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

R. Jason Faberman

2.1 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 United States. The public data were released in 2002, and with its aggregate estimates, the JOLTS has already provided valuable insight on the behavior of worker recruiting and worker turnover.

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

The JOLTS is an evolution of earlier data series, notably the BLS Labor

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I thank Eva Nagypál, Steve Davis, John Haltiwanger, Jim Spletzer, Rick Clayton, John Wohlford, and the editors and conference participants for this volume for helpful comments on this chapter. Any remaining errors are my own. Work on this project was done while I was an employee at the Bureau of Labor Statistics. The views expressed are my own and do not necessarily reflect the positions of the U.S. Bureau of Labor Statistics, the Federal Reserve Bank of Philadelphia, or the Federal Reserve System.

Turnover Survey.[1] The survey also builds on the research on vacancies, worker turnover, and unemployment done by Abraham (1987), Blanchard and Diamond (1989, 1990), and others, as well as theories of labor market search and matching.[2] This research, and the rapidly developing research that has followed, underscores the importance of understanding labor market dynamics. As such, the BLS designed the JOLTS to capture these dynamics. The result is a high-frequency, timely survey with several major advantages over previous data. The first is its reporting of hires and separations directly by an establishment. Other data (e.g., administrative wage records, the Current Population Survey [CPS]) forced researchers to infer these flows from observed changes in a worker's employment status. The second is its reporting of job openings or vacancies directly by an establishment. Previously, researchers had to rely on indices (such as the Help Wanted Index) for a measure of vacancies. This approach did not lend itself to studying vacancy behavior at the micro level. This was an issue because theories of labor market search often model behavior at the level of workers and firms. The final advantage is its distinction between quits and layoffs. The two types of separations have opposing cyclical patterns, and in general, they represent voluntary and involuntary severances, respectively.

Existing research using JOLTS is currently sparse, but thanks to the ballooning of research on the theory and evidence of labor dynamics, it is expanding rapidly.[3] Clark (2004) summarizes the aggregate evidence since the inception of JOLTS. Hall (2005a) and Shimer (2007a) use the JOLTS data to study whether standard theories of labor market search can match the volatility of vacancies relative to unemployment. Valetta (2005) uses the JOLTS data to study the Beveridge Curve. Besides this chapter, Davis, Faberman, and Haltiwanger (2006, 2007) and Faberman and Nagypál (2007) are the first to present analyses of the establishment-level JOLTS data. The data have also become popular with the press and various industry and policy groups. In all, the JOLTS data complement existing data and can vastly improve our understanding of the labor market.

The following section defines the concepts and terminology used throughout the chapter, 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 establishment level. An exploration of the relations between worker flows and aggregate and local labor market conditions comes

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.

2. See, for example, Pissarides (1985) and Mortensen and Pissarides (1994).

3. Davis and Haltiwanger (1999) review the empirical work on labor dynamics, while Mortensen and Pissarides (1999) and Rogerson, Shimer, and Wright (2005) review the theoretical work on labor search.

next. The final section concludes and discusses potential avenues of future research.

2.2 Data and Measurement

2.2.1 Source Data

The BLS uses the JOLTS data to publish monthly estimates of job openings (i.e., vacancies), hires, and separations, with separations reported as quits, layoffs and discharges, and other separations (e.g., retirements).[4] The data start in December 2000 and are updated monthly, with the latest estimates available within two months of a month's end. The survey covers all nonfarm establishments, the same sample frame as the Current Establishment Statistics (CES) survey. The aggregate estimates are available nationally, for four major regions and by 2-digit North American Industry Classification System (NAICS) sector.[5] The BLS reports JOLTS estimates in levels and as rates.

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 establishments. Like the CES, the JOLTS coverage of nonfarm payrolls implies that it generally excludes the self-employed and nonprofit 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 consists of overlapping panels that are each sampled for eighteen months, and is weighted so that its employment estimates match those of the CES.[6]

For the analyses in this chapter, I use the JOLTS establishment data pooled over the December 2000–January 2005 period. For most aggregate statistics, I use the unrestricted sample of all observations. For the establishment-level analyses, I use a restricted sample of all observations with 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). Due to the requirement of reporting in consecutive months, the

4. The published statistics are available at http://www.bls.gov/jlt/home.htm

5. 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.)

6. See Crankshaw and Stamas (2000) for details on the JOLTS sample weighting procedure.

restricted sample excludes the December 2000 observations.[7] Results in my analyses are all sample-weighted, and where noted, also employment-weighted. Estimates are not seasonally adjusted, unless otherwise noted.

2.2.2 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 employment dynamics and to minimize respondent confusion in reporting.

1. Employment. Establishments report their employment for the pay period that includes the twelfth 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 an establishment's payroll. The reference period and definition are standard for all federal statistical establishment surveys and allows the BLS to accurately benchmark the survey to the CES.
2. Hires. Hires are new additions to the workforce of an establishment. They include new hires, rehires, seasonal and short-term hires, recalls after a layoff lasting more than seven days, and transfers from other worksites. The JOLTS hires are a flow measure that is meant to capture all occurrences between the first and last day of the month.
3. Separations. Separations are subtractions from the workforce of an establishment. These removals include quits, layoffs lasting more than seven days, firings and other discharges, terminations of short-term and seasonal workers, retirements, and transfers to other worksites. The JOLTS separations are also a flow measure meant to capture all occurrences between the first and last day of the 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 that include all layoffs lasting more than seven 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 where work can start within thirty 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

7. Even with the noted restrictions, the aggregate estimates from the unrestricted and restricted samples match each other very closely.

