Analyzing the JOLTS Hires and Separations Data[1]

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1. Introduction

The Job Openings and Labor Turnover Survey (JOLTS) is a relatively new survey collected by the U.S. Bureau of Labor Statistics (BLS). It tracks the dynamics of the labor market with monthly estimates of hires, separations, and job openings. The survey began in December 2000 and covers all nonfarm employment, with finer detail for major industries and major regions. The survey samples 16,000 establishments each month, asking their employment level, their number of hires, their number of separations (categorized into quits, layoffs & discharges, and other separations), and the number of job openings posted.

The JOLTS is an innovative data source in that it captures employment levels, employment movements, and job openings all within the same reporting unit. This approach allows consistency in the measurement and research using such variables previously impossible with previous data sources. This innovative approach, however, also pushes the survey into uncharted territories of labor market measurement. For instance, it was unclear at the start of the survey how well respondents would do in directly reporting their hires and separations. It also was unclear if the BLS would need to develop special weighing or estimation techniques to adequately capture the dynamic nature of the data being collected.

This paper summarizes a comprehensive examination of the JOLTS hires, separations, and employment data. The paper focuses on two noticeable differences in the JOLTS aggregate estimates from other aggregate measures. The first is the difference between the employment growth estimated by the Current Employment Statistics (CES, or the "payroll survey", to which the JOLTS sample is benchmarked) and the growth implied by the difference between estimated JOLTS hires and separations. In theory, the two measures should track each other closely over time—differences in reference periods and the measurement of when someone counts as employed can contribute to transitory changes, but over time, the two surveys should track each other well. The cumulative difference between the growth measured in CES and JOLTS, however, has gradually increased since the inception of the JOLTS survey, suggesting that factors other than transitory differences are affecting the estimates. The second difference is the difference in magnitudes between the JOLTS hires and separations data and other comparable sources (such as administrative wage records).

The JOLTS reports rates that are sometimes as low as half those from the other sources.

The study finds that both differences stem from several sources. These include a potential underreporting of hires and separations in JOLTS by respondents (particularly those with large contractions), an over-representation in JOLTS of establishments with relatively stable employment, and an inability to adequately capture entry and exit (which is a handicap for any establishment sample). Differences in scope, timing, and concept definitions, also contribute to both differences, and seem relatively more important for the differences in labor turnover magnitudes observed between the JOLTS data and comparable sources than for the differences observed between CES and JOLTS employment growth.

The study proceeds in three parts. The first analyzes the reporting behavior and estimation procedures using the JOLTS microdata. It builds on previous work by Wohlford et al. (2003) that analyzed the JOLTS hires and separations data by sector and month-by-month by also looking at the data by size and over a longer time horizon. It also takes a detailed look at the microdata by comparing differences between hires, separations, and the net employment change for individual respondents.

The second part compares aggregate and micro JOLTS data to the Business Employment Dynamics (BED) program of the BLS. The BED is built from administrative unemployment insurance records linked longitudinally over time, so it provides a virtual universe to use as a benchmark comparison for the JOLTS estimates. It measures net employment changes at the establishment level through quarterly estimates of gross job gains and gross job losses. Gross job gains are positive employment changes at the establishment level, while gross job losses are negative employment changes at the establishment level. By definition, these employment changes are a subset of hires and separations.

The final part compares the JOLTS data to administrative wage record data in North Carolina. Wage records detail employment histories of individuals and are provided by firms for unemployment insurance purposes. One can estimate quarterly hires, separations, and job flows with wage record data by tracking the movement of individuals into and out of a given firm. These estimates, particularly when one matches them to the JOLTS observations at the micro-level, can lend insight into how much of the observed aggregate differences are due to measurement differences, and how much are due to other factors, such as weighting and sample selection.

