Development of JOLTS Firm Size Estimation Methodology

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Abstract

The Bureau of Labor Statistics' (BLS) Job Opening and Labor Turnover Survey (JOLTS) is an establishment survey that seeks to measure dynamic trends in the US labor market. Each month the survey publishes the number of job openings, hires, and separations at the national, regional, and major super-sector industry level of detail. The Survey also publishes establishment size class estimates as an experimental series. After consultation with some of the key data users, it was found JOLTS users prefer firm size (proxy for size of employer) estimates rather than establishment size estimates. The purpose of this paper is to provide details of the methodology used to develop JOLTS firm size estimates. The process begins with the assignment of firm size to the frame and sample; development of birth/death models and independent population controls for employment at the industry by firm size level; and application of alignment and seasonal adjustments at the industry by firm size level. Finally, a comparison is made of the sum of the firm size class estimates for each industry to the published industry estimates which are independently produced.

Key words: firm size estimation, post-stratification, ratio adjustment

1. Introduction

The JOLTS is a monthly survey of 16,400 business establishments drawn from the Bureau of Labor Statistics' Quarterly Census of Employment and Wages Longitudinal Data Base or LDB, the sampling frame. Data are collected for total employment, job openings, hires, quits, layoffs and discharges, and other separations. From these data, the number of job openings, hires, total separations as well as its three components—layoffs and discharges, quits, and other separations—are published. These data are published by various industry levels, four Census Regions, total private excluding agriculture, local and state government, and Federal government.

Recently the JOLTS program, in response to a request from the Department of Treasury, developed research series by establishment (i.e., worksite) size class under an extremely tight timeline. These data thus have many limitations—neither adjustment for independent population controls nor alignment procedure was performed at the size class level within an industrial sector. It is believed that most of the major users prefer to have the data by firm (i.e., employer) size rather than establishment size. In order to meet this demand, the BLS has undertaken the initiative to produce JOLTS data by firm size for the private sector. The initial data will be released as a research series to get feedback from the users' community which will be incorporated should the series become an official Bureau product.

There are many conceptual and operational issues involved in moving towards published firm size class series. First is the question of how size class is defined. Deciding how many size classes is another key question; the 12 OMB officially designated size classes are a starting point. Another key methodology question is "re-sizing", or how often to reassign a size class designation to a firm that grows or declines. One of our goals is to

have consistent definitions and methodologies across BLS programs as much as possible in order to facilitate comparisons.

The purpose of this paper is to describe the sampling and estimation methodologies used to produce firm size estimates within an industrial sector for JOLTS. The primary BLS goal is to produce firm size estimates for the private sector. However, we are also developing the experimental series for each industrial sector to assess the quality. The second section describes the current sample and estimation methodology. The third section describes the determination of size classes and how often to resize the sample. The fourth section describes the modifications made to the current procedures for producing the firm size estimates for each industrial sector. The fifth section provides some results that compare the published industrial sector estimates to the corresponding sum of size class estimates. The final section is a summary and conclusions of results and future work.

2. Current sample and estimation methodology

Sampling— The JOLTS survey design is a probability-based stratified random sample of 16,400 nonfarm business establishments, including factories, offices, and stores, as well as federal, state, and local governments in the 50 states and the District of Columbia. The establishments are drawn from a universe of over 9.1 million establishments compiled as part of the operations of the Quarterly Census of Employment and Wages (QCEW) program. This program includes all employers subject to state Unemployment Insurance (UI) laws and federal agencies subject to Unemployment Compensation for Federal Employees (UCFE). The basic sampling unit is an establishment or worksite which generally remains in the survey for 24 months for a noncertainty establishment and stays out of the survey for next three years after completion of 24 months. Important features of the sample design are the use of stratified random sampling, a Neyman allocation (Cochran, 1977, pp. 259-261), and ratio estimators. The characteristics used to stratify the sample are: ownership (private sector; local, state, and federal government) by geographic area (four census regions), 2-digit industry divisions and six establishment employment size classes (1-9, 10-49, 50-249, 250-999, 1000-4999, 5000 or more employees).

JOLTS characteristics are highly correlated with an establishment's employment level. Thus for a fixed sample size, stratified sampling results in a greater precision than simple random sampling. Given a fixed sample size, the Neyman allocation provides the maximum precision of an estimate. Some establishments are included in the sample with certainty.

