The future of jobs for college graduates

College graduates entering the labor force during the 1990-2005 period are projected to encounter increased competition for college-level jobs

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College graduates who enter the labor force in the 1990's and the early 2000's are expected to face a more competitive job market than that encountered by graduates during the 1980's. Employment projections for the 1990–2005 period indicate that the average annual openings in jobs requiring a degree will be fewer than the opportunities available during the 1984–90 period. At the same time, projections of bachelor's degrees by the National Center for Education Statistics (or the Center, hereinafter) indicate that the average annual number awarded is expected to be greater over the 1990–2005 period than for the 1984–90 span.

Bureau of Labor Statistics projections of economic growth, labor force, industry employment, and occupational employment provide the basis for determining future employment growth in jobs requiring college graduates. The Bureau developed three alternative projections reflecting low, moderate, and high growth scenarios that were published in the November 1991 issue of the *Review*. Alternative projections of bachelor's degrees awarded—low, middle, and high—are from the Center, the primary source for data on the supply of college graduates. The discussion in this article focuses on moderate employment growth projections and middle degree projections, and includes a brief discussion of alternative projections for comparison purposes.

Despite the prospect of increased job competition, the majority of college graduates are expected to find college-level jobs. However, under the alternative with moderate employment growth and the middle level projection of degrees awarded, approximately 7 of 10 college graduates joining the labor force during the projected period can expect to enter jobs requiring a college degree, compared with about 8 of 10 over the 1984–90 period. Job market conditions would approximate those of the 1984–90 period only if the high growth employment projections prepared by BLS are realized along with the low level of degree projections prepared by the Center.

Recent college graduates

BLS uses data on educational attainment collected through the Current Population Survey as a starting point to analyze supply and demand for college graduates. Because the CPS identifies workers who have completed 4 or more years of college, not college graduates, the data include some workers who have *not* earned a 4-year college degree, and, consequently, do not technically qualify for jobs that require a degree. Also, the supply and demand analysis, as well as the characterization of the 1990 college labor force, requires some analytical judgments to identify graduates employed in jobs that require a college degree from those in jobs that can be performed with fewer years of education.[1]

Nearly 29 million workers with 4 or more years of college education were in the labor force in 1990. Of that total, more than 23 million, or 80 percent, were employed in jobs traditionally re-

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quiring a 4-year college degree. Nearly half of the 23 million worked in professional specialty occupations, such as engineer, teacher, computer scientist, chemist, and writer. Another 30 percent of the workers in jobs requiring a college degree were employed in executive, administrative, and managerial positions, such as accountant, financial manager, and education administrator. Still another 10 percent worked in sales representative and sales supervisor occupations, and a little more than 5 percent worked as technicians. The remaining 5 percent worked in a variety of other jobs requiring college degrees, but in occupational groups that traditionally do not require a degree, such as blue-collar worker supervisor (from the precision production, craft and repair group); police officer (from the service occupational group); farm manager (farm group); and a variety of jobs from the administrative support occupations. (See table 1.)

In addition, about 5.8 million college graduates were "educationally underutilized," that is, they were employed in positions that usually do not require a college degree or were unemployed at the time of the survey. Some of these underutilized college graduates chose to work in a noncollege-level job. For example, individuals whose primary activity is attending graduate school or attending to family responsibilities may choose, at least for an interim period, to work part time as food service or retail sales workers because of flexibility of hours or proximity to their primary activity. There may also be some college graduates who just prefer these jobs to those requiring a degree. However, a large number of graduates were in jobs that do not require a 4-year degree because they could not find college-level jobs. About 1 college graduate of 5 who entered the labor force between 1984 and 1990 took a job that generally did not require a college degree, such as in retail sales or administrative support and clerical occupations, or were unemployed. But the 1984–90 period was not unique. The proportion of college graduates who were under-utilized has been quite high for nearly two decades.[2]

Table 1. **Distribution of the college graduate labor force status by type of job requiring or not requiring a degree**

College graduate labor force	Number (thousands)	Percent
Total	28,983	100.0
Employed in jobs requiring a degree	23,230	80.2
Professional specialty	11,739	40.5
Executive, administrative, and managerial	6,766	23.3
Sales representatives and supervisors	2,261	7.8
Technicians	1,249	4.3
All other occupations	1,215	4.2
Employed in jobs not requiring a degree	5,065	17.5
Unemployed	688	2.4

NOTE: Data are for those who completed 4 or more years of college as reported in the Current Population Survey.

