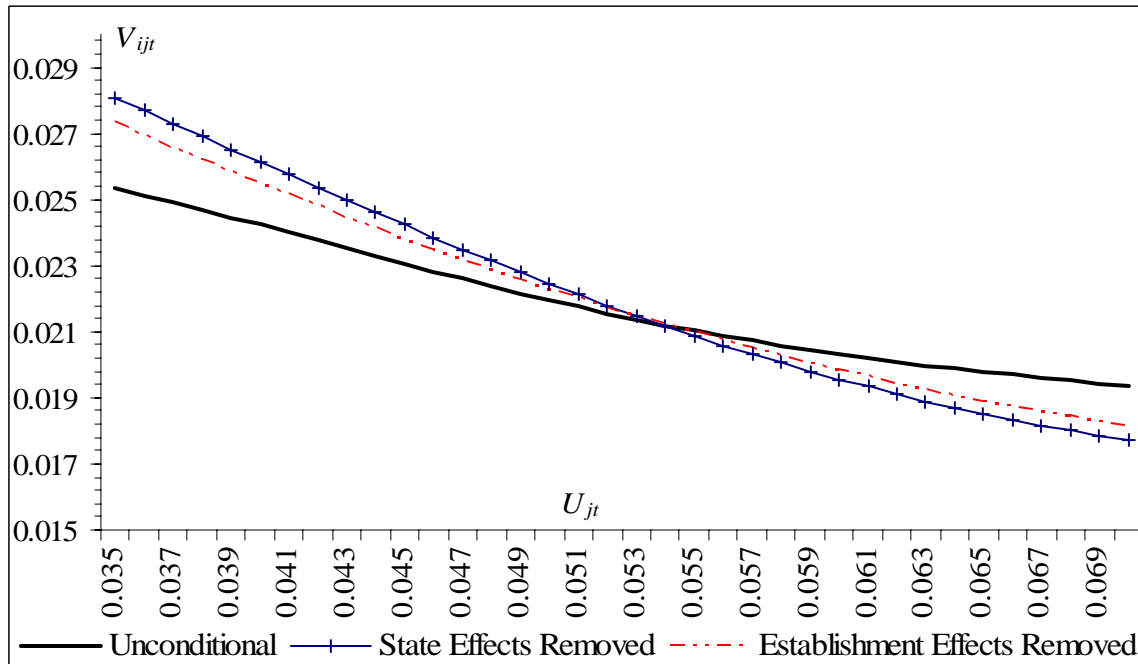**Vacancy and Unemployment Rates, December 2000 – January 2005**

Source: Vacancies are from public JOLTS nonfarm estimates and unemployment is from the CPS. Both are seasonally adjusted.

Figure 3.
**Vacancy vs. Unemployment Rates (Beveridge Curve), Dec. 2000 – Jan. 2005**

Source: Vacancies are from public JOLTS nonfarm estimates and unemployment is from the CPS. Both are seasonally adjusted. The dotted line represents the time-series path of the unemployment-vacancies relation, while the solid line represents the quadratic trend of the relation.

Figure 4.
**Establishment Vacancies and Their Relation to the Local Unemployment**

Source: Author's estimation of establishment vacancy rates on a fourth order polynomial of the state unemployment rate using JOLTS establishment microdata and LAUS unemployment estimates. State and establishment fixed effects are used where noted. See text for details.

