JOLTS Item Imputation using Historical JOLTS data

Mark Crankshaw

Bureau of Labor Statistics

2024 FCSM Research and Policy Conference

October 24, 2024

College Park, MD

Disclaimer: The views expressed are those of the author and do not reflect the views of the Bureau of Labor Statistics.

JOLTS

- Job Opening and Labor Turnover Survey (JOLTS)
- Sample Survey of US businesses
- Frame: BLS Quarterly Census of Employment & Wages
- Sample Size: ~21,000 business establishments
- Since Dec 2000
- Historical Response Rate: 55%
- Item Response Rate: ~90%

Job Openings and Labor Turnover Report

U.S. Department of Labor

Bureau of Labor Statistics, JOLTS DCC, 61 Forsyth Street SW, Rm 7T50, Atlanta, GA 30303 / *Phone:* (800) 341-4620 / *FAX:* (800) 876-2815 / www.bls.gov

BLS Form No. BLS-1411-C1
OMB No. 1220-0170

Your reporting number is:

Need help with this form?
Call 1-800-341-4620.

1 **This form requests information about job openings and employee turnover at:**
COUNTY:

UI: in

2 **Please check all that apply: Employees are paid**
☐ each week ☐ every two weeks ☐ twice a month ☐ once a month ☐ other

3 **Please provide data for the time period indicated for each item. Enter "0" if none. Enter "NA" if data are not available. See the back of this page for explanations of the terms below.**

	EMPLOYMENT	JOB OPENINGS	HIRES	SEPARATIONS		
	Number of full- or part-time employees who worked or received pay for the pay period that includes the 12th of the month	A job is open if it meets **all three conditions**: • A specific position exists • Work could start *within 30 days* • You are actively seeking workers from outside this location to fill the position	A hire is any addition to your payroll, and: • May be a new hire or a previously separated rehire • May be permanent, short-term, or seasonal • May be a recall from layoff	**Quits** (Except retirements)	**Layoffs and Discharges** • Layoffs • Discharges • Terminations of permanent, short-term, or seasonal employees	**Other** • Retirements • Transfers from this location • Employee disability • Deaths
Report for month of:	**A** **Total Employment** *for the pay period that includes the 12th of the month*	**B** **Number of Job Openings** *on the last business day of the month*	**C** **Hires and Recalls** *for the entire month*	**D** **Quits**	**E** **Layoffs and Discharges**	**F** **Other Separations**
				------ *for the entire month* -----		

IMPORTANT
This form requests information about employees *on your payroll* at the location shown in Section 1 on the front of this page. Please follow these instructions as you prepare your information.

Column A
Total Employment
for the pay period that includes the 12th of the month.
Report all persons on your payroll who worked or received pay for the pay period that includes the 12th of the month.

INCLUDE:
- Full-time and part-time employees
- Permanent, short-term, and seasonal employees
- Salaried and hourly workers
- Employees on paid vacation or other paid leave

DO NOT INCLUDE:
- Proprietors and partners of unincorporated businesses
- Unpaid family workers
- Employees on strike for the entire pay period
- Employees on leave without pay for the entire pay period
- Employees of temporary help agencies, employee leasing companies, outside contractors, or consultants. (These employees will be counted by their employer of record.)

Column B
Job Openings
on the last business day of the month.
Report all positions that are open (not filled) on the last business day of the month. A job is open only if it meets **all three** of these conditions:
- A specific position exists and there is work available for that position. The position can be full-time or part-time, and it can be permanent, short-term, or seasonal, **and**
- The job could start *within 30 days*, whether or not you find a suitable candidate during that time, **and**
- You are *actively recruiting* workers from *outside* the location shown in Section 1 on the front of this page

What is active recruiting? Active recruiting means your establishment is taking steps to fill a position. It may include advertising in newspapers, on television, or on radio; posting Internet notices; posting "help wanted" signs; networking or making "word of mouth" announcements; accepting applications; interviewing candidates; contacting employment agencies; or soliciting employees at job fairs, state or local employment offices, or similar sources.

DO NOT INCLUDE:
- Positions open only to internal transfers, promotions or demotions, or recall from layoffs
- Openings for positions with start dates more than 30 days in the future
- Positions for which employees have been hired, but the employees have not yet reported for work
- Positions to be filled by employees of temporary help agencies, employee leasing companies, outside contractors, or consultants

Column C
Hires and Recalls
for the entire month.
Report all additions to your payroll during the month.

INCLUDE:
- Newly hired and rehired employees
- Full-time and part-time employees
- Permanent, short-term, and seasonal employees
- Employees who were recalled to a job at this location following a layoff (formal suspension from pay status) lasting more than 7 days
- On-call or intermittent employees who returned to work after having been formally separated
- Workers who were hired and separated during the month
- Transfers from other locations

DO NOT INCLUDE:
- Transfers or promotions within this location
- Employees returning from strike
- Employees of temporary help agencies, employee leasing companies, outside contractors, or consultants

Columns D, E, and F
Separations
for the entire month.
Report all separations from your payroll during the month. Report by type of separation.

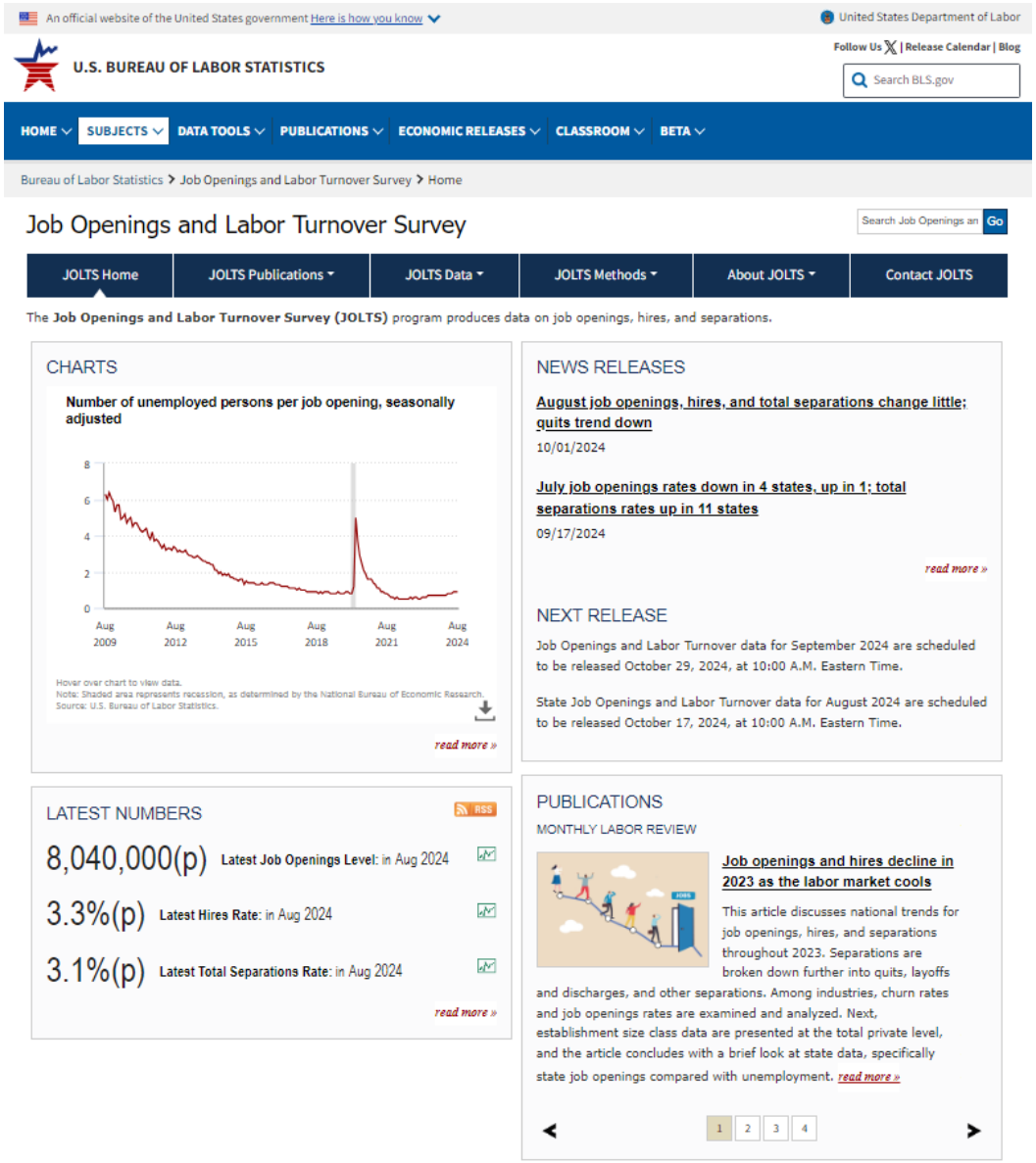
- **Column D, Quits:** Employees who left voluntarily. Exception: Report retirements or transfers to other locations with Other Separations in Column F.
- **Column E, Layoffs and Discharges:** Involuntary separations initiated by the employer, including:
  - Layoffs with no intent to rehire
  - Layoffs (formal suspensions from pay status) lasting or expected to last more than 7 days. (If the employee was later recalled, also include in the Hires column.)
  - Discharges resulting from mergers, downsizing, or closings
  - Firings or other discharges for cause
  - Terminations of permanent or short-term employees
  - Terminations of seasonal employees (whether or not they are expected to return next season)
- **Column F, Other Separations:** Retirements; transfers to other locations; separations due to employee disability; deaths.