Jobs requiring a college degree. Analyzing the demand for and supply of college graduates is a very complex undertaking. The demand for college graduates is determined in our economy by the overall rate of growth, the change in the composition of demand among such categories as defense or personal consumption, the growth of industries that are intensive users of college graduates, changes in occupational utilization of graduates by employers attributable to changes in technology and business practices, the changing complexity of work within specific occupations, and the number of graduates who leave the labor force. The supply of college graduates is determined by the size of the college-age population and the proportion of the population that attends and graduates from college; this, in turn, is affected by the availability of educational assistance, immigration laws, and other factors. Furthermore, wage levels of college graduates relative to wages of other workers have an effect on both supply and demand because relative wages affect both the choices of individuals to enroll in college and employer hiring practices.

Additionally, as mentioned earlier, the analysis requires some judgment in determining which jobs require a college degree. Despite these complexities, factors underlying both the supply of and demand for college graduates have been identified and analyzed. This article compares the projected employment of college graduates over the 1990–2005 period with their actual experience over the 1984–90 period. This comparison allows future job market expectations to be placed in perspective with conditions that existed in the recent past. In developing a historical trend, we used 1984 as the base year because occupational employment data are consistent between 1984 and 1990. Prior to 1984, the industry-occupation employment matrix used in the Bureau's projection program was based on a different occupational classification system.

Demand for college graduates

Projected employment growth. Between 1990 and 2005, total employment in the Bureau's moderate growth scenario is projected to increase from

122.6 million to 147.2 million, or by 20 percent.[3] Employment in jobs requiring a college degree is projected to increase from 23.2 million to 32.3 million, or by 39 percent—nearly double the rate of increase in total employment. (See the appendix.) Of the projected 24.6 million additional jobs, 9 million (36.5 percent) are projected to require a college degree. (See table 2.)

Employment growth between 1990 and 2005, however, will be significantly slower than that during the past few decades when the baby-boom generation entered the job market, spurring employment growth, and labor force participation of women increased significantly. Instead, employment growth in the 1990's and early part of the 21st century will be affected by the decline in the birth rate that began in the late 1960's and a slowing of the rate of growth in labor force participation of women. The slowdown can be seen by comparing average annual employment growth over the 1984–90 period with that projected for the 1990–2005 period. Between 1984 and 1990, total employment increased an average of 2.6 million a year, compared with an increase of 1.6 million projected for the 1990–2005 period. (See table 3.) According to these estimates, between 1984 and 1990, an average of 767,000 jobs requiring a college degree opened up per year. Over the 1990–2005 period, however, the number is projected at 602,000. The average annual rate of growth in employment of college graduates in positions requiring a degree is projected to slow to 2.6 percent a year from 4.1 percent a year from 1984 to 1990. The expected slowing in the rate of growth of college-level jobs merely reflects a deceleration in the overall economy, mirroring the slowdown in labor force growth, thus affecting jobs for workers at all levels of education. However, the slowdown in employment growth in jobs requiring a college degree (–21.5 percent) is projected to be substantially less than in jobs not requiring a degree (–44.0 percent). (See table 3.)

Table 2. **Employment in jobs requiring a college degree, 1990 and projected to 2005**

[Numbers in thousands]

Occupation	Actual 1990	Projected 2005	Change, 1990–2005	
			Number	Percent
Total	122,573	147,191	24,618	20.1
Jobs requiring a college degree	23,230	32,255	9,024	38.9
Executive, administrative and managerial	6,766	9,125	2,359	34.9
Professional specialty	11,739	15,942	4,203	35.8
Technicians	1,249	2,193	944	75.6
Sales representatives and supervisors	2,261	3,336	1,075	47.5
All other occupations	1,215	1,658	443	36.5
Jobs not requiring a college degree	99,343	114,936	15,593	15.7