2. Analysis of the JOLTS Data Alone

This first analysis focuses solely on JOLTS aggregate and microdata. The study uses monthly data from December 2000 through January 2005. After accounting for outliers and nonresponse, each month's estimates are calculated with an average of about 8,100 units, with the number of units used increasing as response rates increase over time. The sample is weighted so that within the month reported JOLTS employment matches CES employment within each sample stratum. BLS applies the same weights to reported hires, separations (including each sub-category), and job openings to obtain the published aggregate statistics. The definitions and timing of employment, hires, and separations are important for this study. Employment follows the standard BLS definition, which counts all employees on payroll during the pay period that includes the 12th of the month. Hires and separations are employment flow measures that count all occurrences of each occurring between the first and last day of the month. Consequently, there is a timing difference between the flow measures and the employment measure. Theoretically, however, the monthly timing differences should cancel out over the course of a year. In addition to timing differences, JOLTS's measure of hires and separations may not capture changes in payroll employment by the definitions it uses. For example if an employee remains with a business during the month but does not receive a paycheck, JOLTS would not count this as a separation, but the CES survey would.

The microdata sample for this study is the subset of all reporting units with observations for two consecutive months—this restriction permits the calculation of the employment change from one month to the next for a given reporting unit. The study also restricts observations to those with positive employment in both months. This excludes entrants and exits—entrants and exits in the JOLTS data make up a very small part of the sample relative to their presence in comparable administrative data. This under-representation is a natural consequence of using sample rather than universe data and will, by definition, lead to an understatement of labor turnover. The final research panel has over 372,000 establishment-month observations, which represents approximately 92 percent of those used in the production of the aggregate statistics.

Where reported, employment flows and changes as transformed into rates by dividing by the average of the previous and current months' employment. This differs slightly from the official BLS methodology, and is done to allow consistency in rate calculation across all data sources used in this survey. The hires and separations rates are straightforward. The Net growth rate is the change in employment from the previous to current month divided by the average employment measure. Unless otherwise noted, all statistics referenced in this study are sample-weighted. In the absence of the reference period and definitional differences above, each reporting unit should satisfy

(1)   Hires – Separations = Net Change in Employment, or
$$H - S = N.$$

If differences between the left and right-hand side of equation (1) were purely random, they would have no effect on the aggregate statistics over the course of a year. Figure 1, however,

illustrates that this is not the case. The figure shows employment levels from the CES and the level imputed from adding the cumulative difference between H and S to the starting level. Throughout the period, the two series diverge, with JOLTS estimates implying consistently higher employment levels. The greatest divergence occurs in the first year (2001), though Table 1 shows that other years still report considerable differences. Between December 2000 and January 2005, the cumulative difference between CES and the imputed JOLTS employment amounts to 5.1 million employees. Table 1 (which focuses on the 2001-04 period) shows that larger establishments (50 workers or more) account for the bulk of the overstatement; the difference between hires and separations at the smallest establishments actually understates employment growth substantially. Sectoral evidence reinforces Wohlford et al. (2003), who, like this study, find that differences are greatest within professional services (which include temporary help agencies), education, and government. The cumulative differences within professional services and government are particularly large.

Figure 1. Employment from the CES and from Cumulative Differences between JOLTS Hires and Separations
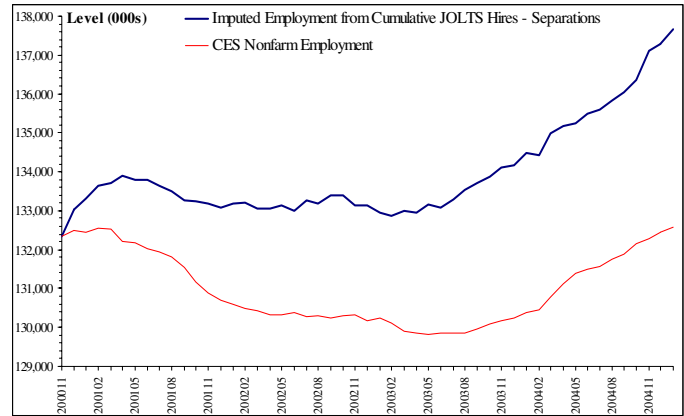
Where do these differences come from? The following three figures lend some insight. Figure 2 is a scatter plot of establishment-level observations of $H - S$ (y-axis) versus N (x-axis). Establishments with identical estimates for each line up along the 45-degree line. Given the definitional and timing differences, many observations most likely line up just near the 45-degee line. If one defines "near" the line as $H - S$ and N being within either 2 percentage points or 2 employees of each other, 95 percent establishments (representing 76 percent of employment) satisfy the condition; 79 percent (representing 35 percent of employment) lie exactly on the 45-degee line. Of those that lie outside the range, 1.3 percent of establishments (3.0 percent of employment) are along the vertical plane where $H - S = 0$. This plane represents observations where there is no difference between hires and separations even though the net change is nonzero. In addition, 0.8 percent of establishments (1.5 percent of employment) lie along this plane with no reported hires or separations (i.e., $H = 0$ and $S = 0$, which is the subset of $H - S = 0$ that excludes observations where $H = S$).