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.[8]

Hires and separations are expressed as rates by dividing each by employment. The vacancy rate is slightly different. It uses the sum of vacancies and employment in its denominator, making this rate a fraction of filled and unfilled jobs. This is analogous to the unemployment rate, which uses the labor force as its denominator (i.e., it is a fraction of employed and unemployed labor).

Given the definitions of employment and worker flows, 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 seven days.[9]

2.2.3 Some Notes on Research with the JOLTS Data

The published JOLTS data have already provided interesting evidence about the labor market, yet the survey remains relatively new and continues to evolve. The passage of time will lengthen the time series, making the survey even more useful in understanding the cyclical behavior of worker flows and vacancies. 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 employment, worker flows, and vacancies can complicate some research studies (Davis, Faberman, and Haltiwanger [2007], however, have one method to deal with the timing issue). 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 Quarterly Census of Employment and Wages, to obtain this information.

A significant issue for JOLTS is the accurate measurement of hires and separations. Nagypál discusses some of these issues later in this volume, while Wohlford et al. (2003) and Faberman (2005) have BLS research

8. "Active recruiting" in the JOLTS is a very broad definition that includes networking and word-of-mouth recruiting. The time aggregation issue (i.e., the posting and filling of vacancies within the month) may have notable macroeconomic implications, as Shimer (2007) argues is the case with unemployment. Davis, Faberman, and Haltiwanger (2007) study the effects of time aggregation on the JOLTS vacancy measure.

9. In light of this issue, the JOLTS has separate surveys for education and temporary help establishments.

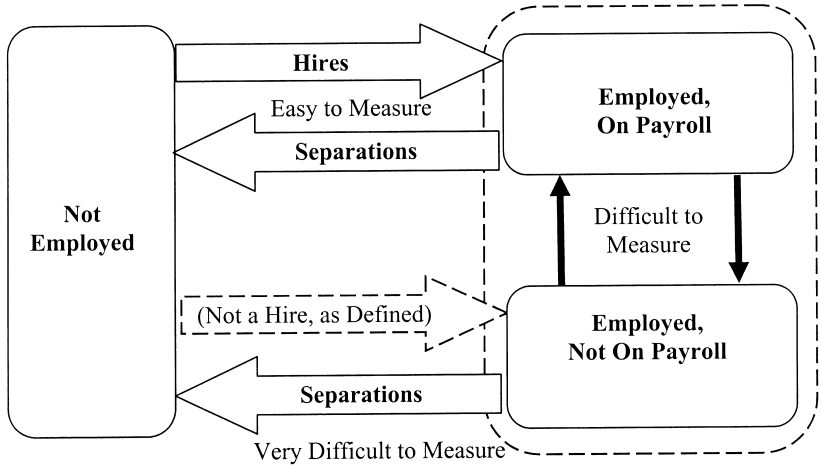

Fig. 2.1 Measurement issues with labor turnover and employment

aimed at understanding and improving measurement. An important finding from this work is that the measurement of hires and separations is not as simple as theory would dictate. As noted earlier, the relations between hires, separations, and the level of employment are 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.[10] These nuances make hires and separations more difficult to measure than a point-in-time count of employees on payroll.

Figure 2.1 illustrates the possible transitions a worker can undertake (and the relative difficulty of measuring each) based on internal analyses by BLS program staff. As one might expect, the easiest flows to measure are those where an employed and working individual either is hired or separates. Flows that deal with employed individuals not currently on payroll are where measurement difficulties arise, with the greatest difficulties occurring when an individual separates from a job match during a period of nonwork. 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 respond to the survey. 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.

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

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 how the employment behavior of establishments translates into the measured statistics.

2.3 Vacancies and the Beveridge Curve

2.3.1 Aggregate Relations

The publicly available JOLTS estimates present a wealth of new evidence for the aggregate labor market. While the time series is relatively 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) states that a recession begins in March 2001 and ends in November of 2001, though losses in payroll employment (based on CES estimates) continue through August 2003. Figure 2.2 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, and the patterns are consistent with the behavior of employment growth during this period. In 2001, unemployment rises while

Fig. 2.2 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.

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.

An important relation in the theory of labor search and matching is the Beveridge Curve, which predicts that the cyclical movements of vacancies and unemployment should have an inverse relation. Figure 2.3 plots the aggregate Beveridge Curve, with the JOLTS vacancy rate on the vertical axis and the CPS 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 and 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 predictions of the Beveridge Curve.