The JOLTS sample is constructed from individual panels of sample units drawn on an annual basis. The full annual sample consists of one certainty panel composed of only large units selected with virtual certainty based on their size and 24 noncertainty panels. Each month a new non-certainty panel is rolled into collection, and the oldest non-certainty panel is rolled out. This means that at any given time the sampled panels going into estimation are constructed from three different annual sampling frames. The entire sample of old plus new panels is post-stratified and re-weighted annually to represent the most recent sampling frame. Additionally, the out-of-business establishments are removed from the old panels. The annual sample is supplemented with a quarterly sample of birth establishments (i.e., new establishments) to better reflect the impact of younger establishments in the JOLTS sample.

Estimation— The survey utilizes a ratio estimator to improve the precision of the sample estimates. This estimator improves the precision of the sample estimates by utilizing the correlation between the employment data and the characteristics to be measured. A Horvitz-Thompson estimator (Lohr, 1999, Chapter 6.) with a ratio adjustment is used to produce estimates of surveyed characteristics at several levels of geographic and industrial detail. These estimates include the following:

- Totals
- Rates
- Estimates of monthly change

The generalized formula for totals for all survey characteristics (job openings, hires, etc.) for time t is as follows for ready reference:

$$\hat{X} = \sum_{i \in cell} W_{t,i} * NRAF_{t,cell} * BMF_{t,cell} * X_{t,i},$$

where Xt,i is the characteristic of interest for the i^{th} unit at time t.

$\hat{X}_t$ is the estimate of a characteristic at time t.

$W_{t,i}$ is the sample weight for i^{th} unit at time t.

$NRAF_{t,cell}$ is computed for each sampling cell (Region/2-digit NAICS/establishment size class) non-response adjustment factor defined by

$$(\sum_{t,cell} \frac{W_{t,eligibles}}{W_{t,respondents}}) \text{ at time t,}$$

where $W_{t,respondents}$ is weighted frame employment for all sampling units that are reporting employment at time t and $W_{t,eligible}$ is weighted frame employment of all sampled units excluding out-of-business units at time t within a cell.

BMF is the benchmark factor at time t. It is computed for each estimation cell as:

$$\text{Benchmark factor} = (\frac{CES\_Emp_t}{JOLTS\_Emp_t}),$$

where CES_Emp_t is the employment level at time t obtained from the monthly Current Employment Statistics (CES) survey, also known as the monthly Payroll Survey. The CES employment serves as a population control for each estimation cell and $JOLTS\_Emp_t$ is the sample weighted employment at time t.

The formula for the Job Openings rate is as follows:

$$JO\_Rate_t = \frac{\hat{JO}_t}{CES\_Emp_t + \hat{JO}_t},$$

where $\hat{JO}_t$ is the estimated level of job openings at time t.

The generalized formula for all other rates is as follows:

$$Rate_t = \frac{\hat{X}_t}{CES\_Emp_t}$$

Details of JOLTS estimation are available at http://www.bls.gov/osmr/pdf/st000140.pdf

Birth/Death Model— As with any sample survey, the JOLTS sample can only be as current as its sampling frame. The time lag from the birth of an establishment until its appearance on the sampling frame is approximately one year. In addition, many of these new units may fail within the first year. Since these universe units cannot be reflected on the sampling frame immediately, the JOLTS sample cannot capture job openings, hires, and separations from these units during their early existence. BLS has developed a model to estimate birth/death activity for current months by examining the birth/death activity from previous years on the QCEW and projecting forward to the present using CES over-the-year change for the same month . The birth/death model also uses historical JOLTS data to estimate the amount of "churn" (hires and separations) that exists in establishments of various sizes. The model then combines the estimated churn with the projected employment change to estimate the number of hires and separations taking place in these units that cannot be measured through sampling.

The model-based estimate of total separations is distributed to the three components—quits; layoffs and discharges; and other separations—in proportion to their contribution to the sample-based estimate of total separations. Additionally, job openings for the modeled units are estimated by computing the ratio of job openings to hires in the collected data and applying that ratio to the modeled hires. The estimates of job openings, hires, and separations produced by the birth/death model are then added to the sample-based estimates produced from the survey to arrive at the estimates for openings, hires, and separations.