Educational upgrading. Increases in jobs requiring a degree stem from employment growth in occupations generally requiring a college degree and from upgrading of jobs, as employers hire college graduates for positions that were formerly filled by persons with less education. Upgrading generally occurs as the skills required to perform jobs become more complex, attributable to changing technology or business practices, thereby requiring workers with more education. However, employers also may hire college graduates for some jobs that may not require a degree just because college graduates are available for those jobs. As a result, it is often difficult to determine whether the increase in the proportion of college graduates in various occupations is attributable to a real increase in the skill required or is simply because of the availability of graduates willing to accept the job. In this analysis, upgrading was only considered in occupations for which analytical evidence shows that college training is or may be needed. It was assumed that the entire increase in the proportion of workers having college degrees in these occupations was attributable to educational upgrading, because it was not possible to identify the proportion of the increases due to other factors. The procedure can be illustrated with the occupation of construction and building inspectors. Between 1984 and 1990, the proportion of college graduates in this occupation more than doubled. Some of the increase can be explained by real changes in the nature of the work performed. However, it is also likely that some of the increase was attributable to the widespread availability of workers with college degrees. Because the latter cannot be distinguished from the former, both were counted in our estimate of upgrading.

Just as the outlook for college graduates could change depending on alternative scenarios regarding the level of economic growth or related factors, the number of job openings could change based on higher than projected educational upgrading. Therefore, measuring the number of openings attributable to upgrading alone is essential. It is calculated by multiplying total employment in the target year by the percent of jobs requiring a college degree in the base year. This produces the educational requirements that would have been, if the proportions of jobs requiring a college degree had not increased in the interim. As indicated earlier, the annual average increase in employment of college graduates in jobs requiring

a college degree was 767,000 between 1984 and 1990. Of this average, 459,000 can be attributed to growth in jobs that required a degree in 1984 and 308,000 to educational upgrading. (See table 3.) During this period, the proportion of all jobs in the economy requiring a college degree increased from 17.4 percent to 19.0 percent.

Over the 1990–2005 period, the annual average growth of jobs requiring a college degree in 1990 is projected to account for 311,000 job openings and upgrading is projected to account for 291,000 of the 602,000 total. The proportion of all jobs in the economy requiring a degree is projected to increase from 19.0 percent to 21.9 percent. Thus, educational upgrading is projected to continue to contribute significantly to the demand for college graduates during the 1990–2005 period as was the case over the 1984–90 period.

It could be argued that upgrading of jobs could grow more quickly over the 1990–2005 period especially in professional and managerial jobs because of changes in technology or business practices or other factors—not the least of which is the greater availability of college graduates. The problems in identifying these potential factors and the magnitude of their impact on upgrading make it difficult to quantify precisely how many new job openings might arise. Therefore, possible deviations in the rate of upgrading from the historical trend are addressed in the section of this article on alternative scenarios. However, the potential for increases in college-level jobs may be limited, even if there are many more college graduates seeking jobs. Many workers without a college degree, but in occupations with the potential to be upgraded to college level, will still be on the job in 2005. It is unlikely that they would be laid off to make room for college graduates. Furthermore, college graduates are not necessarily more qualified than those having less education in many managerial or professional specialty jobs simply by virtue of having earned a college degree. On-the-job experience or 1 or 2 years of technical training is still valued above a college degree in many instances, such as in managerial positions in small retail, service, repair, or construction establishments. In the visual and performing arts, demonstrated ability, rather than a degree, is most important. Dancers and musicians are hired based on auditions; artists and photographers are judged by their portfolios; and athletes are recruited based on observed physical talent and skill. Therefore, greatly accelerated educational upgrading for college graduates beyond the gradual rates of change already projected seems unlikely.