One can also use the aggregate JOLTS estimates to evaluate the magni-

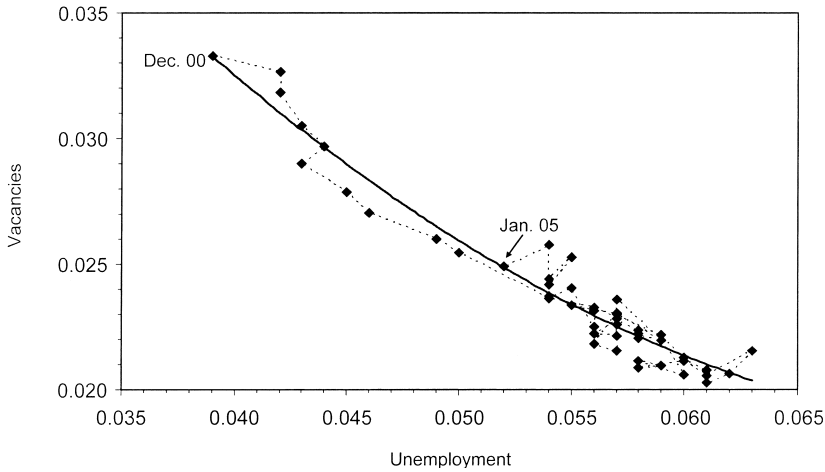

Fig. 2.3 Vacancy vs. unemployment rates (Beveridge Curve), December 2000–January 2005

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

Notes: The dotted line represents the time-series path of the unemployment-vacancies relation, while the solid line represents the quadratic trend of the relation.

tudes, volatility, and comovement of worker flows and vacancies. Table 2.1 presents the aggregate means, standard deviations, and correlations (contemporaneous and dynamic) of vacancies, hires, and separations with relevant labor market variables (i.e., employment growth and unemployment). The vacancy rate averages 2.4 percent. It is the most volatile and persistent of the JOLTS statistics. 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. The dynamic correlations of vacancies to net growth are significant and positive for lagging values of net growth, but insignificant, and in some cases

Table 2.1 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).

Notes: 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.

negative, for leading values of net growth, implying that growth is a good predictor of vacancies, but vacancies are not a good predictor of growth.

Table 2.2 lists the summary statistics for vacancies, hires, and separations by industry and region. Vacancy rates vary considerably by industry, though industries with high worker 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 services have the highest vacancy rate despite also having some of the lowest turnover rates.[11] 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.

2.3.2 Vacancy Postings and the Local Labor Market

Since the JOLTS data are collected at the establishment level, they are especially powerful for a micro-level study. Most theories of labor market search model the relation of vacancies to unemployment as the outcome of firm-level decisions of whether to post vacancies in response to current labor market conditions. Theory dictates that, controlling for outside factors, the negative aggregate relation of unemployment to vacancies should also hold at the micro level. To test this, I estimate the relation of establishment vacancy rates to local (i.e., state) unemployment rates.[12]

I start with the basic statistical properties of establishment-level vacancies, particularly since empirical evidence on them is sparse. Table 2.3 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 at least one vacancy reported. Statistics are employment-weighted. Only 12 percent of establishment-month observations have a vacancy posted at the end of the month, though these represent 53 percent of employment. 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 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

11. Davis, Faberman, and Haltiwanger (2007) note that the JOLTS vacancy rates tend to be higher in industries with more formal hiring practices.

12. 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 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.

Table 2.2 **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	0.031	0.031	0.013	0.013	0.421
	(0.003)	(0.008)	(0.006)	(0.004)	(0.006)	
Construction	0.014	0.054	0.055	0.020	0.033	0.370
	(0.004)	(0.013)	(0.007)	(0.004)	(0.008)	
Manufacturing	0.014	0.022	0.027	0.012	0.012	0.445
	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	
Transportation and utilities	0.016	0.025	0.026	0.013	0.011	0.500
	(0.003)	(0.005)	(0.003)	(0.002)	(0.003)	
Retail trade	0.019	0.044	0.043	0.027	0.013	0.626
	(0.004)	(0.009)	(0.007)	(0.005)	(0.005)	
Information	0.020	0.021	0.023	0.013	0.008	0.577
	(0.005)	(0.004)	(0.005)	(0.003)	(0.003)	
Financial activities	0.021	0.022	0.023	0.013	0.007	0.589
	(0.002)	(0.004)	(0.004)	(0.003)	(0.002)	
Professional and business services	0.029	0.043	0.039	0.020	0.016	0.512
	(0.005)	(0.006)	(0.007)	(0.004)	(0.004)	
Education and health	0.033	0.027	0.023	0.015	0.007	0.638
	(0.005)	(0.005)	(0.004)	(0.003)	(0.002)	
Leisure and hospitality	0.028	0.063	0.059	0.039	0.018	0.661
	(0.006)	(0.013)	(0.011)	(0.008)	(0.005)	
Other services	0.019	0.032	0.032	0.019	0.011	0.593
	(0.004)	(0.007)	(0.009)	(0.004)	(0.006)	
Government	0.018	0.015	0.012	0.006	0.004	0.488
	(0.003)	(0.005)	(0.004)	(0.002)	(0.002)	
Region						
Northeast	0.021	0.029	0.028	0.014	0.012	0.498
	(0.003)	(0.006)	(0.005)	(0.003)	(0.003)	
Midwest	0.020	0.032	0.031	0.017	0.012	0.549
	(0.003)	(0.006)	(0.005)	(0.004)	(0.002)	
South	0.023	0.035	0.034	0.020	0.012	0.585
	(0.003)	(0.005)	(0.004)	(0.003)	(0.002)	
West	0.022	0.033	0.033	0.018	0.013	0.545
	(0.004)	(0.005)	(0.004)	(0.003)	(0.002)	
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.