DO NOT INCLUDE:
- Transfers within this location
- Employees on strike
- Employees of temporary help agencies, employee leasing companies, outside contractors, or consultants

JOB OPENINGS

EMPLOYEE HIRES

EMPLOYEE SEPARATIONS



Publish:

- Job Opening Rate
- Hires Rate
- Quits Rate
- L & D Rate
- Other Sep Rate
- Total Sep Rate

- Monthly Estimates

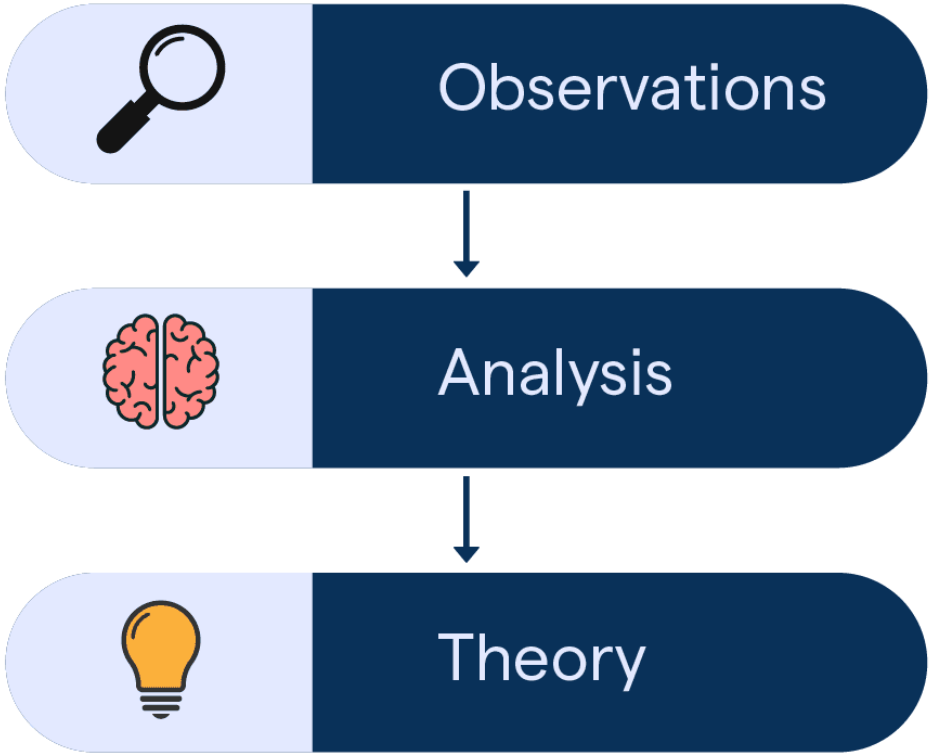
- Rates relative to CES Employment

Item Imputation

EMP	JO	H	Q	LD	OS	TS
82	2	2	1	0	0	1
9	NA	NA	NA	NA	NA	NA
51	2	0	0	0	0	0
NRESP						
NRESP						
42	0	1	1	2	0	3
43	0	NA	1	0	0	1
16	1	5	1	0	0	1
10	NA	4	3	0	1	4
99	2	NA	0	1	0	1

