

Chapter V. Estimating Occupational Replacement Needs

Projections of job growth provide valuable insight into future employment opportunities because each new job created is an opening for a worker entering an occupation. However, opportunities also result when workers leave their occupations and need to be replaced. In most occupations, these replacements provide more job openings than employment growth does.

To suit the needs of different users, the Bureau of Labor Statistics (BLS) produces two estimates of replacement needs:

- *Total replacement needs* estimate the number of openings resulting from the flow of workers out of an occupation, without regard to the number of workers entering over the same period. This estimate sometimes is used to identify occupations with high rates of workers departing. Total replacement needs also can be used to roughly approximate the number of openings expected for any reason. However, because experienced workers seeking to reenter the occupation will fill some of those openings, it is not a good measure of opportunities for people seeking to enter the occupation for the first time.
- *Net replacement needs* estimate the number of workers leaving an occupation who will need to be replaced by relatively younger workers. It often is used to approximate openings stemming from retirements and from the need to replace workers who permanently leave an occupation for other reasons. This number added to openings due to job growth roughly estimates opportunities for workers entering an occupation for the first time. And because workers new to an occupation often need training, this estimate may be used to assess the minimum number of workers who will need to be trained for the occupation. Because the estimate is limited to opportunities created by relatively older workers leaving the occupation, it may underestimate openings for new entrants, especially in occupations where many people permanently leave the occupation at younger ages.

Neither of these estimates counts workers who change jobs but remain in the same occupation. There are many openings advertised that would not be included in the estimates because those openings are created by workers switching jobs but staying in the same occupation.

To develop estimates of replacements, BLS used data from the Current Population Survey (CPS), a household survey that collects demographic and employment information about individuals¹. Although the data source was the same for both types of replacement needs estimates, different methods were used. This chapter summarizes the specific methods used to estimate total and net separations and replacements.

¹ CPS data uses occupational codes consistent with the U.S. Census Bureau, but the occupational employment projections use more detailed occupational codes from the 2000 Standard Occupational Classification (SOC) system. To apply CPS data to the occupations in the projections matrix, analysts identified the CPS occupations that were equivalent to, or included in, the detailed SOC occupation.

Developing estimates of total separations and replacements

Total, or gross, separations measure the flow of workers out of an occupation, without regard to those entering it. To estimate the number of workers who changed their occupation over the year, analysts used data from the January 2006 CPS supplement, which asked workers that question directly. To estimate the number of workers who stopped working altogether, monthly survey data from August 2004 to July 2006 were used to match individuals' employment data from one month to the same month the following year².

If employment in an occupation grew or remained the same, the number of separations was equal to the number of workers replaced over the year. If employment declined, however, that decline was subtracted from the number of separations to determine replacements.

Next, the number of replacements was divided by employment in the first year to determine the replacement rate over the year. To estimate future replacement needs, this historical rate was multiplied by projected employment for the midpoint of the 2006–16 decade.

There are limitations to this method of measuring separations and replacements. The CPS is conducted to obtain current data on the labor force status of individuals, rather than to measure changes over time. One limitation, for example, is that since the CPS collects data by household, data cannot be collected on the original individuals in the household if they have moved. Thus, movers are excluded from calculations of total separations, which may bias separations downward since people who move are more likely to have changed occupations or labor force status. Deaths also are excluded, further downward biasing the estimates.

Because the CPS is a sample survey, sampling error also must be considered. Data on total separations for occupations with fewer than 50,000 employees were judged unreliable because of the limited number of observations in the sample. Data for the remaining occupations were examined individually for cases where data appeared unreliable, such as when replacement rates differed greatly from previously developed rates or from the rates of similar occupations. In these cases, analysts used data from proxies: either a related occupation or a summary occupational group.

Developing estimates of net separations and replacements

Estimates of net separations account for the net effect of workers flowing into and out of an occupation as they age. This measure often is used as a rough estimate of opportunities for workers entering an occupation for the first time. Since these workers often need training to enter the occupation, this estimate also represents the minimum number of workers who will need to be trained for an occupation.