Notes: 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.

**Significant at the 5 percent level.

Table 2.3 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	0.533	n.a.
[Estabs.] with $V_{ijt} > 0$	[0.122]	
Share of empl. [estabs.] with $V_{ijt} > 0 \mid \text{Net} \neq 0$	0.674 [0.336]	n.a.
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.

Notes: Estimates are based on data from December 2000 through January 2005. Estimates (except the share of establishments with positive vacancies) are weighted by employment. n.a. = not applicable.

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 (2007) explore these conjectures.

Table 2.3 also shows that state and month differences account for less than 1 percent of the establishment-level vacancy variation. 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.

To explore the relation between establishment vacancy postings and state unemployment, I regress establishment vacancy rates on state unemployment rates. The unemployment rates come from the BLS Local Area Unemployment Statistics (LAUS) data, which use the CPS and other data sources to produce its 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

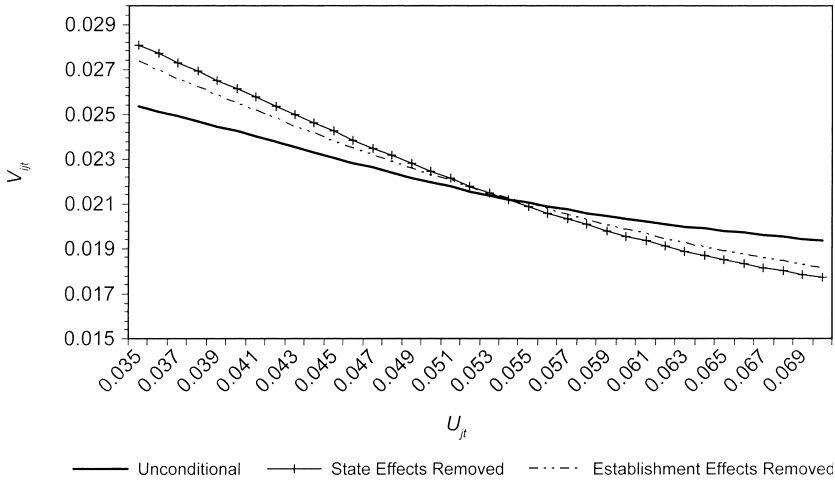

Fig. 2.4 Establishment vacancies and their relation to the local unemployment

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.

also tends to be higher than the volatility at the national level. To allow for a nonlinear relation, I use a fourth-order polynomial of unemployment. Nonparametric analyses of the data (not reported here) suggest that a polynomial of this order fits the data well. I weight the regressions by employment and run separate regressions that include state and establishment fixed effects.[13]

The predicted relations of vacancies to unemployment from these regressions are in figure 2.4. There are separate predicted trends for the unconditional relation, the relation with state effects removed, and the relation with establishment effects removed. As theory predicts, vacancy postings are inversely related to the local unemployment 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 rates across states, suggesting that not controlling for this trend variation understates 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-

13. Note that state fixed effects are a subset of establishment fixed effects, in the sense that establishments cannot change their location in the data.

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 establishment and aggregate levels.

2.4 Worker Flows and the Labor Market

2.4.1 Aggregate Evidence

I now focus on the JOLTS worker flow estimates. Figure 2.5 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 figure 2.6, I plot quarterly worker flow rates calculated from the JOLTS against the gross job losses estimates from the Business Employment Dynamics (BED) program.[14] Hires and gross job gains move together for the most part, though hiring has a more pronounced decline during the 2001 recession and a more pronounced rise during 2004. Gross job losses, relative to separations, show a considerably larger rise during the 2001 recession and a decline thereafter, whereas separations begin to rise again starting in mid-2003. The difference between the two series at the end of the period can be attributed to the increase in the quits rate during this time.

As with vacancies, the aggregate estimates of worker flows are summarized in tables 2.1 and 2.2. Table 2.1 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

14. For more on the BED, see Spletzer et al. (2004), as well as chapter 4 by Clayton and Spletzer in this volume.

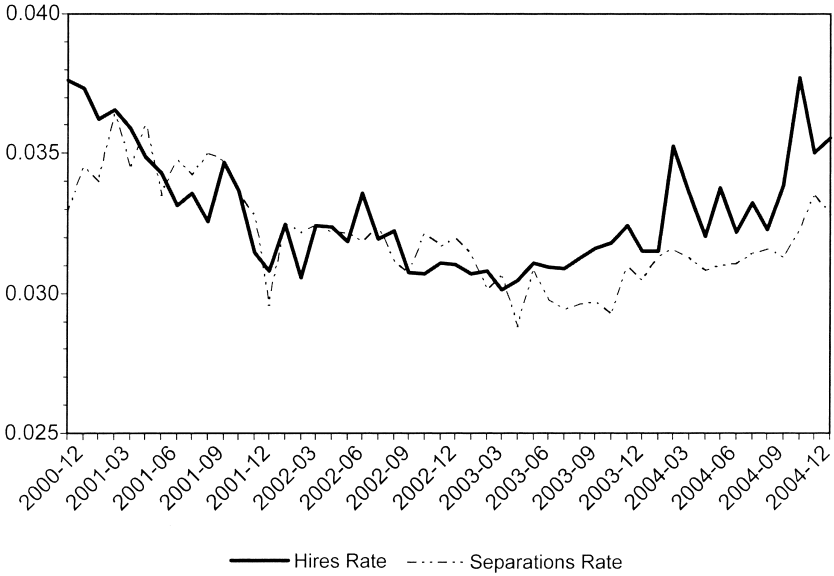

Fig. 2.5 Hires and separations rates, December 2000–January 2005
Source: Public JOLTS nonfarm estimates, seasonally adjusted.