NRESP	Unit Non-Respondent
NA	Item Non-Respondent

Inductive Reasoning

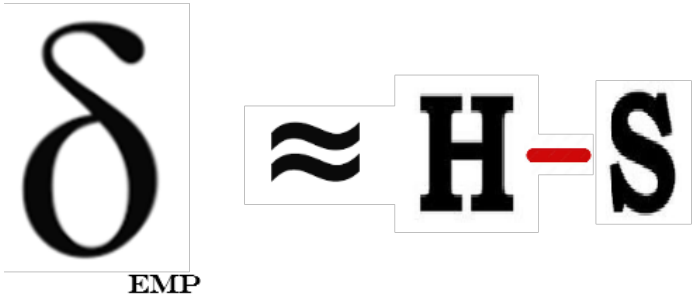


Employment Change drives JOLTS

Employment Change

$$\delta_{EMP} \approx H - S$$

Employment Change

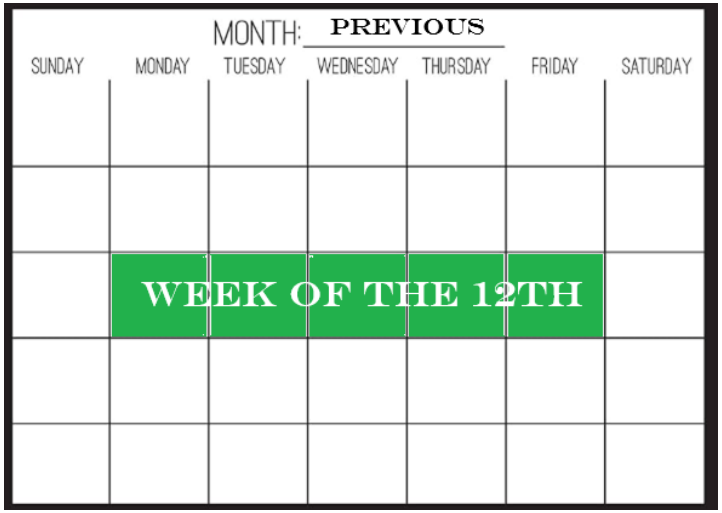


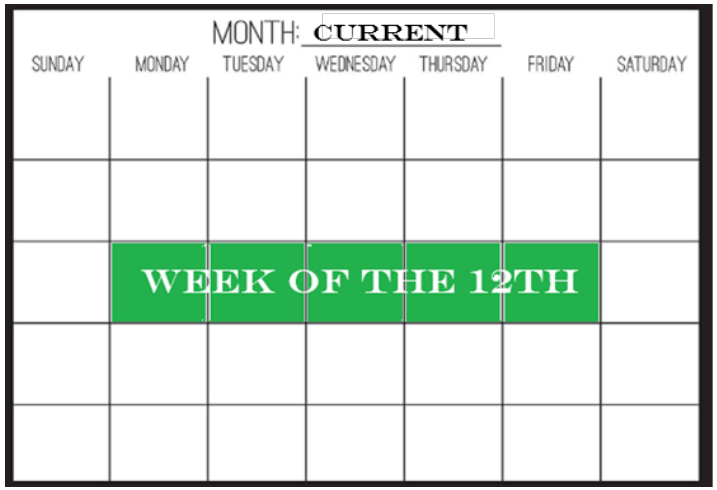
Implied Employment Change

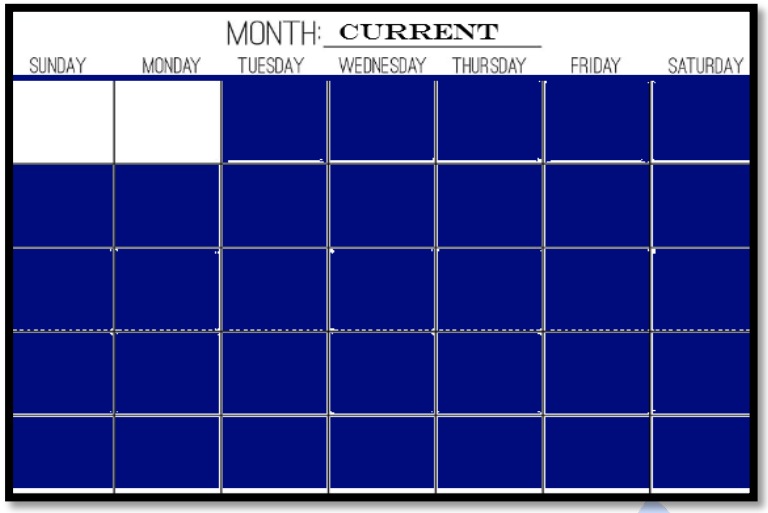
$$H - S$$

δ_{EMP}

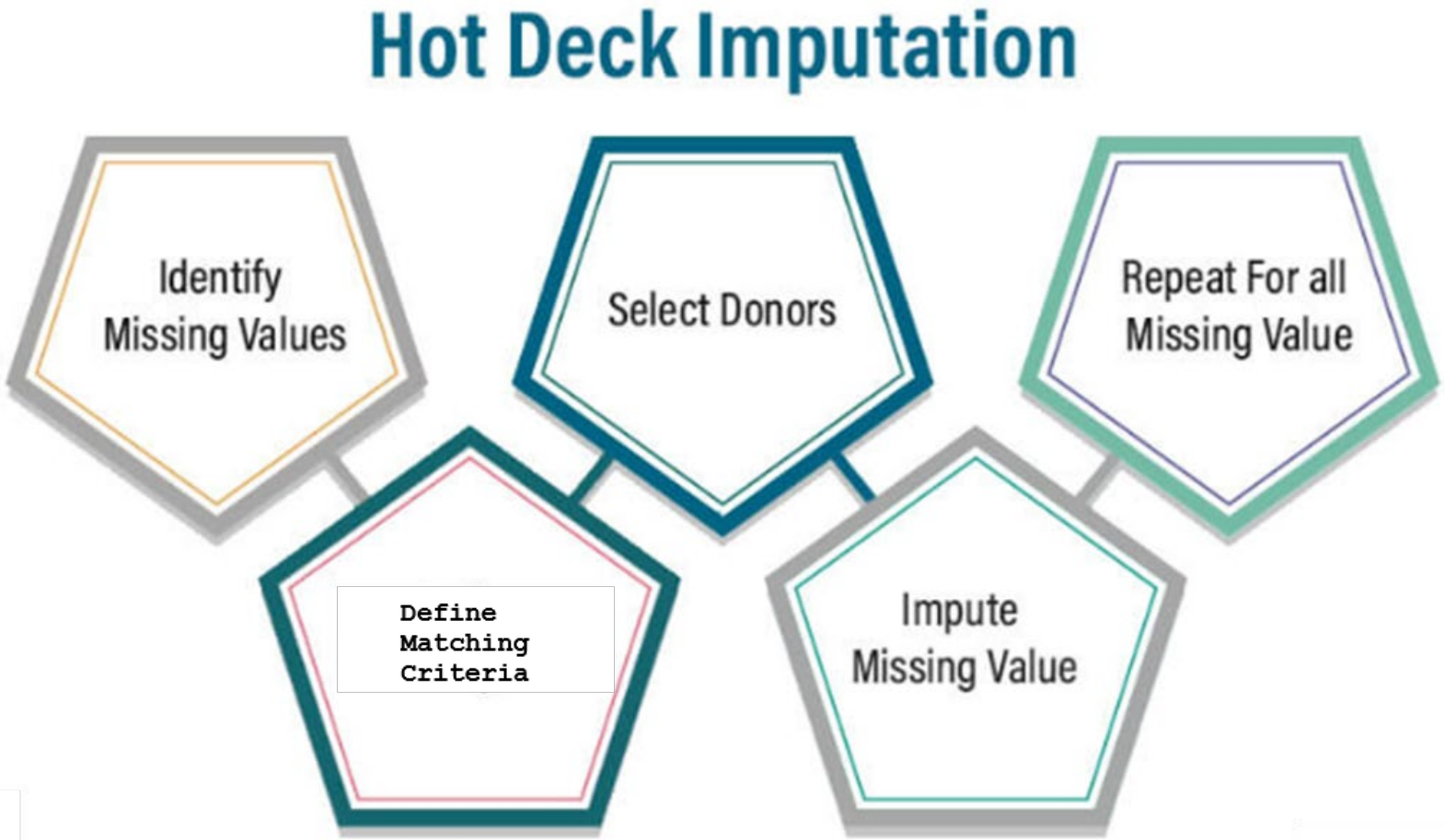
$H - S$

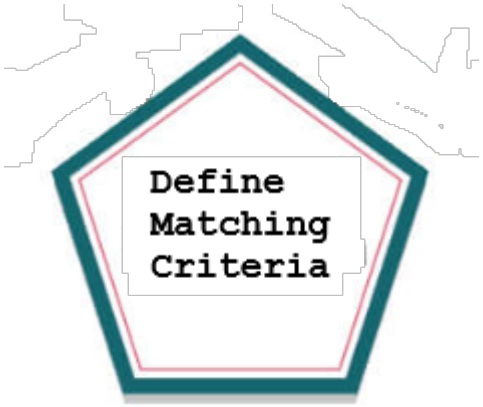

MONTH: PREVIOUS
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
WEEK OF THE 12TH


MONTH: CURRENT
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
WEEK OF THE 12TH


MONTH: CURRENT
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY

JOLTS Imputation History





Problem	Matching Criteria
	Nearest Current Employment
	Sub Optimal

Employment Change

$$\delta_{EMP} \approx H - S$$

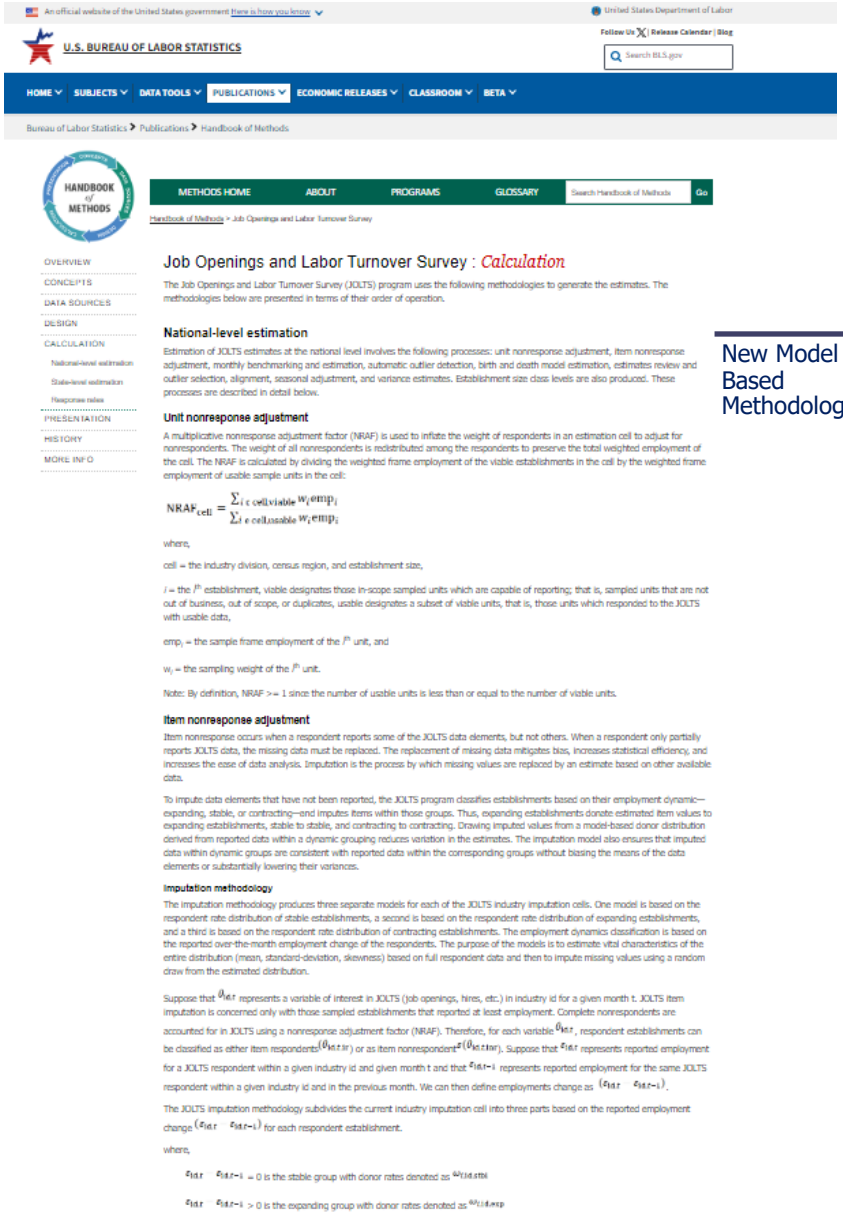
$$\delta_{EMP} = Emp_t - Emp_{t-1}$$

Emp_{t-1}

$$Emp_{t-1}$$

Current Employment Statistics (CES)

- Item Imputation added to CES-JOLTS Divergence



U.S. BUREAU OF LABOR STATISTICS

HOME | SUBJECTS | DATA TOOLS | PUBLICATIONS | ECONOMIC RELEASES | CLASSROOM | BETA

Bureau of Labor Statistics > Publications > Handbook of Methods

HANDBOOK of METHODS

METHODS HOME | ABOUT | PROGRAMS | GLOSSARY | Search Handbook of Methods | Go

Handbook of Methods > Job Openings and Labor Turnover Survey

OVERVIEW
CONCEPTS
DATA SOURCES
DESIGN
CALCULATION
National-level estimation
State-level estimation
Response rates
PRESENTATION
HISTORY
MORE INFO

Job Openings and Labor Turnover Survey : *Calculation*

The Job Openings and Labor Turnover Survey (JOLTS) program uses the following methodologies to generate the estimates. The methodologies below are presented in terms of their order of operation.

