

Creating State Specific Occupational Replacement Rates

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Washington state projection process

- We produce industry and occupational projections annually for 2, 5 and 10 years for Washington state and 12 Workforce Development Areas (WDAs).
- Last year, we used our projections with alternative rates as the basis for the Occupations in Demand (OID) list.

Washington state projection process (continued)

- The OID list supports the unemployment insurance Training Benefits (TB) program.
- The Washington State Employment Security Department (ESD) also uses the list to determine eligibility for a variety of training and support programs.
- The OID list is supplemented by current supply-demand data.

Realistic replacement rates are critical

- Replacement openings create the majority of job openings nationwide and statewide.
- States' specific economic conditions determine actual replacements.
- Net replacement rates used previously significantly undercut the numbers of openings and are unrealistic.
- The newer separation rates do not represent total openings and are not state specific.

Basic idea

- Use wage files (quarterly unemployment insurance tax returns) to identify replacements and separations within industries.
- Use occupational/industry matrices (staffing patterns) to transfer industry rates to occupations.

Note: All calculations for this report (including employment projections) were produced using open source R software.

Pre-processing wage files

- Delete non-valid records.
- Set limits for quarterly work hours between 100 and 1,000. For each SSN, total hours must be less than 1,000.
- Set limits for hourly wages between \$8.00 and \$1,000.
- We used only one record for each SSN in each quarter. We selected the record with the largest number of work hours and defined it the primary job.

Alternative rates

For each sequential pair of wage files, w_t and w_{t+1} , the following characteristics are defined for each industry – the industries of the primary job of the SSNs.

1. For our 2017 projections,

$w_t = 2014Q4$, and $w_{t+1} = 2015Q4$.

2. Base jobs – number of records in an industry in w_t .

Alternative rates

(continued)

3. Lost jobs – number of jobs that moved out of an industry. Records in w_t but not in w_{t+1} .
4. New jobs – number of jobs that moved into an industry. Records in w_{t+1} but not in w_t .
5. Moved-out cross industry matrix – aggregation by originating industries.
6. Moved-in cross industry matrix – aggregation by receiving industries.

Alternative rates

(continued)

7. Industry moves – number of jobs (workers) changing employers but remaining within an industry.
8. Separations = \min (new jobs, lost jobs)
9. Transfers = Moved-in + Industry moves
10. Total replacements = Separations + Transfers

Alternative rates

(continued)

11. Industry replacement rates (IRR)

$$\text{IRR} = \frac{\text{Total replacements}}{\text{Base employment}}$$

Converting industry (IR) to occupation replacements (OR)

- We convert industry replacements to occupations based on the staffing patterns of the occupational/industry matrices.
- In other words, we used occupational shares within an industry – all occupational shares sum to one within each industry.
- For occupational projections, we aggregated the results by industry control total (ICT) codes with base employment in 2014Q4.

Steps for converting IR to OR

1. Aggregate base industry employment, separations, transfers and total replacements to ICT levels.
2. Match aggregated file with staffing patterns file based on ICT codes.
3. Multiply all industry employment, in the new matched file, by shares from occupational/industry matrices.

Steps for converting IR to OR

(continued)

4. Aggregate results by occupational (SOC) codes.
5. Calculate occupational ratios of separations, transfers and total replacements by dividing corresponding values by base employment.

Comparison of different replacement rates

We compared different replacement rates during the 2017 projection cycle using Washington state results.

Definitions:

- Survival time for specific occupations or jobs represents the expected time a worker stays employed in that occupation (job).

Comparison of different replacement rates

(continued)

- Average survival time in years (AST):

$$AST = \frac{1}{\text{Annual replacement rate}}$$

Comparison of different replacement rate methods

Results of simple average of occupational average survival time (ASTs) – years – among all occupations.

	Prior net replacement rate (NRR)	New national separation rate (SR)	Washington state alternative rates (WAar)
Simple average of occupational ASTs (years)	52.15	11.52	3.98

Comparison of different replacement rate methods (continued)

Other findings:

- National net replacement rate (NRR):
 - AST_{NRR} of 45 occupations was more than 100 years – largest was more than 288 years.
- Examples of AST_{NRR} averages:
 - Register Nurses: 42.38 years
 - Computer Hardware Engineers: 48.67 years
 - Computer Programmers: 40.59 years

Comparison of different replacement rate methods (continued)

- New national separation rate (SR):
 - AST_{SR} of 15 occupations was more than 30 years – all within the category of Healthcare Practitioners and Technical Occupations.
- Washington state alternative rate (WAar):
 - Only 10 occupations had an AST_{WAar} of more than eight years – the majority of these within the category of Aerospace and Material Engineering.
 - For computer-related occupations the AST_{WAar} was four years.