Seasonal adjustment— BLS seasonally adjusts several JOLTS series using the X-12 ARIMA seasonal adjustment program. Seasonal adjustment is the process of estimating and removing periodic fluctuations caused by events such as weather, holidays, and the beginning and ending of the school year. Seasonal adjustment makes it easier to observe fundamental changes in the level of the series, particularly those associated with general economic expansions and contractions. A concurrent seasonal adjustment methodology is used in which new seasonal adjustment factors are calculated each month, using all relevant data, up to and including the data for the current month.

JOLTS seasonal adjustment includes both additive and multiplicative seasonal adjustment models and REGARIMA (regression with auto-correlated errors) modeling to improve the seasonal adjustment factors at the beginning and end of the series and to detect and adjust for outliers in the series.

Alignment— JOLTS hires minus separations should be comparable to the CES net employment change. The CES series is considered a highly accurate measure of net employment change owing to its very large sample size and annual benchmarking to universe counts of employment from the QCEW program. However, definitional differences as well as sampling and non-sampling errors between the two surveys historically caused JOLTS to diverge from CES over time. To limit the divergence and to

improve the quality of the JOLTS hires and separations series, BLS implemented a monthly alignment method. This monthly alignment method applies the seasonally adjusted CES employment trends to the seasonally adjusted JOLTS implied employment trend (hires minus separations) forcing them to be approximately the same, while preserving the seasonality of the JOLTS data. A brief description is as follows.

First, the two series are seasonally adjusted and the difference between the JOLTS implied employment trend and the CES net employment change (change of cesemp) is calculated. Next, the JOLTS implied employment trend is adjusted to equal the CES net employment change through a proportional adjustment. This proportional adjustment procedure adjusts the two components (hires, separations) proportionally to their contribution to the total churn (hires plus separations). For example, if hires are 40 percent of the churn for a given month, they will receive 40 percent of the needed adjustment and separations will receive 60 percent of the needed adjustment. The following example illustrates the adjustment.

Example: let hires = 40; separations = 60; change of cesemp = -25
1) D = (hires - separations) - change of cesemp = (40 – 60) - (-25) = 5
2) PropAdj_Hires = [hires / (hires + separations)]* D = [40 / (40 + 60)] * 5 = 2
3) PropAdj_Separations = separations / (hires + separations) * D = [60 / (40 + 60)] * 5= 3
4) Adjusted Hires = Hires - PropAdj_Hires = 40 - 2 = 38
5) Adjusted Separations = Separations - PropAdj_Separations = 60+3 = 63

Where, D is the discrepancy between change in CES employment and the implied change in employment as measured by hires minus separations from JOLTS.

Job openings are adjusted accordingly based on the original ratio of job openings to hires. That is, adjusted job openings = (adjusted hires) X (job openings/ hires). Similarly, the three components of total separations are adjusted in proportion to their contribution to the sample-based estimate of total separations in an estimation cell.

The adjusted job openings, hires, and separations are converted back to not seasonally adjusted data by reversing the application of the original seasonal factors. After the monthly alignment method is used to adjust the not seasonally adjusted level estimates, rate estimates are computed from the adjusted levels. The monthly alignment procedure assures a close match of the JOLTS implied employment trend with the CES trend for not seasonally adjusted data. The adjusted estimates are then again seasonally adjusted (see http://www.bls.gov/osmr/pdf/st090300.pdf)

Reliability—This survey is designed to produce reliable estimates of the characteristics of interest. For the period January 2011 through December 2011, the average relative standard errors for national estimates of job openings, hires, quits, layoffs and discharges, other separations, and total separations rate, respectively, were 2.7, 2.2, 2.4, 4.8, 7.0 and 2.4 percent derived using the methodology described below.

The estimation of sample variances for the JOLTS survey is accomplished through the method of Balanced Half Samples (BHS) similar to CES. This replication technique uses half-samples of the original sample and calculates estimates using those subsamples. The replicate weights in both half-samples are modified using Fay's method of perturbation. The sample variance is calculated by measuring the variability of the estimates made from these subsamples. (For a detailed mathematical presentation of this method, see

Handbook of Methods, BLS Chapter 2, Bureau of Labor Statistics, 2011 or http://www.bls.gov/opub/hom/homch2.htm) under Reliability of Estimates.