Table 3. **Average annual employment change in jobs requiring a college degree, 1984–90 and projected, 1990–2005**

[Numbers in thousands]

Job requirement	1984–90	Projected, 1990–2005	Percent change
Total employment, all education levels	2,622	1,641	– 37.4
Jobs requiring a college degree	767	602	– 21.5
Employment growth	459	311	– 32.2
Upgrading	308	291	– 5.5
Jobs not requiring a college degree	1,855	1,039	– 44.0

Table 4. **Comparison of the demand and supply of college graduates, 1984–90 and projected, 1990–2005**

[Annual averages in thousands]

Status	1984–90	Projected, 1990–2005	Change
Demand			
Total job openings	964	914	–50
Openings resulting from:			
Growth and upgrading	767	602	–165
Replacements	197	312	115
Supply			
Total labor force entrants	1,188	1,320	132
New graduates	974	1,106	132
Others	214	214	0

Replacement needs. The need to replace workers who permanently leave existing college-level jobs provides additional openings for college graduates. Recently developed net replacement rates provide such a measure.[4] Workers employed in occupations requiring a degree in 1984 left at an average yearly rate of 1.06 percent, which opened up 197,000 jobs each year over the 1984–90 period. The replacement rate of workers employed in 1990 in college level jobs is expected to increase to about 1.34 percent per year over the 1990–2005 period. The higher separation rate reflects the aging of the college-educated labor force. Thus, over the 1990–2005 period, an estimated 312,000 annual job openings will result from replacement needs.

Job openings attributable to growth and to the replacement for colleges graduates averaged 964,000 a year over the 1984–90 period. By contrast, annual average job openings are projected to be 914,000 during the 1990–2005 period, or about 50,000 fewer than those of the earlier period. (See table 4.)

Supply of college graduates

New graduates have been, and will continue to be, the major source of entrants to the college-level job market. The Center projects that the number of bachelor's degrees conferred will increase steadily to 2005, averaging 1.138 million degrees per year between 1990 and 2005. The numbers of new graduates projected by BLS to actually enter the labor force during this period is 1.106 million per year. (See table 4.) Demographic trends have a great affect on the number of degrees awarded because the Center's bachelor's degree projections are based on projections of the 18- to 24-year-old population, the 25- to 34-year-old population, and undergraduate enrollment in 4-year institutions. The 18- to 24-year-old age group, traditionally the primary college-attending population, will increase by 0.5 percent a year, or an annual average of 131,000 over the projected period. In addition, the proportion of 18- to 24-year olds enrolled in college began to increase in the mid-1980's, and this trend is projected by the Center to continue over the 1990–2005 period. In fact, the expected continued increase in proportions of enrollments among 18- to 24-year-olds should play an even greater role in expanding degree projections than that age group's population growth. Table 5 shows the population of 22-year-olds in relation to the number of bachelor's degrees awarded, both actual and projected. The population growth of this group will not begin to increase again until the late 1990's, so that, on average, the number of 22-year-olds during the projected period is actually lower than in the 1984–90 period. Nevertheless, the average number of degrees awarded are expected to be higher than the 1 million per year conferred during the 1984–90 period. During this time, despite an increasing proportion of enrollments among 18- to 24-year-olds, the number of bachelor's degrees conferred was lower than that projected for 1990-2005, as the traditional college-age population shrank an average of 1.5 percent, or 399,000 per year.

The second source of supply to the college-level job market are those who are not new college graduates. These other entrants include college-educated immigrants, recently discharged military personnel, persons recently released from institutions, and the net increase of those returning to the labor force (consisting primarily of women who had stopped working to care for their families). During the 1990–2005 period, other entrants are estimated by BLS at 214,000 per year, roughly the same as during the 1984–90 period.[5]

Projections of new college graduates plus other entrants over the 1990–2005 period total 19.8 million, or an average 1.32 million per year. In comparison, over the 1984–90 period, the annual average was 1.18 million. (See table 4.)

Table 5. **Population of 22-year-olds and number of bachelor's degrees awarded, 1980–90 and projected, 1991–2005**

Year	Population (thousands)	Bachelor's degrees awarded	
		Total (thousands)	As a percent of population
Actual:			
1980	4,315	929	21.5
1981	4,311	935	21.7
1982	4,300	953	22.2
1983	4,370	970	22.2
1984	4,282	974	22.8
1985	4,213	979	23.2
1986	4,152	988	23.8
1987	3,981	991	24.9
1988	3,771	995	26.4
1989	3,671	1,018	27.7
1990	3,641	[1]1,043	28.6
Projected:			
1991	3,716	1,064	28.6
1992	3,805	1,081	28.4
1993	3,882	1,101	28.4
1994	3,588	1,100	30.7
1995	3,411	1,100	32.2
1996	3,338	1,098	32.9
1997	3,415	1,100	32.2
1998	3,369	1,102	32.7
1999	3,517	1,114	31.7
2000	3,549	1,129	31.8
2001	3,659	1,164	31.8
2002	3,788	1,189	31.4
2003	3,849	1,220	31.7
2004	3,898	1,242	31.9
2005	3,921	1,262	32.2

[1] This figure is estimated.