National-level estimation

Estimation of JOLTS estimates at the national level involves the following processes: unit nonresponse adjustment, item nonresponse adjustment, monthly benchmarking and estimation, automatic outlier detection, birth and death model estimation, estimates review and outlier selection, alignment, seasonal adjustment, and variance estimates. Establishment size class levels are also produced. These processes are described in detail below.

Unit nonresponse adjustment

A multiplicative nonresponse adjustment factor (NRAF) is used to inflate the weight of respondents in an estimation cell to adjust for nonrespondents. The weight of all nonrespondents is redistributed among the respondents to preserve the total weighted employment of the cell. The NRAF is calculated by dividing the weighted frame employment of the viable establishments in the cell by the weighted frame employment of usable sample units in the cell:

$$\mathrm{NRAF}_{\mathrm{cell}} = \frac{\sum_{i \in \mathrm{cell,viable}} w_i \mathrm{emp}_i}{\sum_{i \in \mathrm{cell,usable}} w_i \mathrm{emp}_i}$$

where,

cell = the industry division, census region, and establishment size,

i = the i^{th} establishment, viable designates those in-scope sampled units which are capable of reporting; that is, sampled units that are not out of business, out of scope, or duplicates, usable designates a subset of viable units, that is, those units which responded to the JOLTS with usable data,

emp_i = the sample frame employment of the i^{th} unit, and

w_i = the sampling weight of the i^{th} unit.

Note: By definition, NRAF >= 1 since the number of usable units is less than or equal to the number of viable units.

Item nonresponse adjustment

Item nonresponse occurs when a respondent reports some of the JOLTS data elements, but not others. When a respondent only partially reports JOLTS data, the missing data must be replaced. The replacement of missing data mitigates bias, increases statistical efficiency, and increases the ease of data analysis. Imputation is the process by which missing values are replaced by an estimate based on other available data.

To impute data elements that have not been reported, the JOLTS program classifies establishments based on their employment dynamic—expanding, stable, or contracting—and imputes items within those groups. Thus, expanding establishments donate estimated item values to expanding establishments, stable to stable, and contracting to contracting. Drawing imputed values from a model-based donor distribution derived from reported data within a dynamic grouping reduces variation in the estimates. The imputation model also ensures that imputed data within dynamic groups are consistent with reported data within the corresponding groups without biasing the means of the data elements or substantially lowering their variances.

Imputation methodology

The imputation methodology produces three separate models for each of the JOLTS industry imputation cells. One model is based on the respondent rate distribution of stable establishments, a second is based on the respondent rate distribution of expanding establishments, and a third is based on the respondent rate distribution of contracting establishments. The employment dynamics classification is based on the reported over-the-month employment change of the respondents. The purpose of the models is to estimate vital characteristics of the entire distribution (mean, standard-deviation, skewness) based on full respondent data and then to impute missing values using a random draw from the estimated distribution.

Suppose that $\theta_{i,s,t}$ represents a variable of interest in JOLTS (job openings, hires, etc.) in industry id for a given month t. JOLTS item imputation is concerned only with those sampled establishments that reported at least employment. Complete nonrespondents are accounted for in JOLTS using a nonresponse adjustment factor (NRAF). Therefore, for each variable $\theta_{i,s,t}$, respondent establishments can be classified as either item respondents ($\theta_{i,s,t \in r}$) or as item nonrespondents ($\theta_{i,s,t \in nr}$). Suppose that $e_{i,s,t}$ represents reported employment for a JOLTS respondent within a given industry id and given month t and that $e_{i,s,t-1}$ represents reported employment for the same JOLTS respondent within a given industry id and in the previous month. We can then define employments change as $(e_{i,s,t} - e_{i,s,t-1})$.

The JOLTS imputation methodology subdivides the current industry imputation cell into three parts based on the reported employment change $(e_{i,s,t} - e_{i,s,t-1})$ for each respondent establishment.

where,

$e_{i,s,t} - e_{i,s,t-1} = 0$ is the stable group with donor rates denoted as $\omega_{i,s,t,stbl}$

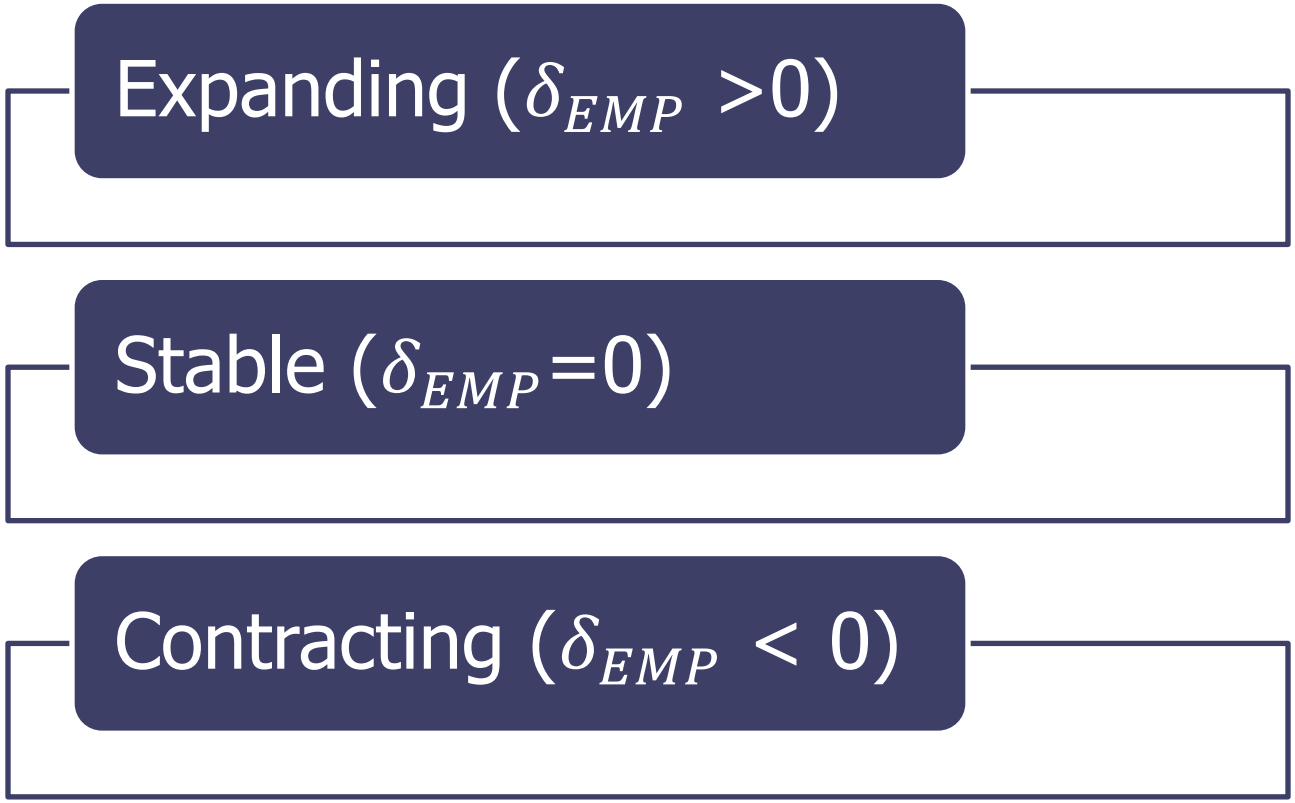
$e_{i,s,t} - e_{i,s,t-1} > 0$ is the expanding group with donor rates denoted as $\omega_{i,s,t,exp}$