We compute the replicate estimates $\hat{Y}^{\alpha}$ using the whole sample rather than only half of the sample, as with the original BRR method. For each replicate, sample units are used with the modified weights w_i^{α} :

$$w_i^{\alpha} = 1+\gamma G_i h^{\alpha} \sqrt{1-f}\ w_i,$$

where

$\gamma = 0.5$ -- perturbation factor;

$G_i = \pm 1$ -- random groups indicator;

h^{α} -- element of the Hadamard matrix (αth row for a given column);

f -- sample fraction;

w_i -- selection weight

(In the above formula, the factor $\sqrt{1-f}$ is not part of the Fay's procedure – this is the way we account for sampling from the finite population.)

After we obtain the replicate estimates, we compute the variance using the usual formula:

$$Var_{FayBRR}\ \hat{Y} = \frac{1}{A\gamma^2}\sum_{\alpha=1}^{A}\ \hat{Y}^{\alpha} - \hat{Y}^{2}$$

NOTE: The squared perturbation factor is in the denominator.

Where A is the number of replicates, in JOLTS case 114 replicates are used from a 116 Hadamard matrix since there are 114 strata (19 industrial sectors by six size classes).

Publishability—Before estimates of these characteristics are released to the public, they are first screened to ensure that they do not violate the Bureau of Labor Statistics' (BLS) confidentiality pledge. A promise is made by the Bureau to each respondent that BLS will not release its reported data to the public in a manner which would allow others to identify the establishment, firm, or enterprise. Estimates which fail confidentiality screening based on the p-percent rule for disclosure (see Federal Committee on Statistical Methodology Working paper 22) are not published.

Annual revision— The CES employment is revised two times on a monthly basis, known respectively, as second and third closings estimates. JOLTS initial estimates are based on CES second closing; JOLTS second closing estimates are based on CES third closing. The CES estimates are also benchmarked or ratio adjusted to the QCEW on a yearly basis. Similarly, JOLTS estimates are revised annually to reflect the updated CES employment.

JOLTS total employment estimates are benchmarked or ratio-adjusted monthly to the employment estimates of the Current Employment Statistics (CES) survey adjusted for strikes. A ratio of CES to JOLTS employment is used to adjust the levels for all other JOLTS data elements.

3. Determination of firm size classes and how often to resize

Definition of firm— BLS uses the federal Employer Identification Number (EIN) as a proxy for firm. An EIN consists of one worksite for single-establishment employer and generally multiple worksites for multi-establishment employers. For multi-establishment employers, the worksites may be in more than one state. An EIN may have multiple Unemployment Insurance accounts associated with it.

Definition of firm size— Each month, we sum the employment of all worksites within an EIN on the sampling frame. Then, we take the maximum employment over the past 12 months for each EIN. We assign firm size based on this maximum employment to each unit on the frame.

Determination of firm size classes— Three entities within the Office of Employment and Unemployment Statistics (OEUS) at BLS independently determined the number of firm size classes as well as the lower and upper boundaries of each size class. The CES Program Office research was conducted by Nathan Clausen and Chris Manning. The results are given in "Estimates by Firm Size Using the CES Survey". Jeffrey Groen and Lowell Mason of the Employment and Research Staff conducted the most rigorous research. Their results are given in "Choosing Size Classes for Industry Employment Estimates by Firm-Size Class".

The JOLTS analysis was relatively simple: we examined the employment distribution by size class on the QCEW in order to decide the appropriate lower and upper boundaries for each firm size class for JOLTS purposes. The firm size distribution for March 2011 QCEW was as follows:

Employment Size Class	No. of Employees	% of Employment
1	1-4	4.1
2	5-9	5.4
3	10-19	7.2
4	20-49	10.7
1-4	1-49	27.3
5	50-99	8.2
6	100-249	10.6
7	250-499	7.3
5-7	50-499	26.1
8	500-999	7.2
9	1000+	29.5
8-9	500+	46.6

NOTE: This distribution by firm size varies only slightly from year to year.

We decided that the JOLTS sample could support three firm sizes (i.e., small, medium, and large) for most of the industrial sectors based on the data in the table above.

Our goal was to have three firm size classes with approximately equal QCEW employment with the constraint that data tabulations can at least be broken out by small vs. large businesses; with small as defined by firms with less than 500 employees. This reasoning led to the formation of three firm size classes: small (1-49 employees); medium (50-499 employees); and large (500 or more employees). The research conducted by Clausen and Manning came to the same conclusion. Groen and Mason show this classification as one their viable sets, but they left the final recommendation to the needs and requirements of the Current Employment Statistics Program.