Figure 5.
**Hires and Separations Rates, December 2000 – January 2005**
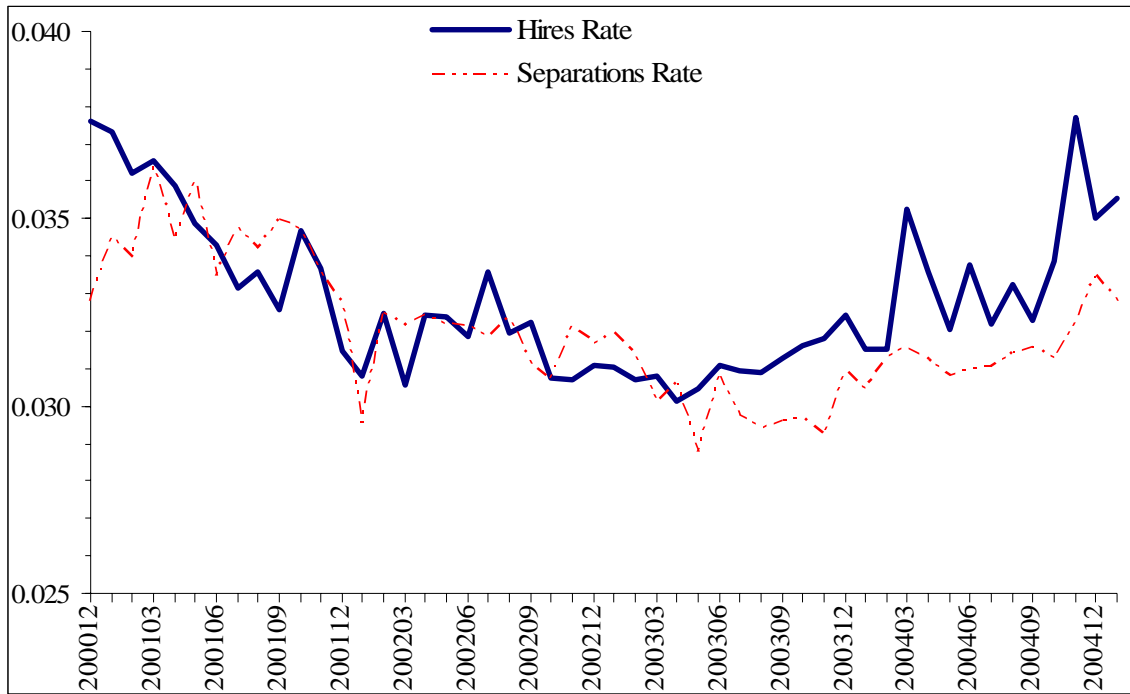
Source: Public JOLTS nonfarm estimates, seasonally adjusted.

Figure 6.
Hiring Rates by Type of Establishment-Level Employment Change
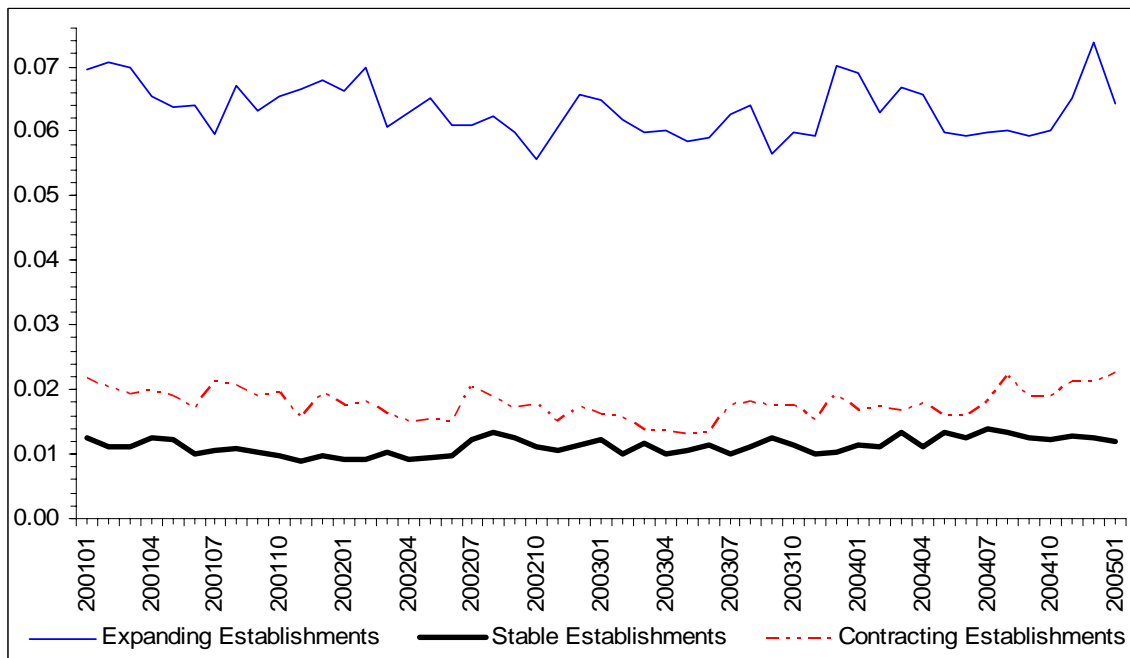
Source: Author's tabulations of JOLTS microdata. Estimates are seasonally adjusted using factors from the aggregate public estimates.