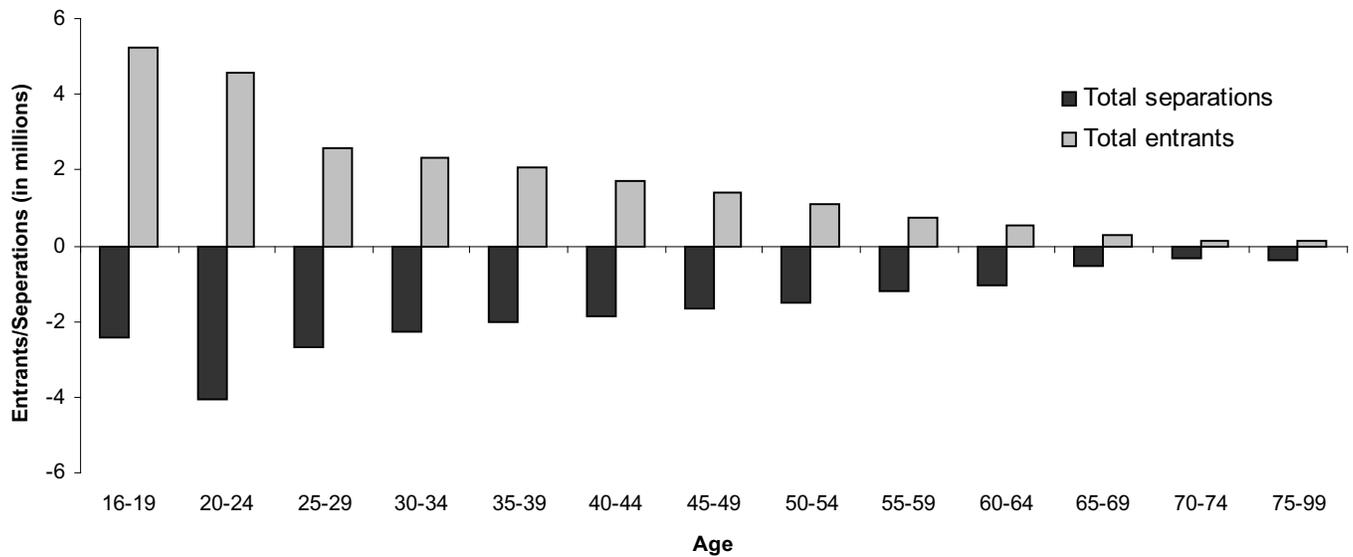
² CPS sample design includes surveying a household for 4 months, not contacting that household for 8 months, and then surveying it again for another 4 months. As a result, half of the sample from an individual year is in the first year of being included, and will be re-contacted the following year.

Figure 1. Total and net occupational entrants and separations

Figure 1 illustrates the differences between total and net separations. For each age group, the figure shows total and net occupational entrants and separations. Most of the younger age groups exhibit an excess of total entrants over total separations as more young people begin working in an occupation than leave the occupation. This excess is referred to as *net entrants*. Likewise, the excess of total separations over total entrants in older age groups is referred to as *net separations*.

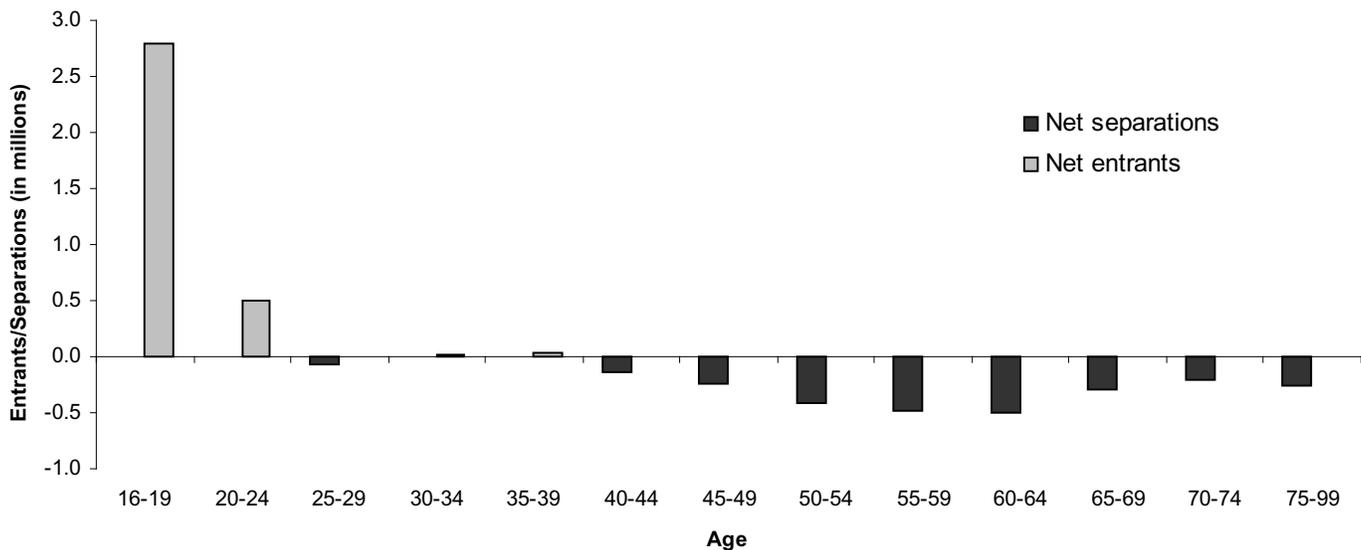
Total separations:

- Occur in all age groups
- Are independent of the total number of entrants
- Identify all of the normal movements out of occupations



Net separations:

- Occur only when total separations exceed total entrants within an age group
- For an occupation, are the sum of separations for each age group
- Exclude information about net entrants



To increase the sample size and reduce cyclical fluctuations, employment data from 5 years (1997, 1998, 1999, 2000, and 2001) were averaged and used as the base year employment³. Similarly, employment data from 2002, 2003, 2004, 2005, and 2006 were averaged and used to represent employment 5 years later. To simplify this discussion, the 1997–2001 averages are referred to as 2001 data, and the 2002–06 averages are referred to as 2006 data.

BLS analysts developed estimates of net separations by comparing the level of occupational employment for 13 different age cohorts at two points in time, 5 years apart. Specifically, in a given occupation, employment data for each age group in 2001 were compared with corresponding data for the group 5 years older in 2006. A decline in employment for an age cohort is a measure of net separations for that cohort, while an increase is a measure of net entrants. For example, the number of registered nurses aged 20 to 24 in 2001 was compared to the number of registered nurses aged 25 to 29 in 2006. (See table V–1) The employment in 2006 was greater, indicating that more individuals aged 20 to 24 in 2001 entered than had left the occupation. Thus, for this age group net separations were recorded as zero. For registered nurses in the cohort aged 50 to 54 in 2001, however, employment declined through 2006, indicating that there were net separations for the group. For each occupation, net separations from each age cohort were summed to develop an estimate of overall net separations for the occupation.

In most occupations, net separations occur only in the older age groups, usually above age 45. This pattern typically reflects retirements. In some occupations, however, net separations happen in younger age groups. A high number of separations of young workers often occurs in occupations that have relatively low entrance requirements and pay relatively low wages. Young workers often take jobs in such occupations while obtaining additional education or training; when these workers qualify for a higher paying occupation, they transfer. Waiters and waitresses are an example of this type of occupation, as shown in table V–1, where net separations occurred for all except the youngest age cohort.

Next, BLS analysts estimated net replacements. Net replacements were equal to net separations unless employment declined between 2001 and 2006. Declines in employment were subtracted from the net separations in groups aged 16–49, because younger workers are more likely to be affected by adverse economic conditions. If the employment decline was greater than those

Table V–1. Net separations for registered nurses and for waiters and waitresses, by age group, 2001–2006

(Numbers in thousands)