Frequency of re-sizing— The sampling weights are assigned annually when the sample is drawn. Re-sizing or assigning firm size, therefore, is also performed annually.

4. Proposed sample and estimation methodology

Assignment of firm size classification to frame— The main sampling frame is the first quarter LDB which has current quarter plus three previous quarters of QCEW. All worksites on this file are aggregated by their EIN (proxy for firm). If a worksite does not have a valid EIN, then State FIPS plus U.I. account number is used to create a new EIN and aggregate the worksites. Firm size is defined as the maximum employment at the EIN level over this 12 month period; that is max employment from April of previous year to March of the current year. Then, all worksites belonging to an EIN are assigned their EIN size class. Size classes are defined as: size 1 (1-49 employees); size 2 (50-499); and size 3 (500 or more employees).The assignment of firm size for 2nd, 3rd, and 4th quarter LDB is performed in an analogous manner; that is maximum employment over the most recent 12 months for the purpose of finding the employment distribution for industry/firm size.

> NOTE: Worksites that are out-of-scope for CES are included in sizing of EIN if they belong to an EIN with some worksites that are in-scope.

Assignment of firm size classification to sample— The sampled establishments are matched to the frame and the firm size is copied to the sampled worksites or establishments. The firm size for sampled establishments is fixed until the next annual sample is selected from the new March LDB. That is, the annual sampled establishments' firm size is fixed based on the first quarter sampling frame. The sampled establishments from 2nd, 3rd, and 4th quarter sampling frames are births (i.e., new businesses). The birth establishments by definition are sized based on maximum employment for only their respective quarter. The firm size for birth establishments is again fixed until the following first quarter frame.

Compute Post Stratification factors for each ID(industry)/firm size and assign them to each sample unit

- Summarize March employment on the annual sampling frame by industry and firm size, where industry is the sampling industry. This employment is designated as frame employment.

- Select all the records on the annual sampling frame in the October sample of the calendar year. This is done by sub-setting the sample by the appropriate panel numbers.

NOTE: Only one post-stratification factor is computed for each annual sampled establishment, since the composition of the sample varies every month because of sample rotation. The month of October is chosen for post-stratification factors because it is middle of the yearly cycle.

- Compute sampled weighted employment for March for all establishments in the October sample from the annual sample. That is, compute for each ID/firm size (sampled weighted employment)$_{\text{id,firm size}}$ = $\sum$ (March employment)$_{\text{id,firm size,i}}$ * SWT $_{\text{id,firm size,i}}$.

  Where, SWT $_{\text{id,firm size,i}}$ is the final sampled weight of ith unit in cell ID/firm size; this weight is adjusted for reweight in the sampled file.

- Compute post stratification factor, PSF, for each ID/firm size.

  PSF$_{\text{id,firm size}}$ = (frame employment$_{\text{id,firm size}}$)/ (sampled weighted employment$_{\text{id,firm size}}$)

- Attach PSF$_{\text{id,firm size}}$ to each annual sampled establishment belonging to ID/firm size.

- The current JOLTS' procedures hold true for: *Non-response adjustment (no change necessary)*; *Imputation (no change necessary)*; and *Atypical Adjustment (no change necessary)*.

Birth/Death model and samples— Produce Birth/Death model estimates for ID/firm size. Quarterly birth samples were implemented since July 2009 in an attempt to incorporate younger establishments into estimation on a timelier basis than the model estimates. As a result, there is some overlap between the model and the birth samples that necessitates reducing the impact of the birth model in estimation. The reduction of the time period of the model starts with January 2011 since that is when the birth sample was fully "seeded" or incorporated in the broad sample. Thus, the birth/death model is structured as follows:

Age in Model	Time Period
1-24 months	December 2000 to December 2010
1-18 months	January 2011 and onwards

Benchmarking level— Benchmarking or ratio adjusting JOLTS employment to CES employment increases the quality and reliability of JOLTS estimates by reducing sampling volatility. At present, there is no official firm size level employment estimate available from CES. For the JOLTS ID/firm size experimental series, the benchmark levels are derived using the proportions or ratios from the QCEW Longitudinal Data Base (LDB); the methodology employed is the same as the procedures used for Region by Industry estimates.

