Is the Market for College Graduates Headed for a Bust? Demand and Supply Responses to Rising College Wage Premiums

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Demand for college-graduate workers was strong during the 1980s (Blackburn, Bloom, and Freeman 1989; Katz and Murphy 1990; Kosters 1989; Freeman 1991). Their relative wage rose, and the share of 18- to 24-year-olds attending college rose in response. Have the demand and technology shocks that produced this result now run their course? Is the supply response large enough to stop or reverse the 1980s escalation of the relative wages of college graduates?

Read superficially, U.S. Bureau of Labor Statistics (BLS) projections appear to suggest that the answer to these questions is "Yes." In the most recent BLS report, the growing supply of college graduates was projected to outstrip growth in demand by 330,000 annually (Shelley 1994). An even larger gap between supply and demand had been projected in 1992 (Shelley 1992). Looking at earlier projections, some in the press even reported that the college graduate labor market was about to go bust. *New York Times* reporter Louis Uchitelle, for example, led off an article titled "Surplus of College Graduates Dims Job Outlook for Others" with the following:

> Hundreds of thousands of jobs, once performed creditably without a college degree, are today going to college graduates as employers take advantage of an oversupply. . . . At roughly 25 percent of the work force—higher than in any other industrial nation—college graduates outstrip the demand for their skills, the Labor Department reports (June 18, 1990, p. 1).

Most economists, however, do not believe a surplus of college graduates and other skilled workers exists now or is likely to develop anytime soon. The Secretary of Labor and the Chief Economist's office within the U.S. Department of Labor apparently give little credence to the BLS projections of a college graduate surplus. Skills shortages are a common theme of Secretary Robert Reich's speeches and of policy initiatives of the department.

Who is right? Is a bust of the college graduate labor market on the horizon? In fact, a closer reading of the latest BLS projections suggests that it is not. The future is predicted to be much like the past. Since the recent past has been characterized by low unemployment and rising relative wages for college graduates, the BLS data can also be interpreted as predicting more of the same.

Past BLS projections have not been particularly successful in predicting changes in the market for college graduates. The BLS projected a strong market for college graduates in 1970, just prior to the bust of the 1970s. The BLS projected a weak market in 1980, just prior to the 1980s boom. Moreover, the task of projecting the number of jobs "requiring a college degree" into the future is essentially impossible. The methods used to make the projections are not well adapted to the task. BLS projections published in 1981, 1983, and 1985 underestimated the growth of managerial and professional jobs and overestimated the growth of lower-skill jobs. The methods used to project occupational employment inevitably miss an important portion of the rise in skills that is under way in our economy.

Findings about skill differentials suggest that we should raise high-school standards, increase student financial aid, make tuition tax-deductible, and stop increasing tuition at public colleges.

An alternate methodology for projecting occupational employment is available. Regressions predicting occupational employment shares with a trend, unemployment, the trade deficit, and the share of workers using personal computers did a better job projecting the early 1990s than the BLS. Both methods, however, missed predicting the slowdowns in the growth of clerical, technical, and craft jobs.

The updated model projects that professional, technical, and managerial jobs will account for 60 percent of job growth between 1990 and 2005. Skill differentials between college-level jobs and other jobs continue to expand, even in the most recent data. And because the college-age population cohort is small, the increase in the share of the cohort attending school has not produced a substantial increase in the ratio of new BAs to total employment. Rates of college completion are not high enough to flood the college graduate market, and U.S. youth are not overeducated relative to those of other nations, as has been claimed. In fact, young Europeans and East Asians spend more years in school than young Americans.

These findings have important policy implications. They suggest that we should raise high school standards, increase student financial aid, make tuition tax-deductible, and stop increasing tuition at public colleges.

What Do the 1994 BLS Projections of Supply and Demand for Graduates Really Imply?

Let us begin by examining the projections of supply and demand made by the U.S. Bureau of Labor Statistics in 1992 and 1994. The 1992 report states that "estimates of available entrants to the college graduate labor force (supply) will average . . . 406,000 more than demand" (Shelley 1992, p. 16). The 1994 report predicts that "nearly 25 percent of new entrants are expected to settle for jobs that do not require a college degree" (Shelley 1994, p. 9). Both sound quite negative about the future demand for college graduates. Table 1 presents the numbers. In 1992, BLS projected a significant deterioration of the supply-demand balance during the 1990s. The annual increase in the number of "underemployed" graduates was projected to be equal to 31 percent of the annual flow of BAs into the labor force (both immigrants and new graduates) during the period. The share of underemployed college graduates was projected to increase from 19.9 percent in 1990 to 25.9 percent in 2000.

However, when later projections were made, predictions of employment growth in professional jobs were revised upward, from the 340,500 per year of the 1991 projections to 477,000 per year in the 1993 projections and to 461,000 in the 1995 projections (Silvestri and Lukasiewicz 1991; Silvestri 1993; BLS 1996). This has improved BLS's projected outlook for college graduates. Consequently, in the most recent report, the gap between supply and demand is expected to grow only slightly, from 22 percent of the gross increase in the supply of BAs to 24 percent after 1992. The BLS also projects that the growth of the "underemployment" share will accelerate somewhat after 1992.