2001 employment ¹		2006 employment ²		Net change, 2001–06	Net separations, 2001–06	Separation rate ³ , 2001–06 (percent)
Age	Number	Age	Number			
Registered nurses						
16–99	2,139	—	2,435	296	110	5.2
		16–20	4	4		
16–19	1	21–24	73	71	0	0
20–24	60	25–29	200	140	0	0
25–29	211	30–34	297	86	0	0
30–34	269	35–39	299	30	0	0
35–39	340	40–44	399	59	0	0
40–44	411	45–49	419	8	0	0
45–49	350	50–54	359	9	0	0
50–54	239	55–59	224	–15	15	6.4
55–59	145	60–64	111	–35	35	23.8
60–64	77	65–69	36	–41	41	53.0
65–69	23	70–74	11	–12	12	52.8
70–74	9	75–79	3	–5	5	60.7
75–99	4	80–99	2	–2	2	54.0
Waiters and waitresses						
16–99	1,790	—	1,903	113	500	27.9
		16–20	540	540		
16–19	406	21–24	478	72	0	0
20–24	510	25–29	258	–251	251	49.3
25–29	239	30–34	159	–80	80	33.6
30–34	165	35–39	124	–41	41	24.9
35–39	152	40–44	113	–39	39	25.7
40–44	118	45–49	90	–27	27	23.2
45–49	74	50–54	56	–18	18	24.0
50–54	52	55–59	36	–16	16	31.2
55–59	32	60–64	24	–8	8	24.2
60–64	24	65–69	12	–12	12	49.0
65–69	11	70–74	7	–4	4	35.6
70–74	7	75–79	4	–2	2	35.0
75–99	3	80–99	1	–2	2	64.1

¹ 2001 data are averages of 1997, 1998, 1999, 2000, and 2001.

² 2006 data are averages of 2002, 2003, 2004, 2005, and 2006.

³ Separation rates were calculated by dividing net separations by 2001 employment.

Note: Age group data may not sum to age 16–99 total due to rounding.

separations, the remaining decline was subtracted from the net separations of those aged 50 and over. The resulting age-specific net replacements were divided by 2001 employment in each age group to calculate a historical 5-year net replacement rate for each group.

These historical replacement rates were used to estimate replacement needs during the 2006–16 decade. First, replacement needs for the first 5 years were calculated in each age cohort. Then, that number of people leaving was used to estimate the number of people remaining in the cohort in 2011. Next, that estimate was multiplied by the historical replacement rate to calculate replacement needs for the next 5 years. Finally, the future replacement needs were summed, and future overall replacement rates for each occupation were computed.

³ Data from 1997–99 used 1990 Census codes, while data from 2000 to present uses 2000 Census codes. However, data from 2000–02 were coded on both systems, which made it possible to develop a crosswalk and estimate employment for 1997–99 using the 2000 Census codes. Thus, all analysis is done using 2000 Census codes.

Table V-2. Net replacement data for registered nurses, by age group, 2006-16
(Numbers in thousands)

Age	2006 employment ¹	Net replacements, 2006-11	Net replacement rate, 2001-06 (percent)	Number remaining, 2011	Net replacements, 2011-16	Net replacements, 2006-16	Net replacement rate, 2006-16 (percent)
16-99	2,435	163	5.2	—	239	402	16.5
16-19	2	0	0	0	0	0	—
20-24	75	0	0	2	0	0	—
25-29	200	0	0	75	0	0	—
30-34	297	0	0	200	0	0	—
35-39	299	0	0	297	0	0	—
40-44	399	0	0	299	0	0	—
45-49	419	0	0	399	0	0	—
50-54	359	23	6.4	419	27	50	—
55-59	224	53	23.8	336	80	133	—
60-64	111	59	53	170	90	149	—
65-69	36	19	52.8	52	28	47	—
70-74	11	7	60.7	17	10	17	—
75-99	6	3	54	7	4	7	—

¹ 2006 data are averages of 2002, 2003, 2004, 2005, and 2006.
Note: Age group data may not sum to age 16-99 total due to rounding.

Specifically, net replacement needs were calculated for 2006-11 by multiplying 2006 employment for each age group by its historical replacement rate. The number of workers remaining in 2011 for each age cohort was calculated by subtracting the number of workers from that age cohort who left (assumed to be equal to 2006-11 replacements) from 2006 employment for the age cohort. For example, table V-2 shows the number of workers remaining 2011 for registered nurses aged 55 to 59 to be 336,000. This was calculated by subtracting the 23,000 net replacements in 2006-11 for those aged 50-54 from the 359,000 employed in that age group in 2006. The younger age group was looked at because the 2006 workforce will age by 2011, and so the cohort must be moved forward.