The CES ID/firm size proxy is obtained in the following manner. The ID/firm size distribution is derived from the first quarter sampling frame. The ratio for a given ID/firm size is then multiplied by the current CES employment for that ID.

Benchmark Factors for ID/firm size (FSBMF)— The "final" data set is used to compute benchmark factors. The "final" data sets include all microdata and the actual weights used in estimation (sample, NRAF, etc.) and reflects all changes made to microdata that occur after sampling (aggregation code adjustment, outlier treatment, winsorization, etc.).

Compute adjusted benchmark employment by subtracting birth/death model employment from the benchmark employment derived in the above step. That is:

$$\text{Adjusted BMEmp}_{\text{id,firm size}} = (\text{BMEmp}_{\text{id,firm size}}) - (\text{FS B/D emp}_{\text{id,firm size}})$$

Where, $\text{FS B/D emp}_{\text{id,firm size}}$ is ID/firm size employment from birth/death model.

$$\text{FSBMF}_{\text{id,firm size}} = (\text{Adjusted BMEmp}_{\text{id,firm size}})/\sum (\text{EMP*adjusted SWT *PSF*NRAF})_{\text{id,firm size,i}}$$

Where, adjusted $\text{SWT}_{\text{id,firm size,I}}$ is the sampling weight adjusted for atypical and outlier adjustments and $\text{FSBMF}_{\text{id,firm size}}$ is the ID/firm size benchmark factor.

Calculation of ID/firm size estimates (Not seasonally adjusted, pre-aligned)—The formula for basic estimates is:

$$(\text{Weighted X})_{\text{id,firm size}} = \sum (\text{adjusted SWT *PSF*NRAF*FSBMF*X})_{\text{id,firm size,i}}$$

Where, X is the characteristic of interest. That is, employment, Job Openings, Hires, Total Separations, Layoffs and Discharges, Quits, and Other Separations.

For each ID/firm size, add birth/death model estimates to weighted estimates according to current procedures to derive not seasonally adjusted, pre-aligned estimates.

Alignment Procedure

- The alignment of implied employment change from JOLTS to CES employment change will be performed at ID/firm size level. NOTE: This is a change from the current procedures of performing alignment at the ID level.
- Additionally, the alignment procedure is modified to prevent negative values that may be created in the event the absolute size of the divergence within a given cell exceeds the level of hires or separations within the cell.
- Derive not seasonally adjusted, aligned estimates at the ID/firm size level according to the current alignment procedures.

For each characteristic, sum the three firm size estimates within each ID to derive the ID, not seasonally adjusted, aligned estimates.

Seasonally adjusted ID/firm size estimates

- For each characteristic, perform seasonal adjustment on the ID/firm size aligned estimates to obtain seasonally adjusted ID/firm size estimates.
- For each characteristic, sum the three firm size, seasonally adjusted estimates within each ID to derive the ID, seasonally adjusted, aligned estimates.