Comparison of replacement, separation and alternative rates

Washington state occupational forecasts, 2015-2025

2-digit SOC code	2-digit SOC title	Estimated employment 2015	Estimated employment 2025	Average annual openings due to alternative replacement rates	Ratio separations to replacement	Ratio alternative to separations
00-0000	Totals	3,586,032	4,185,024	1,186,072	4.63	2.86
11-0000	Management	201,435	241,251	62,357	3.26	3.83
13-0000	Business and financial operations	216,364	258,769	62,245	4.33	3.1
15-0000	Computer and mathematical	168,887	233,354	53,047	4.13	4.25
17-0000	Architecture and engineering	84,757	86,391	17,676	2.68	3.13
19-0000	Life, physical and social science	38,477	45,056	9,606	3.17	2.52
21-0000	Community and social service	59,766	68,084	16,437	4.69	2.53

Comparison of replacement, separation and alternative rates (continued)

Washington state occupational forecasts, 2015-2025

2-digit SOC code	2-digit SOC title	Estimated employment 2015	Estimated employment 2025	Average annual openings due to alternative replacement rates	Ratio separations to replacement	Ratio alternative to separations
23-0000	Legal	28,208	31,777	7,008	3.16	4.3
25-0000	Education, training and library	216,241	261,135	48,283	4.02	2.27
27-0000	Arts, design, entertainment, sports and media	67,708	81,995	22,470	4.09	3.06
29-0000	Healthcare practitioners and technical	167,820	206,639	49,502	2.31	5.29
31-0000	Healthcare support	89,055	108,580	33,071	5.48	2.93
33-0000	Protective service	62,807	72,725	16,518	4.6	2.27
35-0000	Food preparation and serving related	285,348	324,620	123,260	4.63	2.34
37-0000	Building and grounds cleaning and maintenance	116,668	139,247	46,505	6.19	2.92

Comparison of replacement, separation and alternative rates (continued)

Washington state occupational forecasts, 2015-2025

2-digit SOC code	2-digit SOC title	Estimated employment 2015	Estimated employment 2025	Average annual openings due to alternative replacement rates	Ratio separations to replacement	Ratio alternative to separations
39-0000	Personal care and service	149,252	179,994	61,450	7	2.59
41-0000	Sales and related	343,304	383,724	117,860	4.63	2.46
43-0000	Office and administrative support	449,756	512,329	141,337	5.29	2.7
45-0000	Farming, fishing and forestry	93,779	103,178	39,272	5.71	2.69
47-0000	Construction and extraction	199,456	252,989	90,587	6.28	4.25
49-0000	Installation, maintenance and repair	130,739	144,138	41,715	3.88	3.35
51-0000	Production	188,916	195,357	49,492	4.97	2.3
53-0000	Transportation and material moving	227,288	253,692	76,375	4.94	2.64

Comparison of annual average survival time for replacement, separation and alternative rates (in years)

Washington state occupational forecasts, 2015-2025

2-digit SOC code	2-digit SOC title	Replacement rates	Separation rates	Alternative rates
00-0000	Totals	43.37	9.38	3.28
11-0000	Management	44.3	13.6	3.5
13-0000	Business and financial operations	51.2	11.83	3.82
15-0000	Computer and mathematical	66.46	16.11	3.79
17-0000	Architecture and engineering	40.64	15.15	4.84
19-0000	Life, physical and social science	34.63	10.94	4.35
21-0000	Community and social service	46.11	9.83	3.89
23-0000	Legal	58.06	18.4	4.28
25-0000	Education, training and library	45.23	11.24	4.94
27-0000	Arts, design, entertainment, sports and media	41.66	10.18	3.33
29-0000	Healthcare practitioners and technical	46.2	20.02	3.78

Comparison of annual average survival time for replacement, separation and alternative rates (in years - continued)

Washington state occupational forecasts, 2015-2025

2-digit SOC code	2-digit SOC title	Replacement rates	Separation rates	Alternative rates
31-0000	Healthcare support	47.94	8.75	2.99
33-0000	Protective service	42.74	9.29	4.1
35-0000	Food preparation and serving related	26.77	5.78	2.47
37-0000	Building and grounds cleaning and maintenance	49.67	8.03	2.75
39-0000	Personal care and service	48.67	6.95	2.68
41-0000	Sales and related occupations	35.16	7.59	3.08
43-0000	Office and administrative support	48.52	9.18	3.4
45-0000	Farming, fishing, and forestry	38.53	6.75	2.51
47-0000	Construction and extraction	66.63	10.6	2.5
49-0000	Installation, maintenance and repair	42.93	11.05	3.29
51-0000	Production	44.42	8.94	3.88
53-0000	Transportation and material moving	41.12	8.33	3.15

How realistic are our numbers?