NOTE: The 22-year-old population is used for illustrative purposes. Bachelor's degree projections are based on the 18- to 24-year old and 25- to 34-year old populations, and undergraduate enrollment in 4-year institutions.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Projections of Education Statistics to 2002 (middle projection) and unpublished projections; and the Bureau of Labor Statistics.

Demand versus supply

The two forces exerting the most influence on the job outlook for college graduates will be growth of jobs requiring a college degree and the number of new college graduates. Projections of job growth indicate that there will be fewer job openings annually over the 1990–2005 period than from 1984–90, while more degrees are expected to be awarded from 1990–2005 than during the 1984–90 period. Consequently, it seems reasonable to conclude that the job market will be less favorable to college graduates from 1990 to 2005 than during the 1984–90 period. Furthermore, the data indicate that nearly 20 percent of the supply of college graduates who entered the labor force each year during the 1984–90 period worked in jobs traditionally not requiring a 4-year college degree or were unemployed. This analysis shows that this percentage will increase to 30 percent over the 1990–2005 period, given the assumptions made in preparing the projections and the analyses reported in this article.

During the 1984–90 period, openings for college graduates in positions requiring a degree averaged 964,000 a year. During the same period, the available supply—entrants to the college graduate labor force—averaged 1.188 million a year, 224,000 more than demand. For the 1990–2005 period, the number of college-level job openings in the moderate growth scenario are expected to average nearly 914,000 per year. According to the Center's moderate projections, estimates of available entrants to the college graduate labor force (supply) will average 1.32 million annually—406,000 more than demand. Of course, past experience has shown that the vast majority of the 406,000 college graduates entering the labor force each year who are not expected to obtain college-level positions should be able to find work in jobs traditionally not requiring a 4-year college degree.

Alternatives. Both projections of demand and projections of supply are subject to variation. To explore these uncertainties, alternative high and low projections of employment and degrees awarded are examined. It is valuable, therefore, to look at possible supply/demand conditions for college graduates under different combinations of these projections. (See table 6.) The high employment growth alternative (1.029 million) produces 115,000 more college-level jobs per year than the moderate employment growth projection (914,000 per year). Use of the low degree projection indicates a decrease in the average annual supply of entrants of about 50,000. Coupling the high employment growth alternative with the low degree projection still indicates an excess of 239,000 entrants per year, or about 20 percent of the total yearly supply—similar to the conditions which prevailed during the 1984–1990 period.

Table 6. **Alternative scenarios of the demand and supply of college graduates, 1990–2005**

[Annual averages in thousands]

Status	High employment growth, low supply of graduates	Low employment growth, high supply of graduates	Moderate employment growth, middle supply of graduates, high upgrading of jobs
Demand			
Total, job openings	1,029	760	1,070
Growth	412	180	311
Upgrading	305	270	447
Replacements	312	312	312
Supply			
Total, graduates	1,268	1,397	1,320
New graduates	1,054	1,183	1,106
Other graduates entering the labor force	214	214	214

Greater upgrading of jobs requiring college degrees could also change the 1990–2005 outlook. The moderate employment growth projection and trends in the proportion of jobs in occupations requiring a degree indicate 21.9 percent of all jobs in the economy will require a degree. Each increase in this proportion of 1 percentage point would increase job openings by about 98,000 a year. To bring the supply/demand conditions in line with the 1984–90 period (using the middle projections of college degrees and under the same employment growth) requirements for college graduates would have to increase to 23.5 percent of total employment—a rate of upgrading about double the 1984–90 experience. This alternative scenario shows entrants exceeding job openings by approximately 250,000 a year, or 18.9 percent of total supply—again, approximating the 1984–90 period.