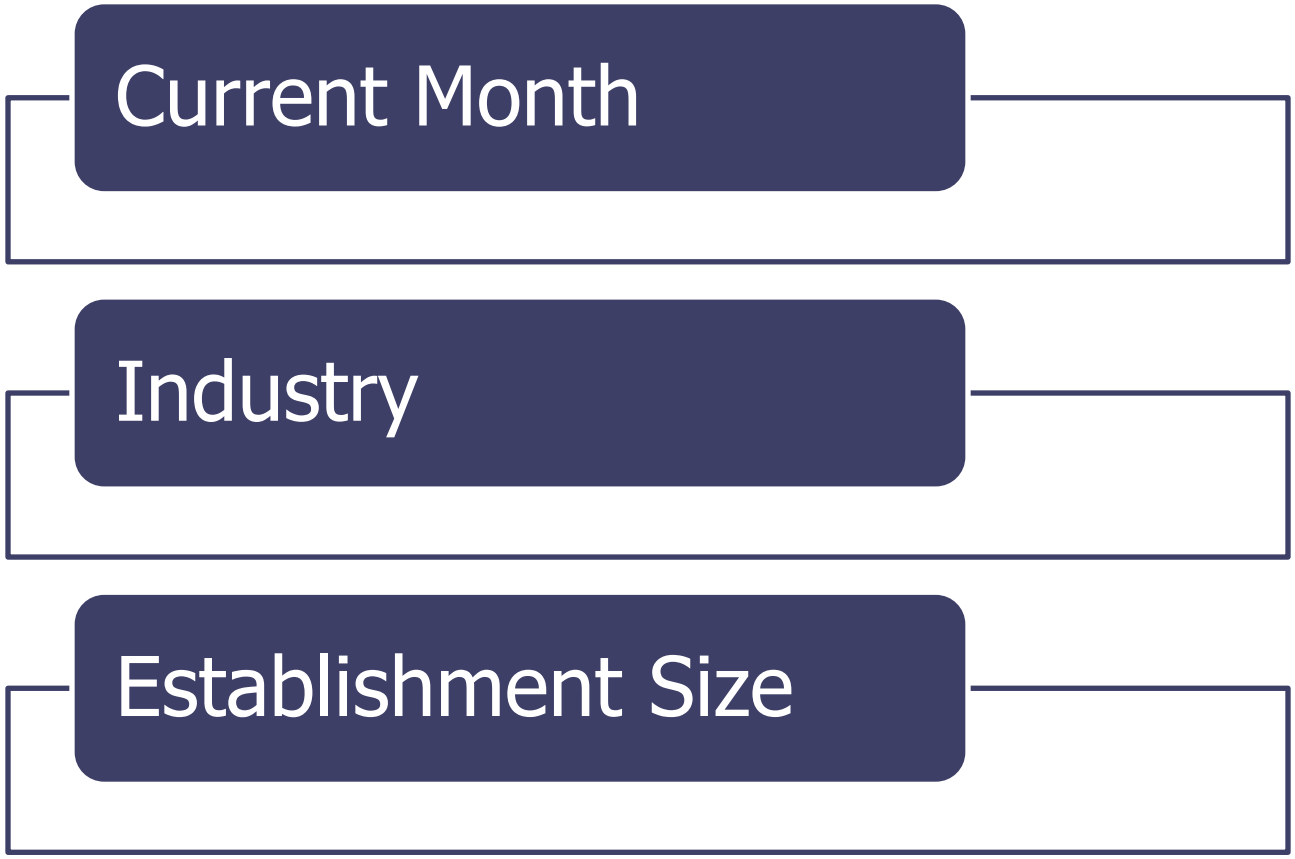
New Model Based Methodology

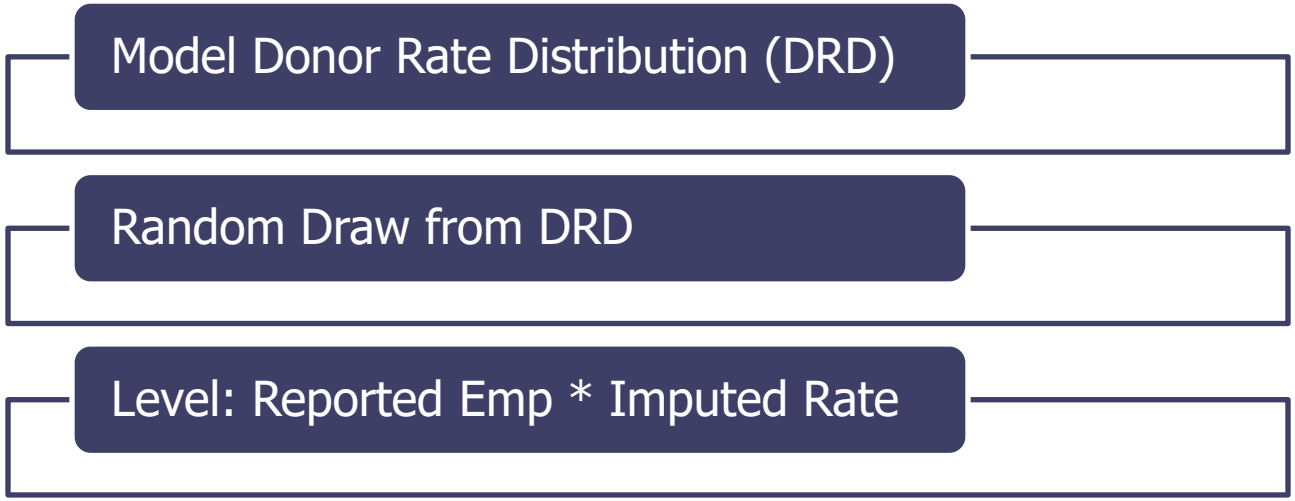
Model donor rates

Based on Employment Change

2018


Expanding (δ_{EMP} >0)
Stable (δ_{EMP}=0)
Contracting (δ_{EMP} < 0)


Current Month
Industry
Establishment Size


Model Donor Rate Distribution (DRD)
Random Draw from DRD
Level: Reported Emp * Imputed Rate

Better

New Model Based Methodology

- Reduced Imputation Contribution to CES-JOLTS Divergence
- Reduced burden on JOLTS program office