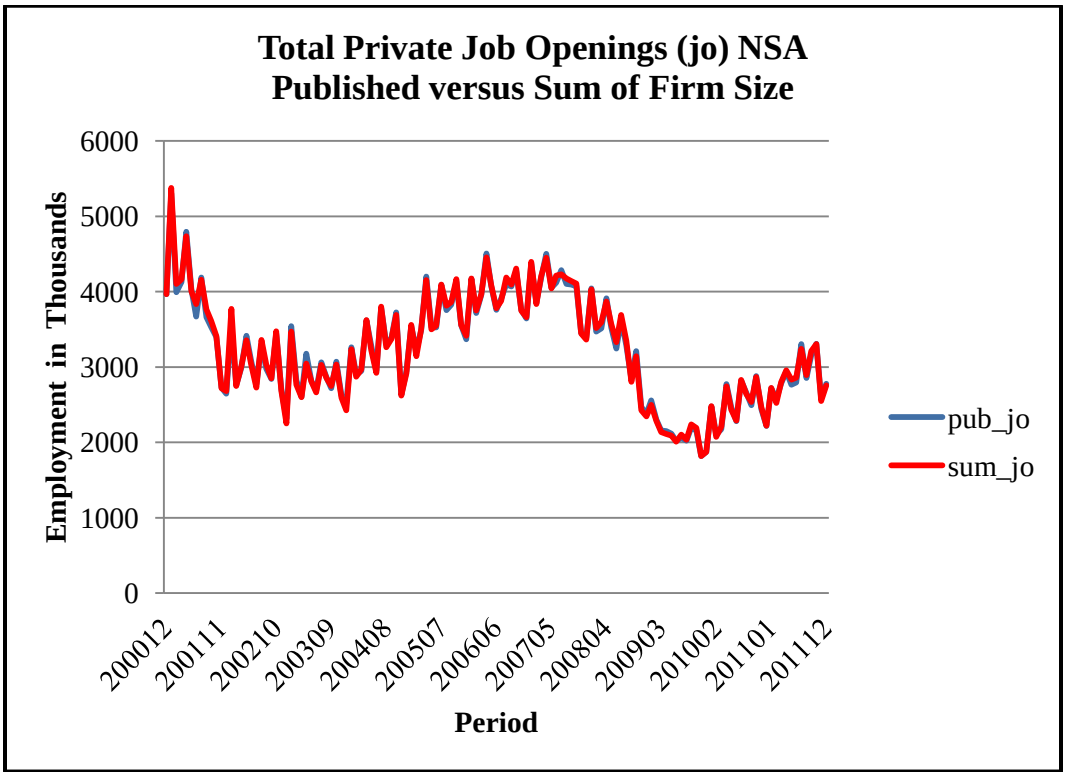
Reliability— Apply the current procedures at the ID/firm size level.

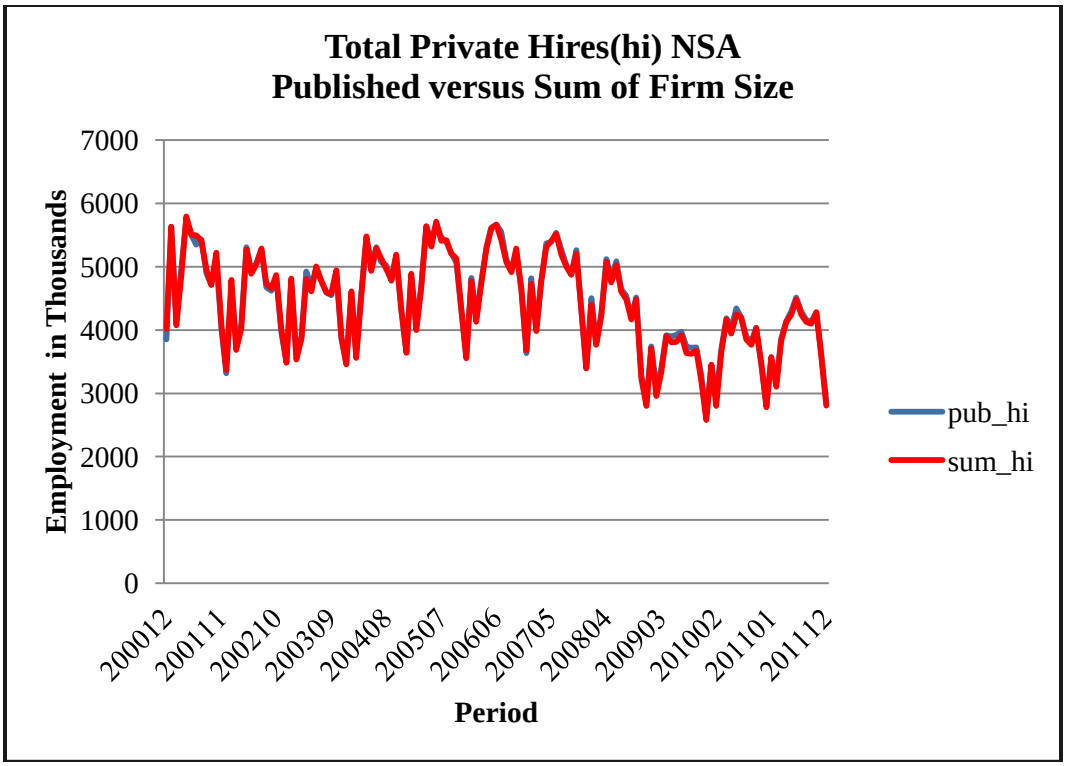
Publishability— Apply the current procedures at ID/firm size level.