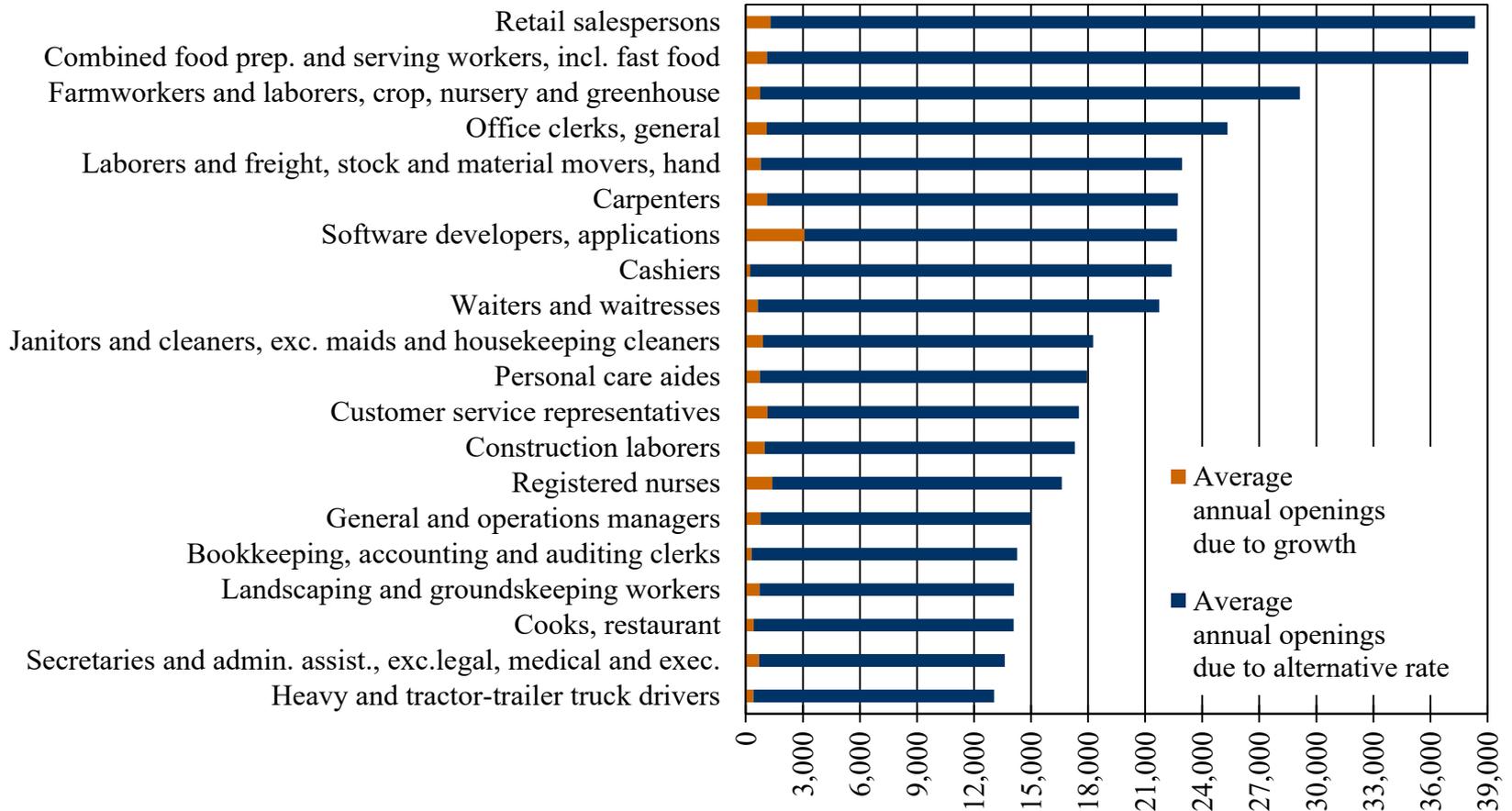
	Projected	HWOL
Total annual openings	1,254,218	872,286
Software developers	22,679	26,964
Computer system analysts	7,183	8,654
Total computer and mathematical occupations	60,107	95,903

JOLT survey: combined percentage of hiring's in *West region* in 2016 was 43.9 percent for total nonfarm employment. Our number was 32.3 percent.