Furthermore, a decidedly worse scenario could prevail if the low employment growth alternative is realized during the projected period, especially if the number of bachelor's degrees awarded is higher than projected from the middle degree alternative. In this case, the number of college graduates would exceed college-level job openings by approximately 637,000 a year, or nearly 46 percent of the total supply of college graduates entering the labor force.

Aside from the number of bachelor's degrees projected to be awarded, the supply of college graduates is also affected by the number of college-educated immigrants entering the labor force over the projected period. In the analysis discussed earlier, this number is projected to be about the same over the 1990–2005 period as it was from 1984–90. However, under the Immigration Act of 1990, the allowable levels of immigrants entering the United States expanded substantially. College-educated immigrants are among those whose numbers may increase because of the new limits. At this point, it is very difficult to know how many more college-educated workers will enter the country and the job market as competitors for college-level jobs under this new law. If the number were to increase substantially, the estimate of other entrants in the supply analysis would be low, and supply/demand imbalances would be even greater.

Transitions from school to work

The prospects of more college graduates entering the labor force than there are openings in jobs requiring a degree means that not all graduates who enter the labor force will be able to enter occupations requiring a degree. Those graduates who carefully select their career objectives, acquire the most appropriate academic preparation, and are most adept at locating job openings and marketing

their abilities will enjoy the smoothest transition from school to work. Others will have to scramble for the best available jobs, risking brief periods of unemployment, relocating to other areas of the country, accepting jobs that do not require their level of education, or job-hopping before finding a satisfying position. Nevertheless, the majority of future college graduates are expected to find jobs that use the education they have attained.

A college degree does not guarantee a job, but college graduates have significantly higher earnings, on average, than do high school graduates—a gap that widened during the 1980's.[6] Similarly, college graduates are less likely to experience unemployment than those with less education. In 1990, the unemployment rate among 25- to 34-year-olds was 2.5 percent for college graduates, compared with 4.2 percent for persons who had completed some college, and 6.3 percent for high school graduates.

The expected increase in the number of college graduates, versus fewer college-level job openings in the future will have an effect on opportunities for workers with fewer years of education as well. The prospect of underemployed college graduates crowding out others who would normally fill positions that do not require a college degree means more careful career planning will be necessary for persons who are not college graduates. Workers who prepare themselves for jobs requiring specific skills, such as bookkeeper, mechanic, or technician, will fare better than those whose lack of specialized training leave them vulnerable to competition with college graduates. ▯

Footnotes

ACKNOWLEDGMENT: Alan Eck, an economist in the Office of Employment Projections, calculated separation rates used to project the numbers of entrants and leavers for this article.

[1] An explanation of how BLS counts the number in each category can be found in Daniel E. Hecker "Reconciling conflicting data on jobs for college graduates," page 3, this issue.

[2] See "Reconciling conflicting data."

[3] For more detailed information on the Bureau's industry and occupational employment projections, see the November 1991 *Monthly Labor Review* articles by Max L. Carey and James C. Franklin, "Industry output and job growth continues slow into next century," pp. 45–63; and George Silvestri and John Lukasiewicz, "Occupational employment projections," pp. 64–94.

[4] Previous supply and demand analyses for college graduates by BLS relied on the use of a total rather than net replacement rate, which produced a much higher number of openings. See Jon Sargent and Janet Pfleeger, "The Job Outlook for College Graduates to the Year 2000: A 1990 Update," *Occupational Outlook Quarterly*, Summer 1990, pp. 2–9. A discussion of the impact of the changes from the estimate used previously is provided in the technical note.

[5] See the technical note for a discussion of how these estimates differ from those used in previous analyses.

[6] See "Reconciling conflicting data."

APPENDIX: Methodology and procedures

Projections of 1990-2005 occupational employment growth derived from the national industry-occupation matrix provided the foundation for the projected demand for college graduates.[1] Herein lies one of the inherent complexities of ascertaining college graduate demand. The industry-occupation matrix is based on establishment data on industry employment from the BLS Current Employment Statistics program and on staffing patterns of industries from the Occupational Employment Statistics survey. However, information on educational attainment is only available from household data from the Current Population Survey (CPS). Because the occupational structure of the CPS and matrix differ, a crosswalk was developed to convert CPS data to a matrix basis. For the executive, administrative, and managerial; professional specialty; and technician occupations, the entire group was considered a match. However, in other occupational groups with only selected occupations employing graduates in jobs requiring a degree, it was necessary to match CPS and matrix data occupation by occupation.