Then, net replacements for 2011-16 were calculated by multiplying the historical replacement rate for each age group by

the number of workers remaining in that age group in 2011. Summing the number of net replacements for each of the 5-year periods, 2006-11 and 2011-16, provided an estimate of net replacements over the 10-year projection period. The 2006-16 net replacement rates were calculated by dividing net replacements for 2006-16 by 2006 employment. Dividing the net replacements for 2006-16 by 10 yielded the annual average net replacement needs.

Just as in the development of total replacements, some estimates

of net replacements used the replacement rates of proxy occupations. For large occupations, the cps data averaged over 5 years provides reliable employment data for each age group. However, for small occupations (fewer than 10,000 workers in 2006), the sample is too small and the net replacement data are unreliable. Data also were deemed unreliable for some other occupations which had larger employment when there was an irregular distribution of net replacements among the age groups or when the net replacement rates were inconsistent with rates for similar occupations.

Table V-3 presents 2005-06 total and projected 2006-16 net replacement rates for OES-based matrix occupations and shows 2006-16 annual average total and net replacement needs. The table notes when proxy occupations were used.

Frequently asked questions about replacement needs

Q. What is the difference between total and net replacement needs?

A. Total replacement needs measure the total number of openings that result from workers leaving the occupation, without regard to the workers who reenter that occupation. Net replacement needs measure the number of relatively older workers who leave an occupation and are replaced by relatively younger workers. Total replacement needs are higher, because they also include openings that may be filled by workers who reenter an occupation after a period of separation and by older workers who are new entrants to the occupation. However, since these scenarios do not create opportunities for younger workers, they are not included in net replacement needs.

Q. How should total and net replacement needs be used?

A. There are many different uses for total and net replacement needs. For example, total replacement needs can be used to study which occupations see more worker turnover and which offer more total openings. Net replacements are often used to learn what job opportunities will be like for future workers, to use in career guidance, and to estimate training needs for future workers.

Q. Why are the estimates of growth and net replacement needs described as providing a minimum measure of training needs?

A. The number of new entrants needed is underestimated due to relatively younger workers permanently leaving an occupation and relatively older workers entering the occupation for the first time. Even if growth and net replacement needs perfectly measured the need for new entrants, training needs would still be underestimated because some people who complete training do not enter the occupation for which they qualify.

Q. Do the 2006–16 projected net replacement needs assume that future labor market behavior will not change from past patterns?

A. Yes, the projected net replacement needs assume workers will continue to retire and otherwise exit an occupation at similar ages as have been observed in the recent past. 2001–06 occupation- and age-specific rates are used in calculating the projected rates. The 2001–06 rates are applied to current occupational age-distribution data to estimate replacement needs for the future. The result is an occupation-specific replacement rate that captures the impact of demographic, but not behavioral, changes.

Q. Are separations the same as replacement needs?

A. In most occupations, yes. If employment declined during the historical period, however, separations will exceed replacement needs by the decline in employment. When employment is declining, not all people who separate from an occupation are replaced.

Q. Should a projected decline in employment be subtracted from replacement needs to estimate job opportunities?

A. No. If employment is projected to decline, the number of opportunities resulting from growth is zero, and replacement needs constitute the only source of opportunities. When employment declines, separations increase both because it is more likely that individuals lose their jobs and, in the case of net separations, because fewer are entering the occupation. Replacement needs already capture these effects by reducing separations by declines in employment. They should not be further reduced by projected employment declines.

Q. If employment is declining rapidly, is it possible for replacement needs to be zero?

A. In the extreme case, yes. For example, assume that, in a limited geographic area, a single firm is the sole employer of tool and die makers. If the firm ceases operations, all tool and die makers in the area will leave the occupation; separations will equal the decline in employment, and there will be no replacement needs. On a national scale, however, a situation like this is highly unlikely because not all areas of the country share the same market conditions.

Q. Are there any data on replacement needs by industry?

A. No, estimates of replacement needs are created only for occupations. The Bureau of Labor Statistics does have a survey that collects data on current job openings and labor turnover by industry. For more information, see the Job Openings and Labor Turnover Survey program Web site: <http://www.bls.gov/jlt/home.htm>. The Bureau also has a program that estimates gross job gains and losses by industry. For more information, see the Business Employment Dynamics program Web site: <http://www.bls.gov/bdm/home.htm>.