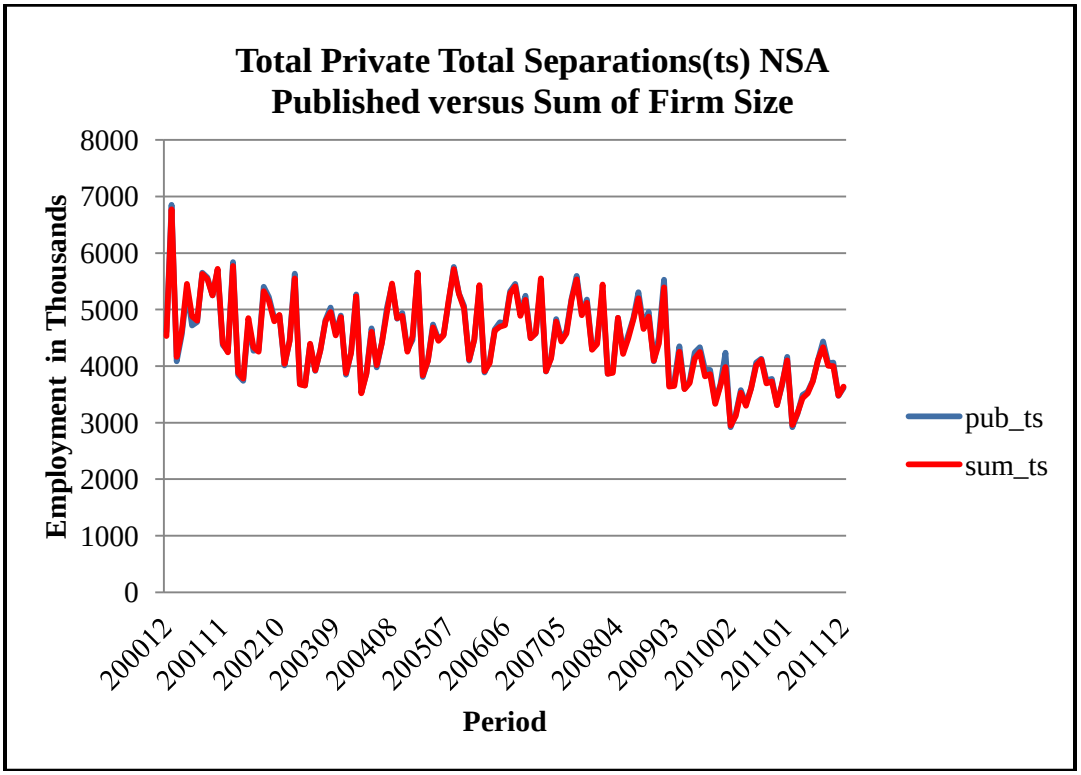
Annual Revisions— The research series are based on the annually benchmarked CES industry sector employment estimates.

5. Results and comparisons with published estimates

The graphs below show the comparisons of JOLTS published estimates versus the summed firm size job openings, hires, and total separations for total private industry. The published and sum of firm size for total private level are almost overlapping, showing little variation between the two estimates.




Total Private Hires(hi) NSA
Published versus Sum of Firm Size
Employment in Thousands
7000
6000
5000
4000
3000
2000
1000
0
200012
200111
200210
200309
200408
200507
200606
200705
200804
200903
201002
201101
201112
Period
pub_hi
sum_hi


Total Private Total Separations(ts) NSA
Published versus Sum of Firm Size
Employment in Thousands
8000
7000
6000
5000
4000
3000
2000
1000
0
200012
200111
200210
200309
200408
200507
200606
200705
200804
200903
201002
201101
201112
Period
pub_ts
sum_ts

6. Summary, conclusions, and future work

The estimates derived from the sum of the three firm size classes, compare well to the JOLTS published not seasonally adjusted (NSA) estimates with slight variations. The summed firm sizes emulate the published estimates during the economic cycles.

For a more detailed and in depth analysis along with graphs refer to Katherine Bauer Klemmer's paper on *"Analysis of JOLTS Research Estimates by Size of Firm"* (presented in the same session as this paper). BLS expects to release firm size estimates in the future.

The CES has also developed experimental ID/firm size estimates. A future research project is to determine whether JOLTS should benchmark to CES current ID/firm size employment or to the ratios based on the average of last 4 quarters of LDB.

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