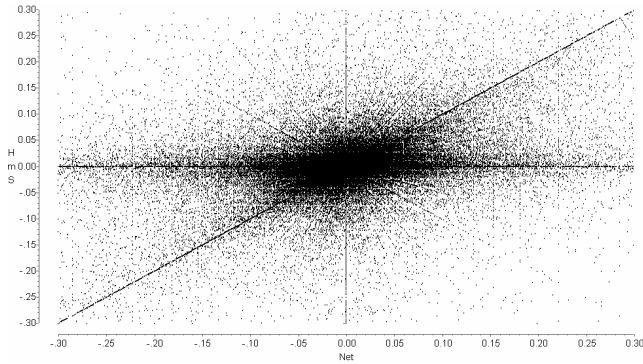**Figure 2. $H - S$ (y-axis) vs. N (x-axis) from Pooled JOLTS Microdata**

Figure 3 illustrates how a relatively small fraction of inconsistent observations can create such large aggregate differences. For each value of N (expressed as a rate along the x-axis), the figure depicts the share of employment with $H - S$ "near" N (as defined above). Those with little to no changes in their net growth rates are also those most likely to have estimates near each other. The likelihood of internally consistent measures drops off sharply as one moves away from $N = 0$, with the lowest likelihoods being for the largest employment changes.

Figure 4 illustrates how the cumulative $H - S$ may come to overstate net growth over the survey's history. It illustrates two shares: the share of employment with $H - S = 0$ for each N (i.e., observations on the vertical plane from above) and the share of employment with both H and S equal to zero. The latter is a subset of the former. There is a large spike for each at $N = 0$; these observations represent internally consistent estimates, since both indicate no net change. There are also relatively large shares (between 11 and 37 percent) with no difference between H and S as one moves away from $N = 0$, though. In addition, the shares are relatively higher for establishments with large employment contractions. Put another way, declining establishments are considerably less likely to report any hires or separations, which may lead to an understatement of separations (since declines have $S > H$, by definition) in the aggregate statistics.

The study also looked at these patterns by sector, size, and firm type (results not reported). Establishments in Hospitality & Leisure and Government, establishments with 50 or more employees, and multi-unit establishments were least likely to have $H - S$ "near" its value for N. Establishments in Construction, Information, Professional Services, Hospitality & Leisure, and Government, and medium-sized establishments (10-250 employees) were most likely to report no hires or separations even though they reported a change in employment. The share of establishments (and employment) with estimates "near" each other modestly increases over the sample period, while the share with no reported flows in the presence of a net change remains essentially unchanged. Overall, the results suggest that most survey respondents have consistent measures of hires, separations, and employment growth; observed differences between public JOLTS hires and separations data and CES employment data stem from an under-reporting of labor turnover, particularly separations, at a relatively small share of observations. These observations have a notable effect on the public estimates because they tend to represent relatively large employment changes, especially large employment contractions.