Figure 7.
Separation Rates by Type of Establishment-Level Employment Change
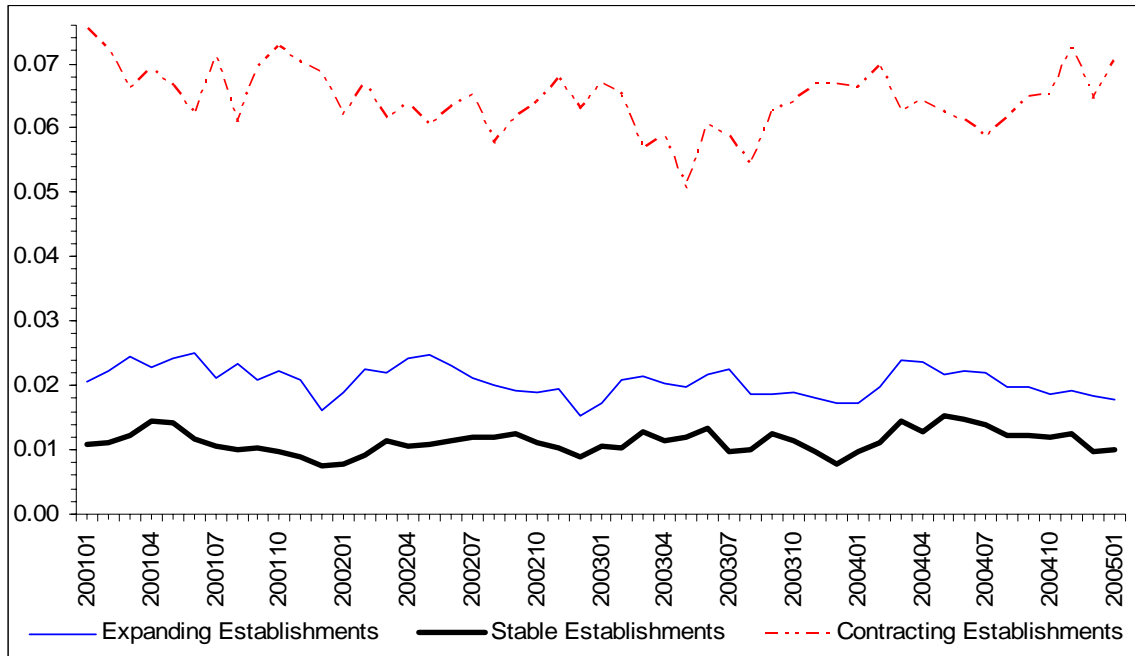
Source: Author's tabulations of JOLTS microdata. Estimates are seasonally adjusted using factors from the aggregate public estimates.