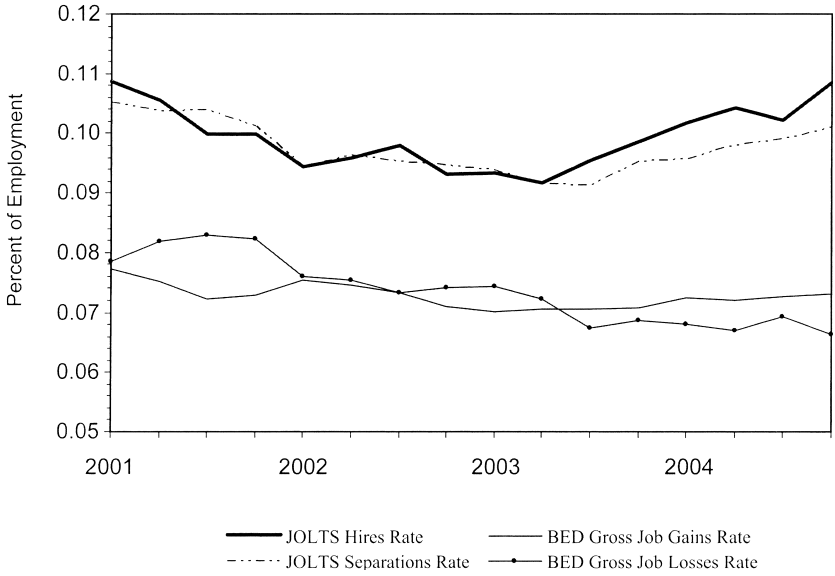

Fig. 2.6 Quarterly worker flow and job flow rates, JOLTS and BED data
Source: Quarterly worker flows are from the published JOLTS estimates and quarterly job flows are from the published BED statistics. All estimates are seasonally adjusted.

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 layoffs) shed some light on the cyclical behavior of worker flows. 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 have little relation to the stock of unemployment. This evidence has implications for the recent debate on whether recessions are primarily periods of high job loss or reduced hiring. Hall (2005b) and Shimer (2007b) argue that the job-finding rate, and not necessarily the separations rate, drives cyclical movements in unemployment. The correlations in table 2.1 support that claim, but only to the extent that movements in the *quits* rate drives the relationship between separations and unemployment. This suggests that separations and the job-finding rate are not mutually exclusive, and that the relative importance of separations versus the job-finding rate may depend critically on the cyclical behavior of employer-to-employer transitions (described by Fallick and Fleishmann 2004; Nagypál 2005) since quits tend to dominate these flows.

Table 2.2 illustrates that worker flow 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, 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. The majority of separations tend to be layoffs in goods-producing industries (resources, construction, manufacturing) and quits in other industries, such as services and retail trade. A large fraction of separations in the Northeast and Midwest, where shares of goods-producing industries are relatively high, are 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.

2.4.2 Worker Flows 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.

Another advantage of the JOLTS microdata is its ability to illustrate the relationship between establishment-level employment behavior and the aggregate behavior of worker flows. 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 large fractions of establishments simultaneously create and destroy jobs each period. There is little evidence, though, on the relation between these establishment-level decisions and patterns of worker turnover. To explore this relation, I split the JOLTS microdata into three groups: establishments with expanding employment (i.e., more hires than separations); establishments with contracting employment (i.e., more separations than hires); and establishments with constant employment (i.e., either offsetting hires and separations or no turnover at all). 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 2.7 and 2.8 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. Establishments with no employment change have the lowest hires and separations rates. Their rates are also the least volatile. This evidence suggests that the relation of establishment-level hires and separations to net growth is nonlinear and nonmonotonic—contracting establishments have more hires and expanding establishments have more separations than establishments with no employment change. Finally, even though figure 2.5 shows a long, persistent drop in hiring during the downturn and a mild pickup in separations during the recession, the series depicted in figures 2.7 and 2.8 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 2003–2004 recovery period. How can the evidence in the two figures be reconciled? As Davis, Faberman, and