Top 20 specific occupations by average annual total openings, alternative methodology

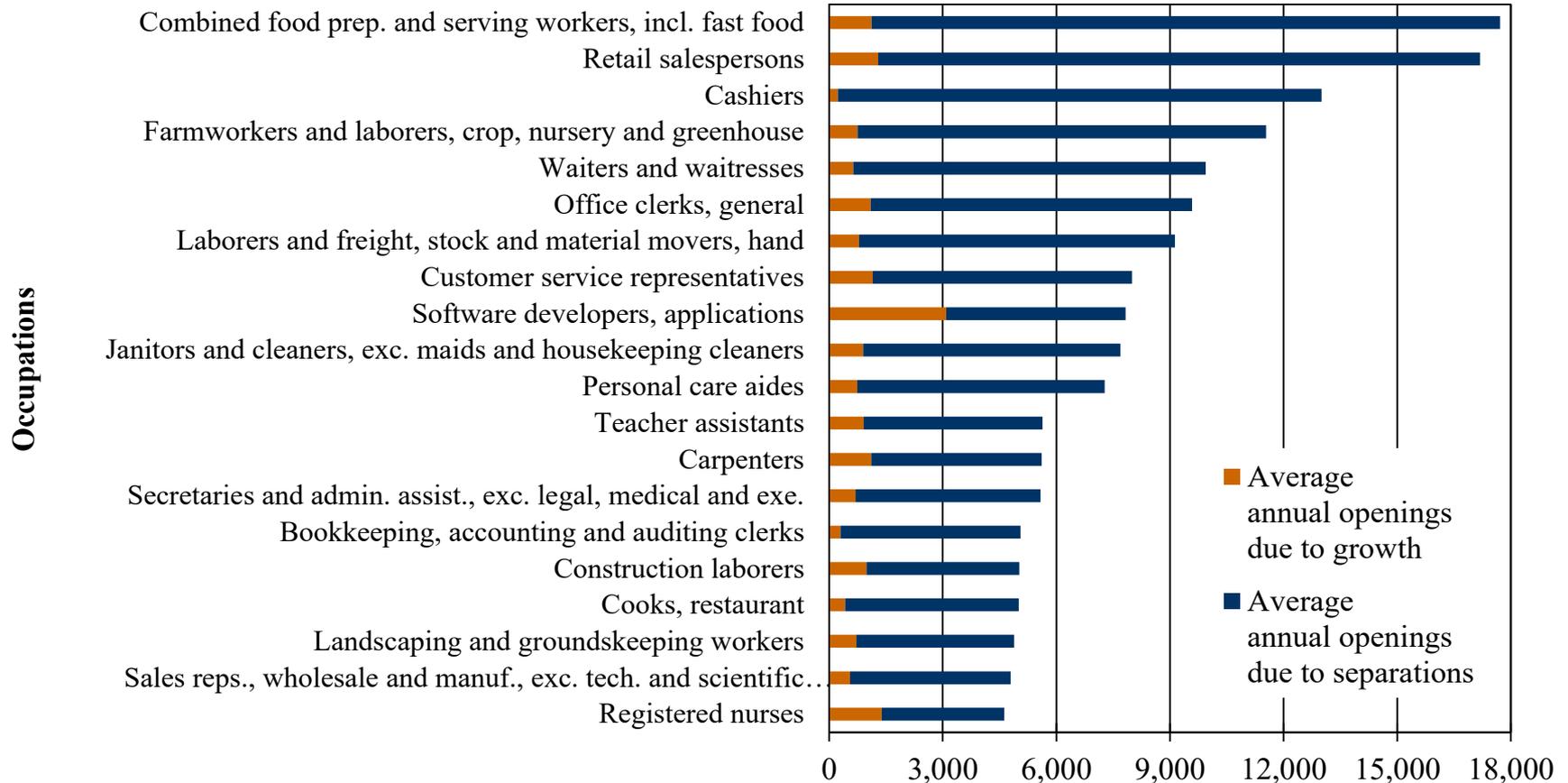
Washington state, 2015-2025

Occupations



Top 20 specific occupations by average annual total openings, separations methodology

Washington State, 2015 to 2025



Pros and Cons

Prior BLS net replacement rates

- Pros – not used anymore.
- Cons – numbers are unrealistic, not intended to represent all job openings, do not reflect state specifics.

Pros and Cons

New national separation rates

- Pros – numbers are realistic and directly based on occupational data; they allow to estimate transitions between occupations.
- Cons – numbers do not reflect total job openings or states' unique structures.

Pros

Alternative state specific rates

- Pros – numbers are realistic, based on solid administrative data, reflect a state's unique structures and represents estimations of total job openings.

Cons

Alternative state specific rates

- Cons – estimations are not directly targeted at occupations, but instead at jobs within occupations. Estimations rely heavily on staffing patterns. They are tied to industries and assume equal rates for all occupations in an industry. Openings cannot be separated into transitions within the same occupation and between occupations.

Possible improvements

- Use wage files with extended time periods.
- More combinations of paired quarters for more stable estimations of annual data. For example, 2014Q4-2015Q4, 2015Q1-2016Q1.
- Use survey data or HWOL.
- Attempt to estimate the variance in turnover rates by occupations within specific industries.

Possible applications

- Could be used for other states.
- A simplified version could be developed based on results from LED data for states.

Contact Information



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