Figure 8.
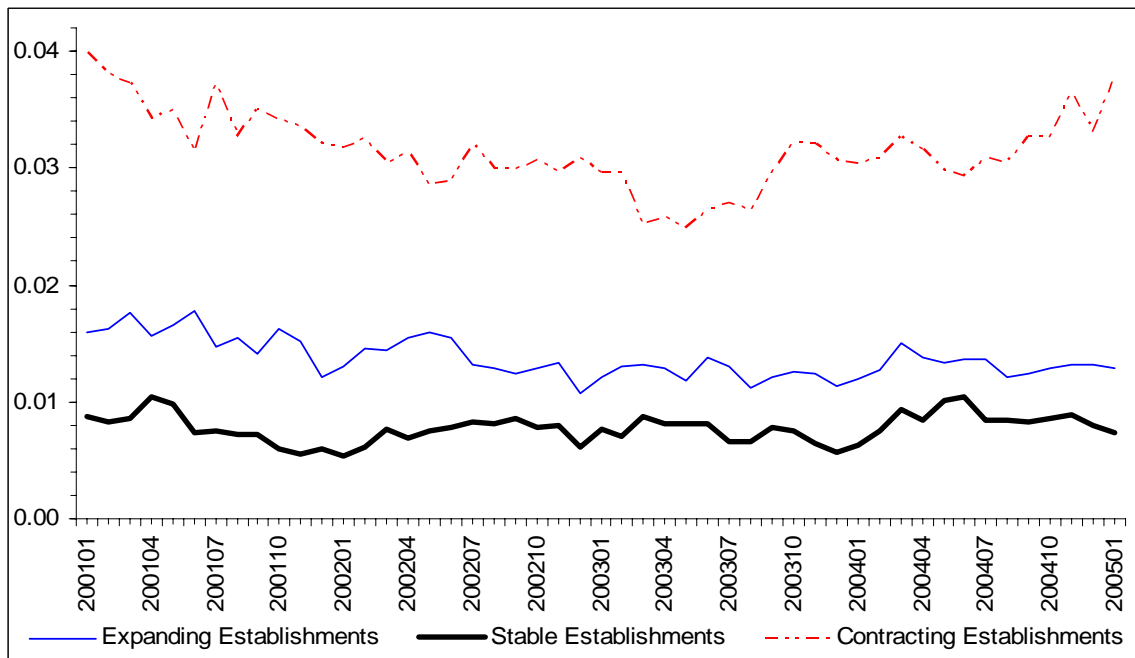**Quit Rates by Type of Establishment-Level Employment Change**

Source: Author's tabulations of JOLTS microdata. Estimates are seasonally adjusted using factors from the aggregate public estimates.

Figure 9.
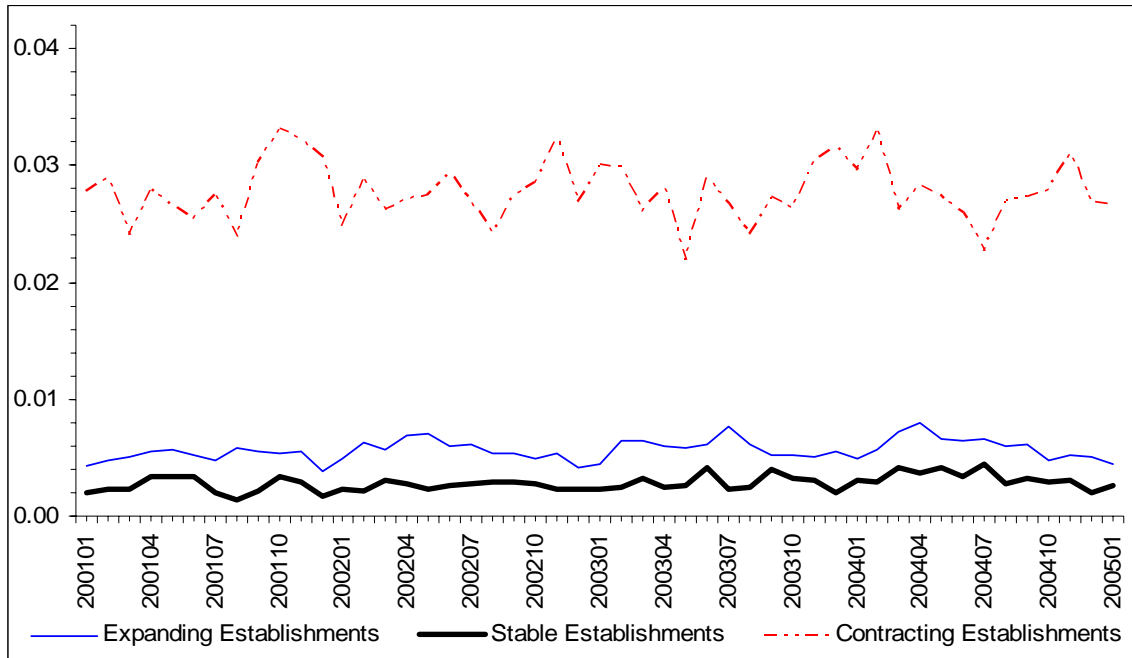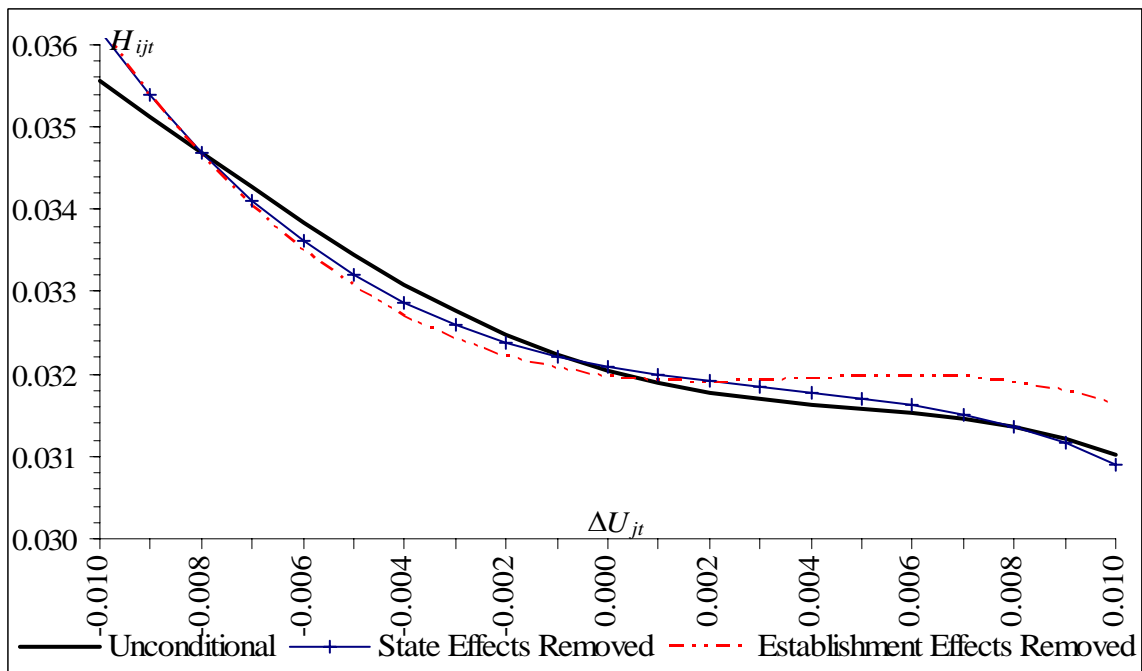**Layoff Rates by Type of Establishment-Level Employment Change**