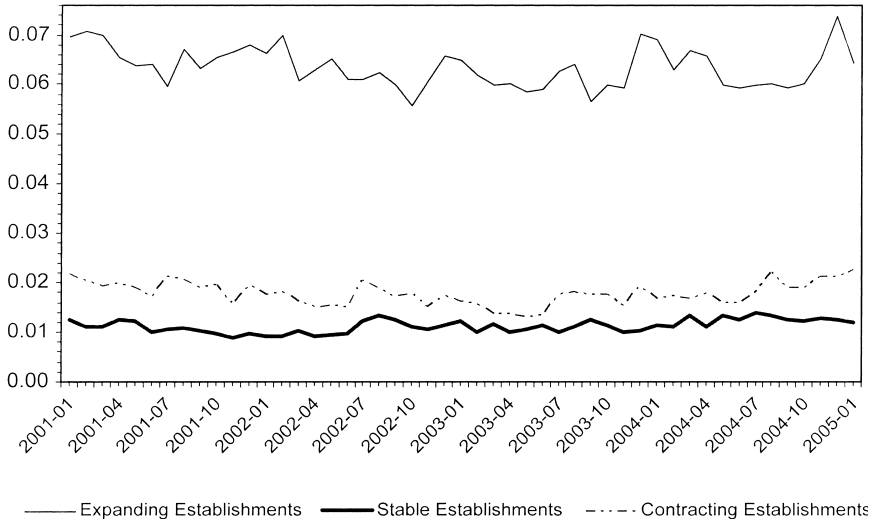

Fig. 2.7 Hiring rates by type of establishment-level employment change

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

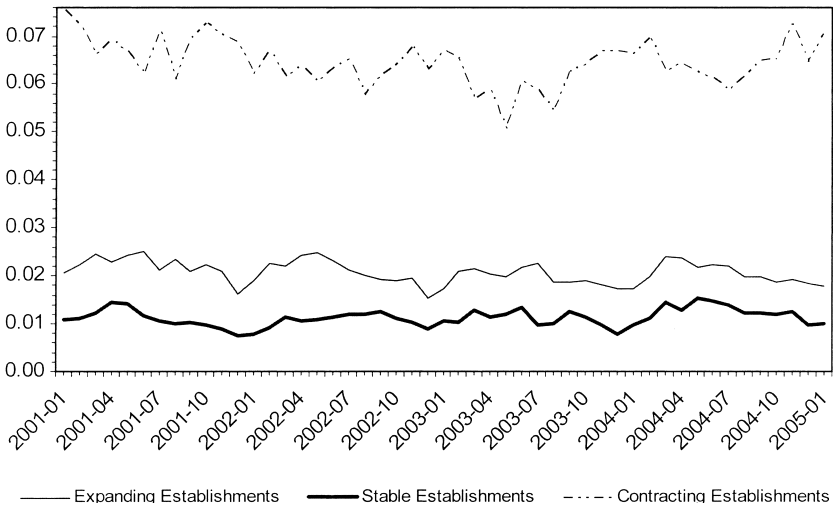

Fig. 2.8 Separation rates by type of establishment-level employment change

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

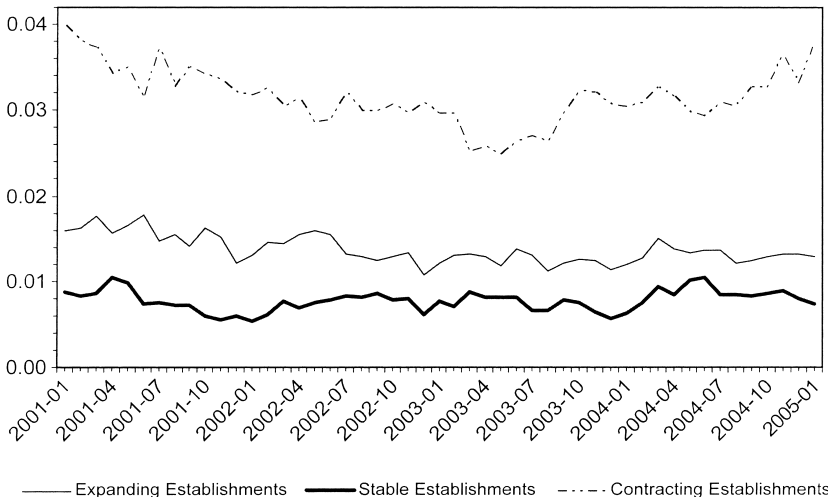

Fig. 2.9 Quit rates by type of establishment-level employment change
Source: Author's tabulations of JOLTS microdata. Estimates are seasonally adjusted using factors from the aggregate public estimates.

Haltiwanger (2006) illustrate, cyclical shifts in the distribution of establishment growth account for the differences between the figures.[15]

Figures 2.9 and 2.10 show two notable caveats for quits and layoffs. In figure 2.9, the quits rate mimics the procyclical behavior of its aggregate estimates among contracting establishments and, to a lesser extent, among expanding establishments. In figure 2.10, layoffs among contracting establishments exhibit a mild spike in late 2001, but are otherwise acyclical.

Table 2.4 summarizes worker flow rates for different intervals of the growth rate distribution. Quit rates exceed layoff rates for all but the largest contractions, but remain relatively high for all contracting establishments. Only job losses at establishments with large contractions are dominated by layoffs. Finally, there is an asymmetry between the tails of the growth rate distribution: separations at expanding establishments are considerably higher than hires at rapidly contracting establishments. This may suggest that a shakeout process within the hiring patterns of expanding establishments exists, but further research is warranted.

2.4.3 Worker Flow Relations to the Local Labor Market

Understanding how worker flows relate to *local* labor market conditions can be an important aspect of understanding their aggregate movements.

15. Davis, Faberman, and Haltiwanger (2006) also note that the patterns illustrated are robust to size, industry, and establishment controls.