Matching the CPS occupations with the matrix occupations did not eliminate all data-related problems. Matrix employment is somewhat lower than CPS employment in executive, administrative, and managerial and professional specialty occupational groups, in which most college graduates are concentrated. To avoid possible undercounting of college graduates, BLS used the CPS numbers as the most accurate portrayal of the employment of workers having 4 or more years of college education in 1990. These numbers were used to calculate college graduates as a proportion of matrix employment in each occupation.

However, the analysis was designed to measure college graduate requirements, not college graduate employment. Therefore, college graduate employment was divided into jobs requiring a degree and those not requiring a degree (educationally underutilized) by means of requirement ratios. Requirement ratios—the number of workers in each occupation in jobs requiring a degree as a proportion of all workers in the occupation having a degree—were developed based on the Bureau's in-depth knowledge of occupational educational requirements and on a supplemental survey of the CPS in which workers in all occupations indicated whether or not their jobs needed a college degree.[2] Multiplying requirement ratios by the employment of college graduates identified the number of workers with 4 or more years of college in each occupation that actually required a degree.

To project future requirements, BLS first projected the changes in proportions of jobs requiring a degree in each occupation. This was done by examining historical CPS data on college graduate employment as a percent of employment of all workers in the occupation, and extrapolating the trend to 2005. (The trends were based on data for the 1983–90 period in which the CPS incorporated the Standard Occupational Classification used in the 1980 census. Prior to 1983, the CPS used the 1970 census classification.) To relate the CPS trends to matrix employment, the CPS-based change between 1983 and 1990 in the percent of jobs in occupations that required a college degree in 1990 were converted to

average annual rates of change. The projected rates of change for each occupation were determined by multiplying the annual rates by 15, the number of years in the projected period. The projected rates of change were then applied to the proportion of jobs in an occupation requiring college graduates in 1990, yielding the projected proportion of jobs in an occupation requiring college graduates in 2005. These proportions were then multiplied by the projected total employment for each occupation, and summed to derive estimated total requirements for college graduates in 2005.

Replacement needs. The need to replace individuals who leave jobs are an important source of job openings. Because there are two primary concepts reflecting replacement needs—net and total—it is important to clearly identify the concept that was used in the analysis for this article. Replacement needs in this article present "net" rather than the "total or gross" needs used in analyses of the supply/demand of college graduates done in the past. Direct comparisons of the data in this report with earlier reports are not appropriate because net and total estimates represent different concepts.[3]

Net replacement needs data approximate the number of college graduates who leave jobs in which they are employed, and who are not expected to ever return; they quantify the need to replace individuals who stop working due to retirement or death.[4] By comparing changes in employment over time by age groups, replacement needs data summarize differences between leavers and entrants without identifying the total flows into or out of the group.

Briefly, net replacement needs data were developed as follows. Current Population Survey information about college graduates employed in executive, administrative and managerial; professional specialty; technician; and selected sales and other occupations, by age group, were prepared for 1985 and 1990. Employment information about an age group in 1985 was compared with 1990 information for the age group 5-years older than those in 1985. For example, the 60-64 age group in 1990 was compared with the 55-59 age group in 1985. If the number of workers in the 55-59 age group declined over the period, a measure of net separations was recorded. However, if the group experienced increased employment, the measure of net separations for that age group was set to zero. The 1985–90 net replacement rate for college graduates in occupations requiring a college degree was developed by dividing the sum of net separations for all age groups by 1985 employment of college graduates in those occupations cited above. To obtain replacement estimates for 1984–90 (a period of 6 years) based on employment in the industry-occupation matrix, the 1985–90 CPS-based rate (5 years) was increased by 20 percent and applied to 1984 matrix employment of college graduates in jobs requiring a degree.