Figure 3. The Share of Establishments Where $H - S$ is "Near" N, Employment-Weighted
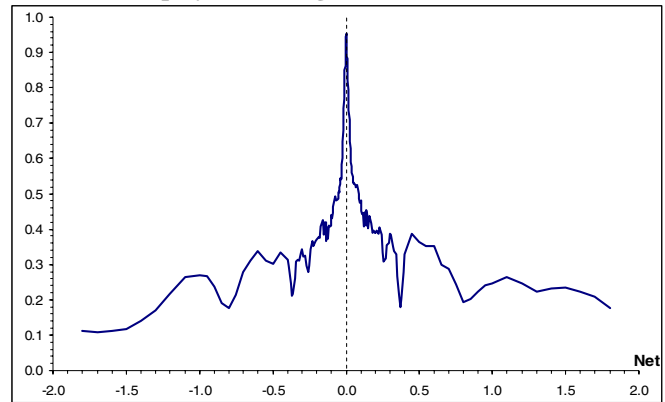
Figure 4. Share of Establishments Where $H - S = 0$ or H and S Equal Zero, Employment-Weighted
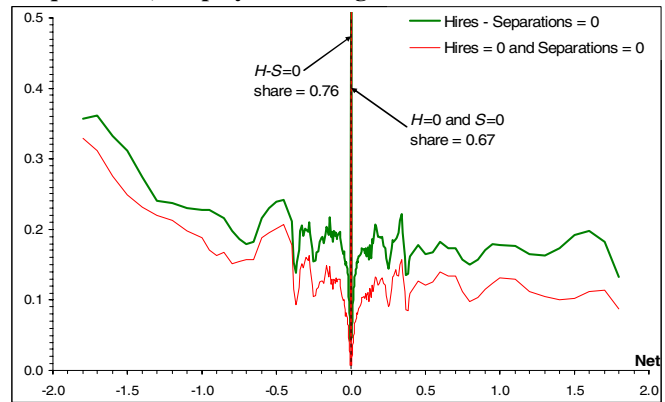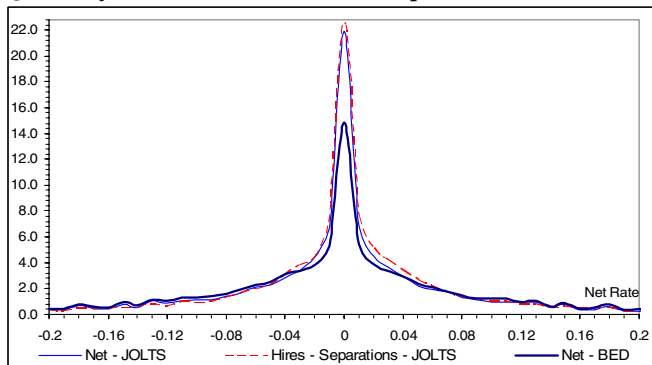

3. Comparing the JOLTS and BED Data

The next analysis compares the JOLTS data to the BED. The BED measures gross job gains and losses, which are simply measures of net growth at the establishment level. Since the BED is the universe of payroll employment, this comparison may lend insight into whether the estimated distribution of net growth in JOLTS is representative of the actual distribution. The study compares the two data with comparable aggregate statistics and with a subsample of matched microdata. The latter are created using a unique establishment identifier common to both the JOLTS and BED data. The study restricts matched JOLTS observations to those with data for four consecutive months, so that one can tabulate quarterly estimates of H, S, and N. The matched observations are further restricted to those with similar reported employment levels (within 10 percent or 10 workers) in both data sources; some firms aggregate their JOLTS survey reports, and these can distort the analysis. Quarterly H and S estimates are sums of their three monthly estimates for the quarter, while N is the difference between the third month's employment of the current and previous quarters. The matched sample uses 36,375 pooled observations over 10 quarters (2001Q1–2003Q2), which represents 54 percent of the original sample.

Table 2 presents the basic comparisons between the JOLTS and BED. The matched sample shows that the gross job gains and losses are less than half of their associated labor turnover (38 percent of *H* and 41 percent of *S*). Remember that gross job flows are a subset of labor turnover, so their rates will be lower by definition. More importantly, gross job flows estimated from JOLTS employment are lower than those estimated from BED employment—JOLTS job gains are 23 percent lower while JOLTS job losses are 31 percent lower. Further analysis (not reported here) indicates that these differences persist across sectors, size classes and firm types, with establishments in Construction, Retail, and Professional Services, small establishments (less than 50 employees), and single-unit establishments having the largest differences.