Source: Author's tabulations of JOLTS microdata. Estimates are seasonally adjusted using factors from the aggregate public estimates.

Figure 10.
Establishment Hirings and Their Relation to Changes in Local Unemployment

Source: Author's estimation of establishment vacancy rates on a fourth order polynomial of the state unemployment rate using JOLTS establishment microdata and LAUS unemployment estimates. State and establishment fixed effects are used where noted. See text for details.

Figure 11.
Establishment Quits and Their Relation to Changes in Local Unemployment
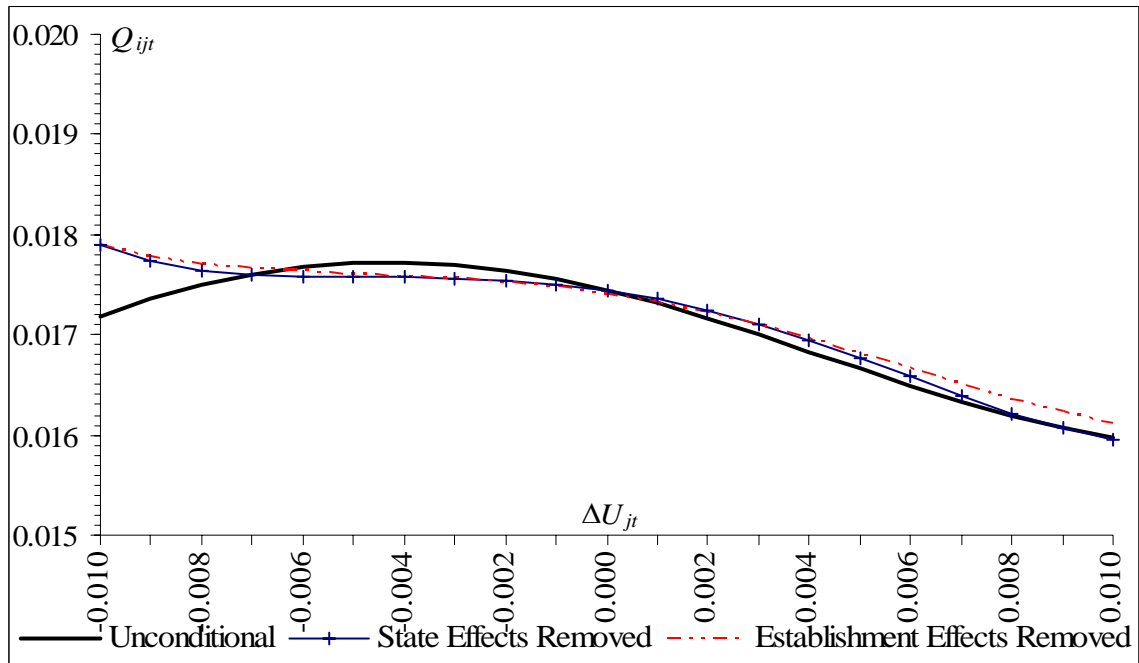
Source: Author's estimation of establishment vacancy rates on a fourth order polynomial of the state unemployment rate using JOLTS establishment microdata and LAUS unemployment estimates. State and establishment fixed effects are used where noted. See text for details.