Limitations

Using only current month data is limiting

Limitations

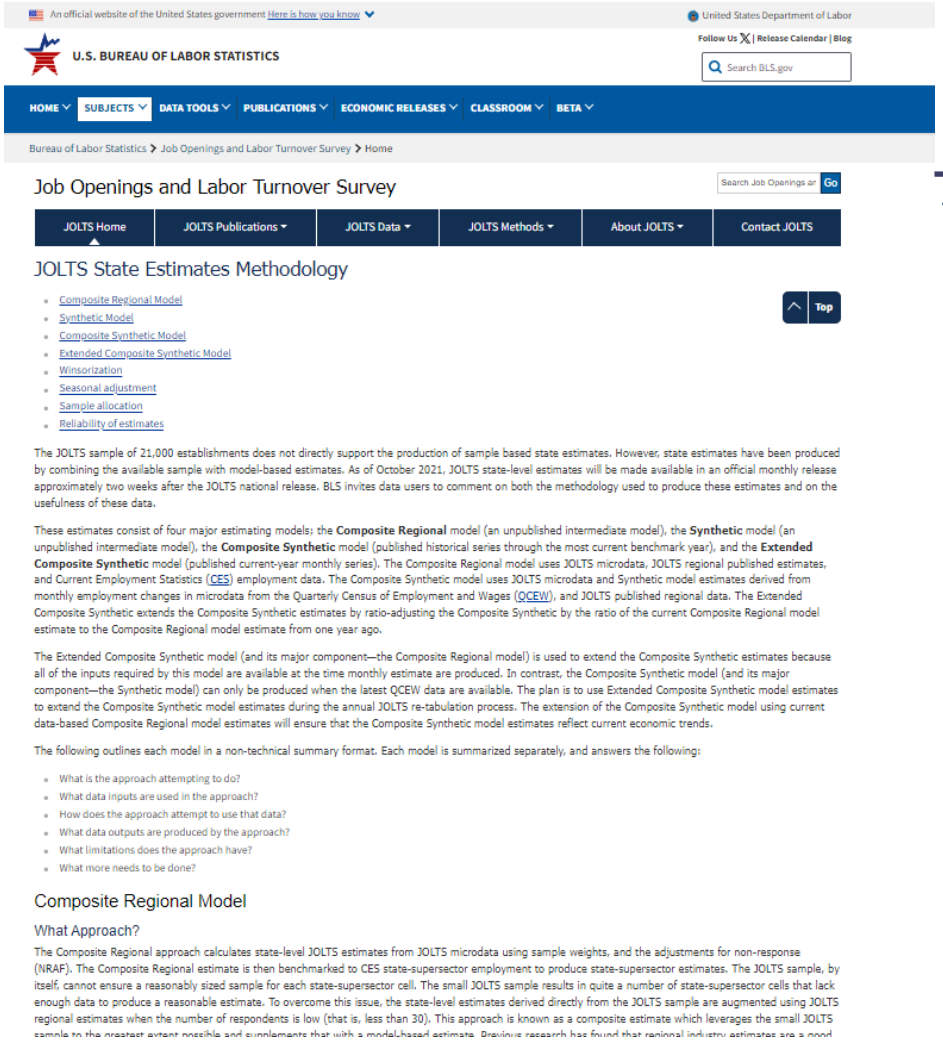
Little Data in each imputation cell

High Variance

Distributional Skew

Asymmetrical

Meanwhile…



An official website of the United States government Here is how you know

United States Department of Labor

U.S. BUREAU OF LABOR STATISTICS

Follow Us | Release Calendar | Blog

Search BLS.gov

HOME | SUBJECTS | DATA TOOLS | PUBLICATIONS | ECONOMIC RELEASES | CLASSROOM | BETA

Bureau of Labor Statistics > Job Openings and Labor Turnover Survey > Home

Job Openings and Labor Turnover Survey

Search Job Openings ar Go

JOLTS Home | JOLTS Publications | JOLTS Data | JOLTS Methods | About JOLTS | Contact JOLTS

JOLTS State Estimates Methodology

Top

- Composite Regional Model
- Synthetic Model
- Composite Synthetic Model
- Extended Composite Synthetic Model
- Winsorization
- Seasonal adjustment
- Sample allocation
- Reliability of estimates

The JOLTS sample of 21,000 establishments does not directly support the production of sample based state estimates. However, state estimates have been produced by combining the available sample with model-based estimates. As of October 2021, JOLTS state-level estimates will be made available in an official monthly release approximately two weeks after the JOLTS national release. BLS invites data users to comment on both the methodology used to produce these estimates and on the usefulness of these data.

These estimates consist of four major estimating models: the **Composite Regional** model (an unpublished intermediate model), the **Synthetic** model (an unpublished intermediate model), the **Composite Synthetic** model (published historical series through the most current benchmark year), and the **Extended Composite Synthetic** model (published current-year monthly series). The Composite Regional model uses JOLTS microdata, JOLTS regional published estimates, and Current Employment Statistics (CES) employment data. The Composite Synthetic model uses JOLTS microdata and Synthetic model estimates derived from monthly employment changes in microdata from the Quarterly Census of Employment and Wages (QCEW), and JOLTS published regional data. The Extended Composite Synthetic extends the Composite Synthetic estimates by ratio-adjusting the Composite Synthetic by the ratio of the current Composite Regional model estimate to the Composite Regional model estimate from one year ago.

The Extended Composite Synthetic model (and its major component—the Composite Regional model) is used to extend the Composite Synthetic estimates because all of the inputs required by this model are available at the time monthly estimate are produced. In contrast, the Composite Synthetic model (and its major component—the Synthetic model) can only be produced when the latest QCEW data are available. The plan is to use Extended Composite Synthetic model estimates to extend the Composite Synthetic model estimates during the annual JOLTS re-tabulation process. The extension of the Composite Synthetic model using current data-based Composite Regional model estimates will ensure that the Composite Synthetic model estimates reflect current economic trends.

The following outlines each model in a non-technical summary format. Each model is summarized separately, and answers the following:

- What is the approach attempting to do?
- What data inputs are used in the approach?
- How does the approach attempt to use that data?
- What data outputs are produced by the approach?
- What limitations does the approach have?
- What more needs to be done?

Composite Regional Model

What Approach?

The Composite Regional approach calculates state-level JOLTS estimates from JOLTS microdata using sample weights, and the adjustments for non-response (NRAF). The Composite Regional estimate is then benchmarked to CES state-supersector employment to produce state-supersector estimates. The JOLTS sample, by itself, cannot ensure a reasonably sized sample for each state-supersector cell. The small JOLTS sample results in quite a number of state-supersector cells that lack enough data to produce a reasonable estimate. To overcome this issue, the state-level estimates derived directly from the JOLTS sample are augmented using JOLTS regional estimates when the number of respondents is low (that is, less than 30). This approach is known as a composite estimate which leverages the small JOLTS

JOLTS State Estimation	Model Based (since 2018)

Impute JOLTS data for entire QCEW data using monthly QCEW employment change along with JOLTS Historical data

Ratio adjust model estimates at regional level

(imputed JOLTS/estimated JOLTS)

JOINT POINT AND VARIANCE ESTIMATION UNDER A HIERARCHICAL BAYESIAN MODEL FOR SURVEY COUNT DATA* September, 2023

BY TERRANCE D. SAVITSKY[1,a], JULIE GERSHUNSKAYA[2,b] AND MARK CRANKSHAW[2,c]

[1]*Office of Survey Methods Research, U.S. Bureau of Labor Statistics,* [a]*Savitsky.Terrance@bls.gov*

[2]*OEUS Statistical Methods Division, U.S. Bureau of Labor Statistics,* [b]*Gershunskaya.Julie@bls.gov;* [c]*Crankshaw.Mark@bls.gov*

We propose a novel Bayesian framework for the joint modeling of survey point and variance estimates for count data. The approach incorporates an induced prior distribution on the modeled true variance that sets it equal to the generating variance of the point estimate, a key property more readily achieved for continuous data response type models. Our count data model formulation allows the input of domains at multiple resolutions (e.g., states, regions, nation) and simultaneously benchmarks modeled estimates at higher resolutions (e.g., states) to those at lower resolutions (e.g., regions) in a fashion that borrows more strength to sharpen our domain estimates at higher resolutions. We conduct a simulation study that generates a population of units within domains to produce ground truth statistics to compare to direct and modeled estimates performed on samples taken from the population where we show improved reductions in error across domains. The model is applied to the job openings variable and other data items published in the Job Openings and Labor Turnover Survey administered by the U.S. Bureau of Labor Statistics.

1. Introduction. Count data response variables are commonly measured by government surveys; for example, the American Community Survey administered by the U.S. Census Bureau counts the population below a poverty threshold for household domains indexed by geography (e.g., census tracts). The U.S. Census Bureau administer the Consumer Expenditures surveys of consumer units (independent households) for the U.S. Bureau of Labor Statistics (BLS) that include count variables related to local and regional locations of the consumer units. BLS administers surveys and a census instrument of business establishments related to total employment and its components (e.g., job openings, hires, separations).

As with surveys conducted for continuous data response types, surveys that include count data responses aggregate respondent-level counts, such as total employment for a business establishment respondent, to a collection of domains (such as state-by-industry classification) and produce both a point estimate and an estimated variance statistic for each domain. Small domain estimation models for the continuous response type that jointly model the point estimates and the estimated variances for the domains exist within both frequentist and Bayesian frameworks; see, for example, Maiti et al. (2014) and Sugasawa et al. (2017). These models borrow strength from the underlying correlations among the domain estimates to provide de-noised model-based estimators that are

arXiv: math.PR/0000000

*U.S. Bureau of Labor Statistics, 2 Massachusetts Ave. N.E, Washington, D.C. 20212 USA

Keywords and phrases: Bayesian hierarchical models, Small Area Estimation, Count data, Stan.