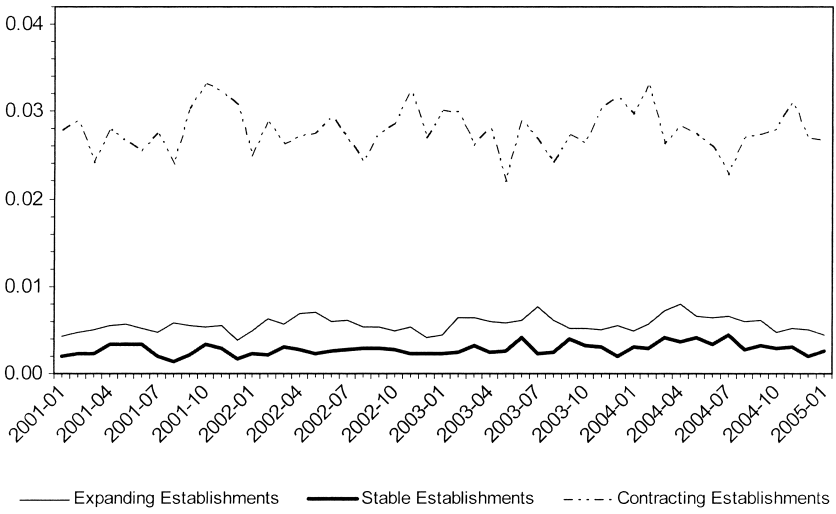

Fig. 2.10 Layoff rates by type of establishment-level employment change
Source: Author's tabulations of JOLTS microdata. Estimates are seasonally adjusted using factors from the aggregate public estimates.

Table 2.4 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.
Notes: Estimates are based on data from December 2000 through January 2005. Estimates are weighted by employment.

One basic yet important question the JOLTS microdata can address is how do local worker flow rates relate to the local unemployment rate?

Table 2.5 reports the basic relations of pooled establishment-month observations of hires (H_{ijt}), quits (Q_{ijt}), and layoffs and discharges (L_{ijt}) to state-level labor market statistics. These statistics include the state unemployment rate, its change from the previous month (ΔU_{jt}), and the state employment growth rate (N_{jt}) (obtained from the CES). The reported correlations appear very weak, yet nearly all are significant at the 5 percent

Table 2.5 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).

Notes: 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.

**Significant at the 5 percent level.

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. Therefore, the most relevant characteristics of these correlations are their sign and their magnitudes relative to each other.[16] 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 evidence suggests a procyclical pattern for establishment hires and quits and a countercyclical pattern for layoffs—higher growth, lower unemployment, and decreases in unemployment at the state level are related to more hires and more quits. Layoffs are negatively related to growth and positively related to increases in unemployment, but consistent with the national evidence, they are essentially uncorrelated with the unemployment rate.

I also estimate the establishment-level relations of hires, quits, and layoffs to the change in the state unemployment rate. I focus on the change rather than the level because it is more comparable to a flow measure.[17] In the previous section, vacancies were a stock measure, so the level of unemployment was the appropriate metric. 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.[18]

16. Ideally, I would calculate state-level worker flow estimates 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.

17. Note that the change in unemployment is the net effect of the flows into unemployment and flows out of unemployment.

18. As with the regressions of section 2.4, the fourth-order polynomial results are consistent with similar nonparametric fits of the data.

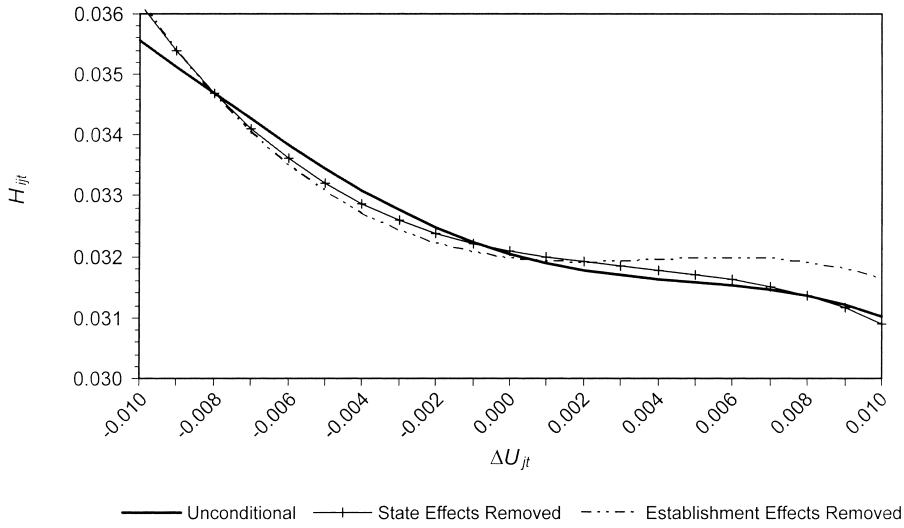

Fig. 2.11 Establishment hirings and their relation to changes in local unemployment
Source: Author's estimation of establishment vacancy rates on a fourth-order polynomial of the state unemployment rate using JOLTS establishment microdata and LAUS unemployment estimates. State and establishment fixed effects are used where noted. See text for details.

As before, I perform separate regressions for the unconditional relation, the relation with state effects removed, and the relation with establishment effects removed.