Figure 12.
Establishment Layoffs and Their Relation to Changes in Local Unemployment
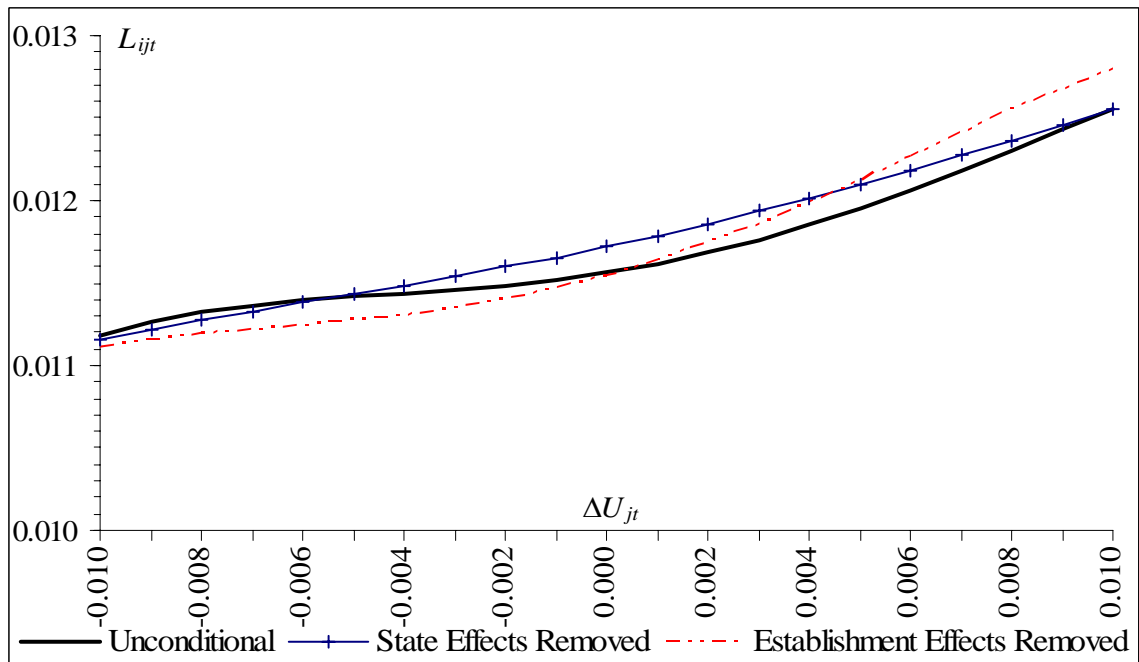

Source: Author's estimation of establishment vacancy rates on a fourth order polynomial of the state unemployment rate using JOLTS establishment microdata and LAUS unemployment estimates. State and establishment fixed effects are used where noted. See text for details.