JOLTS State Estimation

Bayesian (QCEW model prior, posterior informed by reported JOLTS data

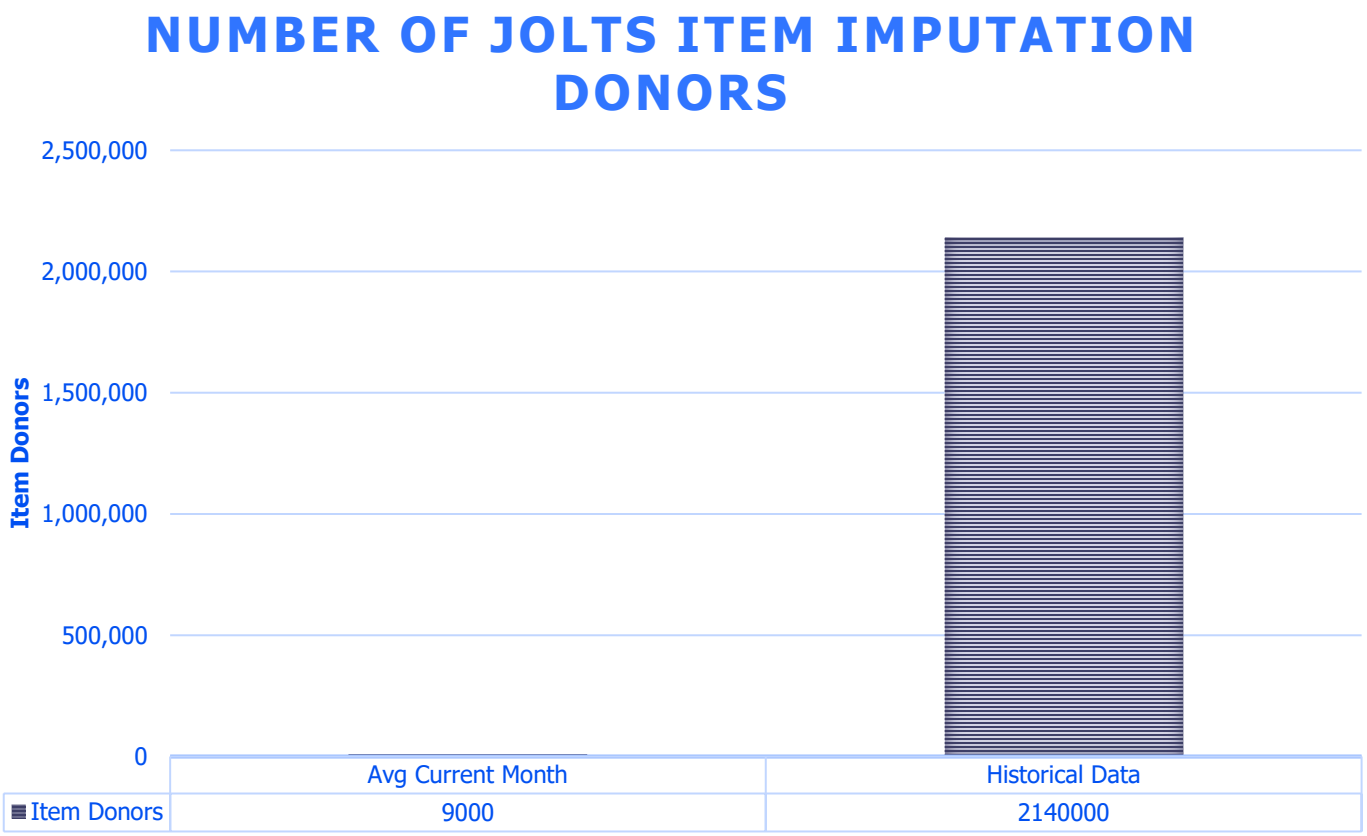
Terrance Savitsky, Julie Gershunskaya

https://www.bls.gov/osmr/research-papers/2023/pdf/st230090.pdf

JOLTS Item Imputation

If we can impute QCEW records using employment change and historical JOLTS data, why could we not impute JOLTS data using historical JOLTS data?

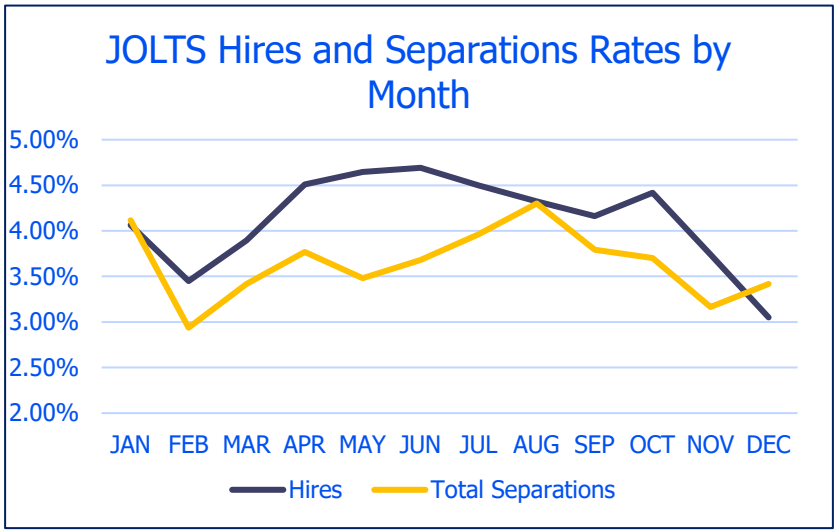
MOTIVATION

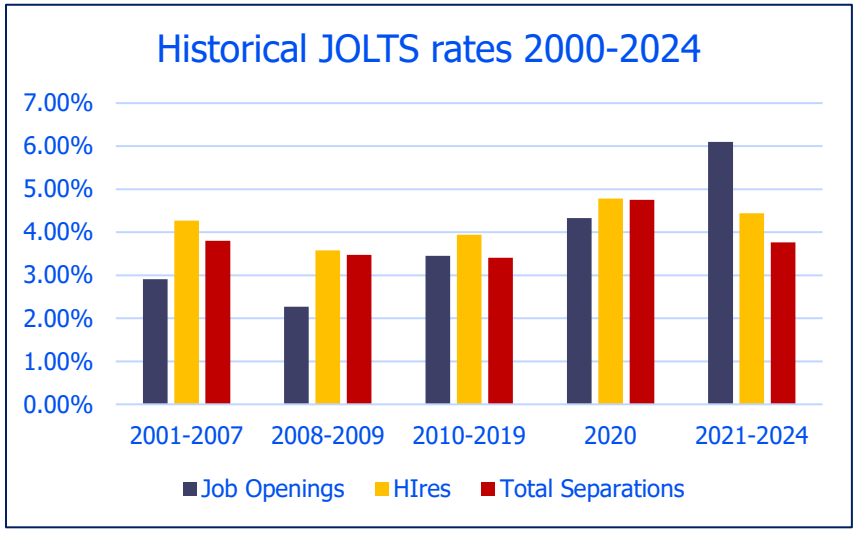

NUMBER OF JOLTS ITEM IMPUTATION DONORS
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Item Donors
Avg Current Month
Historical Data
Item Donors
9000
2140000

Hurdles to Using Historical Data

Hurdles	Current data reflects current seasonality and business cycle effects
	Historical data does not
	How to tailor imputed values based upon historical data to reflect current seasonality and business cycle effects

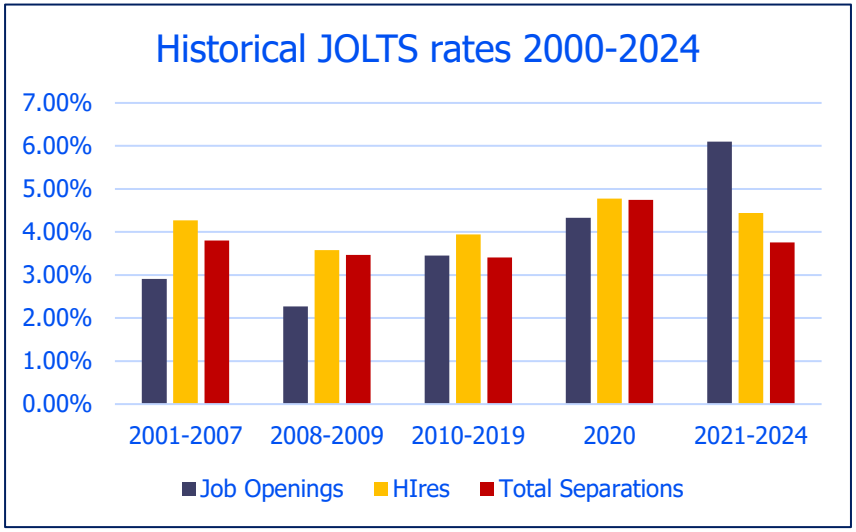
JOLTS Seasonality and Business Cycle Effects





Solution

- Impute for item-respondents (time t)
- Each item respondent: imputed, reported values
- Sum imputed values for each JOLTS variable (t)
- Sum reported values for each JOLTS variable (t)
- Calculate ratio (R) of imputed to reported (t)
- Impute (I) for item-non-respondents (t)
- R * I