Figures 2.11, 2.12, and 2.13 plot the results for hires, quits, and layoffs, respectively. Figure 2.11 shows that establishments hire less when the local unemployment rate is rising. The relation is nonlinear, with hires changing the most during large decreases in unemployment. Figure 2.12 shows that quits also decrease as unemployment rises. This relationship is also nonlinear, with quits changing the most during large increases in unemployment. In Figure 2.13, layoffs increase with increases in local unemployment. The relationship is close to linear. This establishment-level evidence parallels the patterns in the aggregate evidence. Controlling for state or establishment fixed effects does not alter these results.

2.5 Conclusions and Further Research Potential

The JOLTS data provide a wealth of labor market information at both the aggregate and establishment level. The data are the most comprehensive data source for vacancies in the United States, and have the timeliest, most frequent, and most direct measures of worker turnover. While its time series is still relatively short, the JOLTS already presents rich new evidence

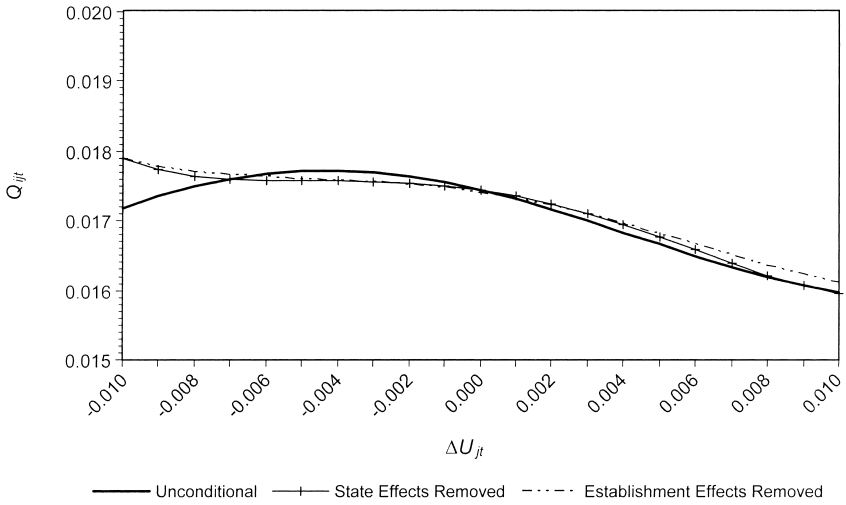

Fig. 2.12 Establishment quits and their relation to changes in local unemployment

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.

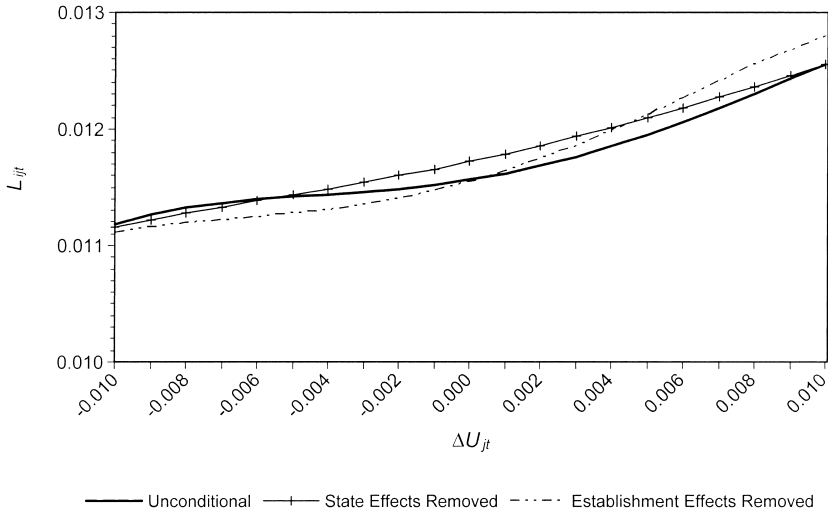

Fig. 2.13 Establishment layoffs and their relation to changes in local unemployment

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.

on the time-series and cross-sectional patterns of these 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 their employment) often do not post vacancies. Expanding establishments have high hiring rates while contracting establishments have high separation rates. Establishments with no change exhibit a steady pattern of turnover, but have the lowest worker flow rates. 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 aid labor market research. The first is how firms use vacancies to attract workers. 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 establishments. This provides a representative, tangible measure of job openings and allows micro-level studies of vacancy posting behavior similar to previous work by Holzer (1994) and current work by Davis, Faberman, and Haltiwanger (2007) and Faberman and Nagypál (2007). 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 and job loss. The JOLTS data can provide a better understanding of separations since it differentiates between quits and layoffs. This is important for macroeconomic analyses of employment adjustment, since quits are procyclical, while layoffs are countercyclical. The distinction between quits and layoffs and its importance for labor market movements is highlighted by the models of Akerlof, Rose, and Yellen (1988) and McLaughlin (1991), and the importance of this distinction is evident in the recent debate on whether recessions are hiring-driven, as argued by Hall (2005b) and Shimer (2007), or job-loss driven, which was the conventional wisdom.

A final area of potential research deals with worker 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 joint behavior that was previously impossible, but is essential for evaluating theories of labor market search and the matching of workers to firms. Overall, the JOLTS data provide many opportunities to increase our understanding of labor market dynamics.

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