Table 1.
Vacancy and Labor Turnover Aggregate Summary Statistics

	Vacancies (V_t)	Hires (H_t)	Separations (S_t)	Quits (Q_t)	Layoffs (L_t)
Mean	0.024	0.033	0.032	0.018	0.014
(Standard Deviation)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)
Correlation with...					
Unemployment (U_t)	-0.97*	-0.78*	-0.77*	-0.93*	0.05
Net Growth (N_t)	0.22	0.54*	-0.29*	0.06	-0.75*
Vacancies (V_t)	1.00	0.82*	0.73*	0.92*	-0.12
Hires (H_t)		1.00	0.68*	0.83*	-0.13
Autocorrelations					
AR(1)	0.97*	0.77*	0.78*	0.93*	0.37*
AR(2)	0.94*	0.68*	0.79*	0.91*	0.37*
AR(3)	0.90*	0.63*	0.64*	0.84*	0.00
Dynamic Correlations with Unemployment					
U_{t-3}	-0.86*	-0.60*	-0.88*	-0.88*	-0.50*
U_{t-2}	-0.91*	-0.67*	-0.85*	-0.91*	-0.31*
U_{t-1}	-0.95*	-0.73*	-0.84*	-0.92*	-0.21*
U_t	-0.97*	-0.78*	-0.77*	-0.93*	0.05
U_{t+1}	-0.96*	-0.84*	-0.74*	-0.92*	0.09
U_{t+2}	-0.95*	-0.85*	-0.69*	-0.90*	0.16
U_{t+3}	-0.93*	-0.89*	-0.60*	-0.84*	0.24
Dynamic Correlations with Net Growth					
N_{t-3}	0.43*	0.45*	0.13	0.31*	-0.25
N_{t-2}	0.37*	0.38*	-0.04	0.21	-0.49*
N_{t-1}	0.36*	0.37*	0.02	0.21	-0.37*
N_t	0.22	0.54*	-0.29*	0.06	-0.75*
N_{t+1}	0.05	0.14	-0.25	-0.09	-0.38*
N_{t+2}	-0.14	0.04	-0.42*	-0.29*	-0.38*
N_{t+3}	-0.28	-0.09	-0.41*	-0.39*	-0.18

Source: Author's calculations based on public JOLTS and CPS aggregate data (seasonally adjusted). Net growth rates are the difference between the hires and separations rates. Statistics are based on data from December 2000 through January 2005. Asterisks (*) denote significance at the 5 percent level.

Table 2.
Vacancy and Labor Turnover Summary Statistics by Industry and Region

	Vacancies (V_j)	Hires (H_j)	Separations (S_j)	Quits (Q_j)	Layoffs (L_j)	Quit Share (Q_j / S_j)
Major Industry						
Resources	0.011 (0.003)	0.031 (0.008)	0.031 (0.006)	0.013 (0.004)	0.013 (0.006)	0.421
Construction	0.014 (0.004)	0.054 (0.013)	0.055 (0.007)	0.020 (0.004)	0.033 (0.008)	0.370
Manufacturing	0.014 (0.003)	0.022 (0.004)	0.027 (0.004)	0.012 (0.002)	0.012 (0.003)	0.445
Transportation & Utilities	0.016 (0.003)	0.025 (0.005)	0.026 (0.003)	0.013 (0.002)	0.011 (0.003)	0.500
Retail Trade	0.019 (0.004)	0.044 (0.009)	0.043 (0.007)	0.027 (0.005)	0.013 (0.005)	0.626
Information	0.020 (0.005)	0.021 (0.004)	0.023 (0.005)	0.013 (0.003)	0.008 (0.003)	0.577
Financial Activities	0.021 (0.002)	0.022 (0.004)	0.023 (0.004)	0.013 (0.003)	0.007 (0.002)	0.589
Prof. & Business Services	0.029 (0.005)	0.043 (0.006)	0.039 (0.007)	0.020 (0.004)	0.016 (0.004)	0.512
Education & Health	0.033 (0.005)	0.027 (0.005)	0.023 (0.004)	0.015 (0.003)	0.007 (0.002)	0.638
Leisure & Hospitality	0.028 (0.006)	0.063 (0.013)	0.059 (0.011)	0.039 (0.008)	0.018 (0.005)	0.661
Other Services	0.019 (0.004)	0.032 (0.007)	0.032 (0.009)	0.019 (0.004)	0.011 (0.006)	0.593
Government	0.018 (0.003)	0.015 (0.005)	0.012 (0.004)	0.006 (0.002)	0.004 (0.002)	0.488
Region						
Northeast	0.021 (0.003)	0.029 (0.006)	0.028 (0.005)	0.014 (0.003)	0.012 (0.003)	0.498
Midwest	0.020 (0.003)	0.032 (0.006)	0.031 (0.005)	0.017 (0.004)	0.012 (0.002)	0.549
South	0.023 (0.003)	0.035 (0.005)	0.034 (0.004)	0.020 (0.003)	0.012 (0.002)	0.585
West	0.022 (0.004)	0.033 (0.005)	0.033 (0.004)	0.018 (0.003)	0.013 (0.002)	0.545
Across-Industry Correlations with...						
Net Growth (N_j)	0.74*	0.23	0.05	0.21	-0.20	0.47
Vacancies (V_j)	1.00	0.33	0.21	0.38	-0.07	0.66*
Hires (H_j)		1.00	0.98*	0.94*	0.80*	0.32