The study also compares growth rate distributions. Figure 5 shows the (employment-weighted) frequency distributions of net growth from three sources: JOLTS using *N* as the growth measure, JOLTS using *H* – *S* as the growth measure, and the BED, which uses *N* by definition. The figure is for all (matched and unmatched) quarterly observations, and it illustrates a striking difference between the distributions of the JOLTS measures and the BED measure—the JOLTS data have considerably more observations with little or no net growth. About 22 percent of JOLTS observations (with either measure) have *N* equal to zero, while only 14 percent of BED observations have *N* equal to zero. The JOLTS estimates also have slightly higher shares of growth between the narrow range of -4 and 4 percent, and the distribution measured from *H* – *S* also shows a slightly higher share of observations that grow between 1 and 6 percent. The latter is consistent with the disparity observed in Figure 1. Some portion of these differences may be because the quarterly JOLTS subsample excludes relatively more volatile observations, though Table 2 indicates that labor turnover in the subsample is only 4 percent lower than the aggregate estimates. Nevertheless, the evidence for the remaining portions suggest that JOLTS tends to capture a relatively high share of stable establishments.

Figure 5. Frequency Distributions of JOLTS and BED Quarterly Net Growth and Hires – Separations

4. Comparing the JOLTS and Wage Record Data

The final analysis compares the JOLTS data to administrative wage records from North Carolina. The analysis compares both the aggregate data and a matched subsample, using a unique identifier as before (in this case the UI account number). The aggregate data only compare continuous units. The matched sample uses only firms with "similar" employment levels (defined as within 10 percent or 10 employees). This tends to limit it to single-unit firms, since multi-unit firms will generally not match up with their individual sampled establishments in the JOLTS survey employment-wise. Both data sources allow one to measure, hires, separations, and job flows. For wage record estimates, "cumulative" flows measure all employment changes within and between firms, while "full quarter" flows ignore transitory, within-quarter changes. The cumulative measure of hires and separations is closest to the JOLTS definition, though neither wage record measure of hires and separations is directly comparable.

Table 3 shows that, in the aggregate, JOLTS labor turnover estimates are 42-46 percent lower than the cumulative wage record estimates and 18-23 percent lower than the full quarter wage record estimates. The matched data show nearly identical patterns, with JOLTS estimates 40-44 percent lower than the cumulative estimates and 25-35 percent lower than the full quarter estimates. JOLTS job flow estimates are also 36-51 percent lower than wage record job flow estimates for the matched sample. These results suggest that differences between JOLTS and wage record estimates of hires and separations stem from how firms report to the two data sources, and not necessarily from differences in scope, from sample selection, or other methodological matters. Further analysis by size (not reported here) shows that differences are somewhat larger among very small firms (< 10 employees). Given the way wage record data are reported, comparable analyses by sector and firm type are not feasible. Finally, note that the matched sample is a very small subsample (1,091 observations over 14 quarters), so one should view these conclusions with a degree of caution.

5. Conclusions

The publicly available JOLTS data on hires and separations have two notable differences with comparable data sources. The first is a disparity between the employment levels implied by the difference between hires and separations and that reported by the CES. The evidence presented in this paper suggests that this stems from an underestimate of separations relative to hires, which is likely driven by several sources. First, JOLTS is a survey that cannot easily account for entry and exit, which makes up a nontrivial portion of labor turnover. Second, some JOLTS respondents tend to report hires and separations that are inconsistent with their reported employment, and this is more prevalent among establishments with large contractions. Finally, the JOLTS survey tends to capture relatively stable establishments (in terms of employment dynamics), and does a slightly better job of capturing expanding versus contracting establishments.