Several additional steps were required to project replacement needs for the 1990–2005 period. Using the 1985 and 1990 data just described, net separation rates for college graduates, by age group, were obtained by dividing net separations for the age group in the occupation by 1985 employment for that age group. Next, occupational replacement needs for the 1990–95 period were calculated by applying the 1985–90 age-specific separation rates to 1990 employment in the age group and summing across age groups. With estimates of replacements for the 1990–95 period, 1995 employment for a 5-year-older group was calculated as the difference between 1990 employment and net separations from 1990 to 1995. For example, 1995 employment of graduates age 60-64 was calculated as the 1990 employment of persons age 55-59 minus the net separations from that group for 1990–95. Net occupational separations for the 1995–2000 period were the product of 1995 employment, by age, multiplied by the 1985–90 age-specific separation rates and summed across age groups. The procedure used to get 1995–2000 separation data was repeated to obtain net separations from years 2000 to 2005. Net separations for 1990–2005 were derived by summing 1990–95, 1995–2000, and 2000–2005 separations. Dividing the 1990–2005 net separations by 1990 CPS employment in jobs that required a college degree yielded the 1990–2005 replacement rate. Finally, 1990–2005 net replacement needs for employment in the industry-occupation matrix were derived by multiplying 1990 matrix employment for jobs in occupations requiring a college degree by the 1990–2005 net replacement rate.

In the procedure used in this article, estimates of annual average net replacement needs for the 1990–2005 period were estimated at 312,000, a significant difference from the 1,075,000 annual average replacement estimate for 1988–2000 presented in the previous supply/demand analysis of college graduates.[5] The difference exists because the concept used to measure replacements has changed: Replacement information developed in this report reflect net separations, whereas previous estimates reflected total or gross separations. Total separations in the previous report were developed by using 1986–87 CPS based data that provided information about an individual's employment status at two points 12 months apart, which provided information on the number who left employment.[6] Specifically, a total separation rate was calculated by identifying the number of college graduates who were employed in 1986 and who were not in the labor force in 1987 as a percent of all employed college graduates in 1986. College graduates who left the labor force for any reason between 1986–87 were included in the annual total separation rate, 6.9 percent. Because the total separation rate includes all separations from the labor force—temporary as well as permanent—it is greater than the 1.06-percent 1985–90 annual average net separation rate that provides a measure of permanent separations.

The use of estimates of employment growth and total separations in the 1988–2000 analysis of the supply and demand for college graduates to describe annual average openings depicted the dynamics of the labor market for college graduates. However, the need for new additions to the stock of college graduates in that analysis includes needs for leavers who would return to work in the future. While the previous descriptions of annual entrants other than new entrants quantified the number returning to the labor force, many were returning after temporary absences. Thus, separations for brief periods followed by a return to employment—sometimes referred to as churning in the labor market—were captured in total separation data. However,

the recent availability of replacement needs based on net separation data permits an alternative description that is better suited to a supply/demand analysis for new college graduates.

Footnotes to the appendix

[1] See George Silvestri and John Lukasiewicz, "Occupational employment projections," *Monthly Labor Review*, November 1991, pp. 64–65.

[2] See *How Workers Get Their Training*, Bulletin 2226 (Bureau of Labor Statistics, February 1985).

[3] For a discussion of differences between net and total replacement needs and a more complete description of how the data were developed, see Alan Eck, "Improved estimates of future occupational replacement needs," *Monthly Labor Review*, November 1991, pp. 95-102. The methodology described for developing and projecting net replacement needs for occupations is identical to that used for college graduates.

[4] Because the net replacement needs data used are based on net separations for all college graduates, transfers out of occupations equal transfers into occupations. Consequently, occupational transfers are excluded from the net replacement needs data in this analysis, but they are included in analyses for individual occupations used in other analyses prepared by BLS.

[5] See Jon Sargent and Janet Pfleeger, "The Job Outlook for College Graduates to the Year 2000; A 1990 Update," *Occupational Outlook Quarterly*, Summer 1990, pp. 2–9.

[6] For a more detailed discussion of how total separations are estimated, see Eck, "Improved estimates."

A note on communications

The *Monthly Labor Review* welcomes communications that supplement, challenge, or expand on research published in its pages. To be considered for publication, communications should be factual and analytical, not polemical in tone. Communications should be addressed to the Editor-in-Chief, *Monthly Labor Review*, Bureau of Labor Statistics, U.S. Department of Labor, Washington, DC 20212.