Source: Author's tabulations from JOLTS data. Net growth rates are the difference between the hires and separations rates. Means are reported, with standard deviations in parentheses. Statistics are based on data from December 2000 through January 2005. Asterisks (*) denote significance at the 5 percent level.

Table 3.
Local Unemployment and Establishment Vacancy Summary Statistics

	All Establishments	Establishments with Positive Vacancies Only
Mean	0.021	0.040
Standard Deviation	0.039	0.046
Median	0.003	0.026
10th, 90th Percentiles	0.000, 0.063	0.005, 0.089
Number of Observations	372,288	175,981
Share of Employment [Estabs.] with $V_{ijt} > 0$	0.533 [0.122]	NA
Share of Empl. [Estabs.] with $V_{ijt} > 0 \mid Net \neq 0$	0.674 [0.336]	NA
Percent of Variation Explained by...		
Month Effects	0.5	0.8
State Effects	0.7	0.6
Establishment Effects	40.7	66.0

Source: Author's tabulations from pooled JOLTS microdata. Estimates are based on data from December 2000 through January 2005. Estimates (except the share of establishments with positive vacancies) are weighted by employment.

Table 4.
Labor Turnover Rates by Establishment Growth Rate Interval

Net Growth Interval (N_{ijt})	Hiring Rate (H_{ijt})	Separations Rate (S_{ijt})	Quits Rate (Q_{ijt})	Layoffs Rate (L_{ijt})
(-2, -0.3)	0.018	0.554	0.132	0.393
[-0.3, -0.1)	0.028	0.191	0.089	0.088
[-0.1, 0)	0.017	0.039	0.023	0.013
0	0.011	0.011	0.008	0.003
(0, 0.1)	0.042	0.019	0.013	0.005
[0.1, 0.3)	0.199	0.037	0.024	0.017
[0.3, 2)	0.541	0.034	0.020	0.013

Source: Author's tabulations from pooled JOLTS microdata. Estimates are based on data from December 2000 through January 2005. Estimates are weighted by employment.

Table 5.
Table 5.
Establishment Labor Turnover Variation and Local Labor Market Conditions

	Hiring Rate (H_{ijt})	Quits Rate (Q_{ijt})	Layoffs Rate (L_{ijt})
Pooled Correlation with...			
Net Growth Rate (N_{jt})	0.026*	0.008*	-0.009*
Unemployment (U_{jt})	-0.025*	-0.036*	0.001
Unemployment Change (ΔU_{jt})	-0.012*	-0.010*	0.009*
Percent of Variation Explained by...			
Establishment Effects	28.5	27.9	21.0
State × Month Effects	1.9	2.2	1.1

Source: Author's tabulations from pooled JOLTS microdata (worker flows), supplemented by LAUS state data (unemployment), and CES state data (net growth). Estimates are based on data from December 2000 through January 2005. All estimates are weighted by employment. The variations explained are from the regression of each worker flow estimate on either 14,573 establishment effects or 1,887 state × month effects. Asterisks (*) denote significance at the 5 percent level.