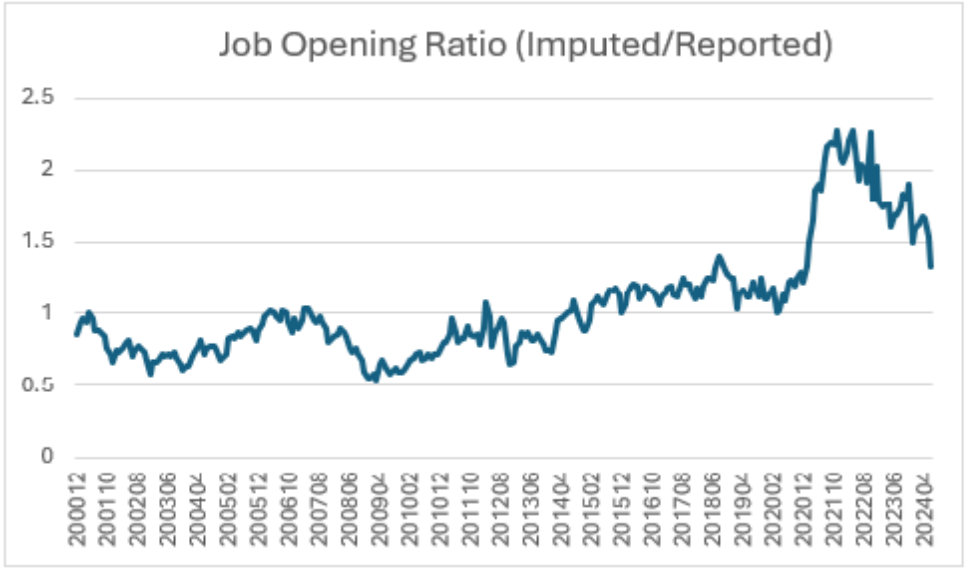


Ratio of Imputed to Reported

Ratio ~ 1 when current mean nears historical mean

Ratio > 1 when current mean above historical mean

Ratio < 1 when current mean below historical mean



PERIOD	%JOR
OVERALL	3.62
2001-2007	2.92
2008-2009	2.27
2010-2019	3.45
2020	4.28
2021-2024	6.10

Item Imputation using JOLTS Historical Data

Classify	All historical item reporters by classification scheme used in State QCEW model (2 million +)

Classification Scheme

Employment change (EC) classification

Contracting Records	Classification
emp Δ less than -50	C5
emp Δ [-30 to -50]	C4
emp Δ [-10 to -30)	C3
emp Δ [-2 to -10)	C2
emp Δ (0 to -2)	C1

Stable Records	Classification
emp Δ =0	S

Contracting Records	Classification
emp Δ (0 to 2)	E1
emp Δ [2,-10)	E2
emp Δ [10,30)	E3
emp Δ [30,50)	E4
emp Δ greater than 50	E5

No over-the-month employment Records	Classification
emp Δ unknown (didn't respond consecutively)	NA

Reported Employment size (SIZE) classification

	Classification
Small	$emp_t < 250$
Medium	$250 <= emp_t <= 1000$
Large	$emp_t > 1000$

Industry (ID) classification

NAICS Super-sector	Classification
21	Mining & Natural Resources
23	Construction
31	Non-durable Manufacturing
33	Durable Manufacturing
42	Wholesale Trade
44	Retail Trade
48	Warehousing TTU
51	Information
52	Finance
53	Real Estate
54	Professional Services
56	Temp Help
61	Private Educational Services
62	Health & Social Assistance
71	Arts & Entertainment
72	Recreation & Food Services
81	Other Services
91	Federal Government
92	State & Local Education
93	State & Local Non-Education

Classification Scheme

Classification

~2.1 million historical item reporters

Classified into 720 imputation cells

(11 x 3 x 20)

JOLTS Data by Employment Change

EMP Change	N	JOR	HR	QR	LDR	OSR	TSR	H-S
ALL	2,141,794	3.28%	1.94%	0.90%	0.67%	0.20%	1.77%	0.16%
ec <-50	43,061	2.89%	1.56%	1.05%	1.42%	0.32%	2.79%	-1.22%
-30 <ec <=-50	22,808	3.06%	1.35%	0.91%	0.71%	0.24%	1.86%	-0.52%
-10 < ec <=-30	82,089	3.21%	1.35%	0.93%	0.64%	0.23%	1.80%	-0.45%
-2 < ec <=-10	261,643	3.15%	1.40%	1.02%	0.56%	0.21%	1.80%	-0.39%
0 < ec <=-2	176,663	2.96%	1.42%	1.06%	0.50%	0.20%	1.77%	-0.34%
ec=0	959,221	2.48%	1.31%	0.77%	0.44%	0.14%	1.35%	-0.05%
0 < ec <= 2	173,059	3.03%	1.88%	0.90%	0.42%	0.15%	1.47%	0.41%
2 < ec <= 10	262,126	3.44%	2.02%	0.90%	0.41%	0.16%	1.47%	0.55%
10 < ec <= 30	87,106	3.70%	2.00%	0.83%	0.39%	0.16%	1.38%	0.62%
30 < ec <= 50	24,736	3.77%	2.04%	0.80%	0.38%	0.16%	1.34%	0.70%
ec > 50	49,282	3.49%	2.83%	0.79%	0.51%	0.16%	1.46%	1.37%

Benefit of using Historical Data

- Rather than 3 categories there are now 11
- Current imputation gets 'direction' but not 'magnitude' effect
- Using historical data gets both

Summarize

- For each of the 720 imputation cells (ic) and for all 6 JOLTS variables calculate:
  - $(\bar{x}_{v,ic}, s_{v,ic})$ for each v,ic

Current Item Respondents

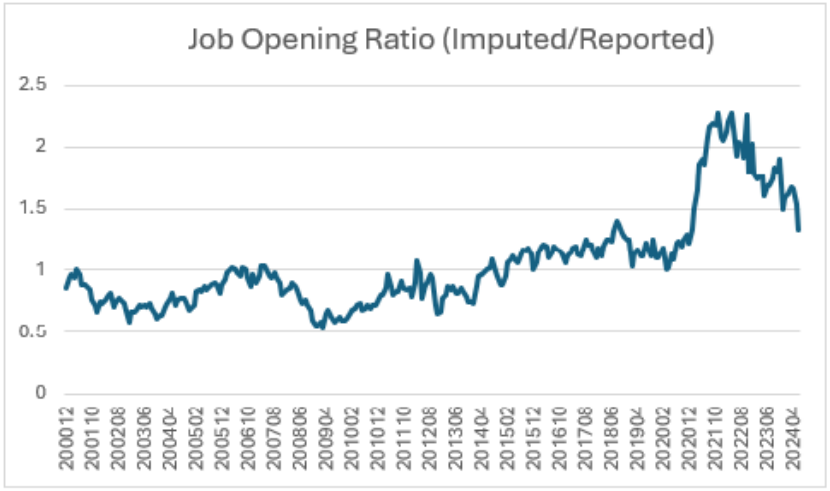
- Imputed Value= Reported Employment * $\bar{x}_{v,ic}$
- Each Item respondent now has
  - Reported Value
  - Imputed Value

Calculate Ratio

- For each JOLTS variable (v)
  - Calculate weighted sum of imputed values
  - Calculate weighted sum of reported values
  - Weight = sample weight

Calculate Ratio

- For each JOLTS variable (v)
  - Calculate weighted sum of imputed values (WSI)
  - Calculate weighted sum of reported values (WSR)
  - Weight = sample weight



PERIOD	%JOR
OVERALL	3.62
2001-2007	2.92
2008-2009	2.27
2010-2019	3.45
2020	4.28
2021-2024	6.10

Ratio	Ratio (R) of WSI to WSR
	Will be used when imputing item non-respondents
	Each month, one R for each JOLTS variable

Current Item Non-Respondents

- Classify Item Non-respondents like Item Respondents
- Imputed Value= draw from $N(\bar{x}_{v,ic}, s_{v,ic})^* R_{v,t}$
- If $N(\bar{x}_{v,ic}, s_{v,ic}) < 0$, then $N(\bar{x}_{v,ic}, s_{v,ic}) = 0$.
  - Since JOLTS rates can not be less than 0

Incremental Improvement

- Using $R_{v,t}$ allows historical data derived imputed values to:
  - Have the positive attributes of using only current data
    - Seasonality
    - Business Cycle effects
  - Uses massively more data than with using only current data
    - Reduces variance of imputed values
    - Finer gradation of employment change
      - Gets at 'direction' AND 'magnitude'

Thanks


감사합니다
Natick
Grazie
Danke
Ευχαριστίες
Dalu
Obrigado
Thank You
Köszönöm
Tack
Спасибо
Dank
Gracias
谢谢
Merci
Seé
ありがとう

JOLTS Item Imputation using Historical JOLTS data

Mark Crankshaw
Bureau of Labor Statistics
2024 FCSM Research and Policy Conference
October 24, 2024
College Park, MD