The second difference explored in this paper is the low estimates of JOLTS hires and separations relative to administrative data sources. The analysis presented in this paper suggests several sources of this difference as well. First, JOLTS tends to capture relatively stable establishments (and because of its nature as a sample, generally does not capture entrants and exits), which implies that its estimates are based on firms with inherently lower labor turnover. Also, some survey respondents seem to report different hires and separations estimates for the JOLTS and administrative data. This may be due to definitional differences or to differences in how respondents interpret those

definitions. Further research is needed to better understand these differences among the same respondents.

Overall, the JOLTS data are a new and innovative source of labor turnover measurement. As a consequence of its pioneering nature, it has encountered interesting and new complexities in its estimation of labor turnover. Uncovering and examining these complexities aids in the understanding of the labor market, and also improves the ability of BLS as well as other statistical agencies to measure its rich and complex dynamics. The evidence in this study suggests that original and low-cost enhancements to the JOLTS estimation methodology—such as greater weight given to consistent data reporters and estimation

procedures that adjust for the relatively stable growth distribution—may add to the success of JOLTS in measuring the complex dynamics of the U.S. labor market. Again, though, further research is needed to explore the extent to which such enhancements could be successful.

Reference

Wohlford, John, Phillips, Mary Anne, Clayton, Richard, and Werking, George, 2003. "Reconciling labor turnover and employment statistics." *2003 Proceedings of the Annual Statistical Association* [CD-ROM]. Alexandria, VA: American Statistical Association.

Table 1. Hires, Separations, Net Growth, and their Difference (1,000s of Employees), Jan. 2001 – Dec. 2004

	Hires	Separations	Net Growth	Avg. Difference	Cum. Difference
Nonfarm Employment	4,326	4,237	-1	90	4,307
Industry					
Resources	19	19	0	-0	-5
Construction	377	385	6	-14	-686
Manufacturing	340	414	-60	-14	-677
Trade, Transportation & Utilities	932	949	-17	-1	-62
Information	69	79	-12	3	120
Finance & Real Estate	177	173	8	-5	-216
Professional & Business Services	693	640	-3	57	2,722
Health & Education	438	385	38	15	696
Hospitality & Leisure	780	754	13	12	619
Other Services	173	176	5	-8	-384
Government	329	264	18	47	2,232
Establishment Size					
0-9 employees	479	628	-26	-124	-5,937
10-49	1,218	1,201	2	15	730
50-249	1,468	1,369	24	75	3,581
250-999	673	610	12	52	2,477
1,000-4,999	364	323	-8	48	2,318
5,000 +	124	106	-7	24	1,181
Year					
2001	4,548	4,546.3	-148	154	1,840
2002	4,143	4,133.0	-45	48	679
2003	4,109	4,026.8	8	78	900
2004	4,499	4,240.4	183	79	937

Table 2. Comparison of JOLTS and BED Labor Turnover Estimates, Quarterly Averages, 2001Q1 – 2003Q2

	Hires	Separations	Gross Job Flows		Observations
			Expansions	**Contractions**	
Aggregate JOLTS Data	10.8	10.9			6,717
Aggregate BED Data			5.8	6.1	6.68 million
Matched JOLTS Microdata	10.5	10.4	4.0	4.3	3,638
Matched BED Microdata			5.2	6.2	

Notes: Estimates are in rates. The matched microdata sample is sample- and employment-weighted.

Table 3. Comparison of JOLTS and Wage Record Labor Turnover Estimates, North Carolina, Quarterly Averages, 2001Q1 – 2004

		Hires	Separations	Gross Job Flows		Observations
				Gains	**Losses**	
Aggregate JOLTS Data		10.2	9.8			255
Aggregate WR Data	*Cum.*	17.6	18.1	5.9	6.4	154,642
	FQ	13.9	14.6	4.4	4.7	
Matched JOLTS Microdata		6.6	6.1	3.1	2.4	
Matched WR Microdata	*Cum.*	11.0	10.9	4.9	4.8	78
	FQ	8.8	9.4	4.4	4.9	

Notes: Estimates are in rates. The matched microdata sample is sample- and employment-weighted.

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[1] The views expressed are solely those of the author, and do not necessarily reflect the official positions or policies of the U.S. Bureau of Labor Statistics or the views of other staff members.