Table 1
College Graduates Entering the Labor Force and College-Level Job Openings, Past and Projected to 2005
Annual Averages, in Thousands

	1992 Projections		1994 Projections	
	1984–1990	1990–2005	1984–1992	1992–2005
Supply coming from:				
New graduates (National Center for Educational Statistics projections)	974	1106	1000	1180
Other entrants (immigration)	214	214	200	200
Increase in supply of BAs in labor force	1188	1320	1200	1380
Demand coming from:				
Growth of occupations normally "requiring" a BA	459	311	593	562
Growth due to upgrading	308	291	157	168
Replacement demand—due to retirements	197	312	190	320
Increase in college-level jobs held by BAs	964	914	940	1050
Yearly increase in graduates not in college-level jobs	224	406	260	330
Ratio of this supply-demand gap to growth of BAs in labor force	18.9%	30.8%	21.7%	23.9%
Annual change in the share of BAs underemployed	.16%	.61%	.35%	.50%

These projections can be interpreted in two very different ways. Many reporters have interpreted them as implying that the market for college graduates is about to deteriorate. This interpretation comes from focusing on projected gaps between demand and supply in the future. Focusing instead on how the future is expected to differ from the recent past, one arrives at a different conclusion. The 1994 report projects that the supply-demand balance for college graduate workers for the 1992–2005 period will be rather similar to the conditions that prevailed during the previous eight years. Since unemployment rates of college graduates remained low and relative wage rates grew substantially from 1984 to 1992, the BLS projections really predict a continuation of the strong labor market for college graduates that characterized the 1980s. They also point out, quite correctly, that a strong market for college graduates does not imply that all college graduates will have professional, technical, managerial, or sales representative jobs.

Are the BLS Estimates of Jobs "Requiring" a College Degree and of "Underemployed" College Graduates Credible and Reliable?

The BLS assesses the current demand-supply balance for college graduates by defining a set of jobs that "require" a college degree and then counting up the number of college graduates who do not have one of these jobs. The workers being categorized are not asked whether they believe a college degree is required or useful in their job. The classification is based on the match between reported education and reported occupation. Workers with fewer than 16 years of schooling are automatically counted as having jobs that do not require a college degree. Workers with 16 or more years of schooling are classified as "underemployed" when the reported occupation appears not to "require" a college degree.

This classification of occupations is inherently arbitrary and idiosyncratic to the analyst. When Sargent and Pfleeger (1990) did the analysis, the BLS concluded there were 18.1 million college-level jobs in 1988. When Hecker (1992) reestimated the number two years later, he found 21.8 million college-level jobs (a 20 percent increase). Yet the validity of the whole effort to measure "underemployment" depends on this classification being done correctly in every detail, not only for the present but also for up to 15 years in the future. This is essentially impossible.

First, the occupational coding system used by the Current Population Survey (CPS) and the Census is not reliable and comprehensive enough to allow accurate measurement of a concept like "underemployment." Census Bureau studies have found that between 18.3 and 27.3 percent of the individuals recorded as professionals, technicians, or managers in one interview are recorded in a less skilled occupation in a subsequent interview four to seven months later (U.S. Bureau of the Census 1972).

Substantial errors also occur in measuring educational attainment. Between 5.5 and 9 percent of respondents recorded as having more than 16 years of schooling in one interview are recorded as having fewer than 16 years of schooling in a later interview. If errors in reporting occupation and schooling are uncorrelated with each other, measurement error raises the estimated "underemployment" share by as much as 12 to 18 percentage points.[1]

Consequently, reporting and coding errors are responsible for many of the apparent mismatches between an individual's occupation and his or her education. How else can one explain the 9.6 percent of college teachers and the 5.4 to 6.5 percent of lawyers, physicians, and secondary school teachers who claim not to have completed 16 years of schooling (BLS 1990, Table F-3)? The unreliability of individual measures of occupation and education means that counts of mismatches between schooling and occupation derived from micro CPS data have little validity. True mismatches between education and occupation are a lot less common than these statistics suggest.

The second problem is the lack of symmetry in the handling of possible mismatches between educational qualifications and occupation. Large numbers of workers without college degrees say they occupy jobs that most people would agree "require" at least a four-year degree. In 1988, 44,000 lawyers, 42,000 social scientists, 46,000 natural scientists, 33,000 physicians, 61,000 college teachers, 143,000 elementary and secondary school teachers, and 363,000 engineers said they had not completed four or more years of college (BLS 1990, Table F-3). The BLS does not classify these individuals as "undereducated." By ruling out the possibility of undereducation, the conceptual framework makes inevitable a conclusion that there are too many college graduates.

The third problem is the great heterogeneity of the college graduate category. Ten percent of college graduates cannot write a brief letter explaining an error made on a credit card bill or determine the discount from an oil bill for early payment (National Center for Education Statistics (NCES) 1995a, pp. 38, 40, 66). As one can see in Table 2, these graduates are less likely to have professional, technical, or managerial jobs and much more likely to have service or laborer jobs (NCES 1995a, p. 95).

Table 2
Occupations of College Graduates by Degree of Prose Literacy

	Prose Literacy Group (5 = highest)					
	1	2	3	4	5	Total
Percent in Service or Laborer Job	11.2	7.3	7.5	4.6	2.3	5.5
Percent in Professional, Technical, or Managerial Job	46	56	64	75	83	71
Percent of College Graduates in Literacy Group	1.6	7.8	30	42	16.8	100

More than 40 percent of young adults with associate or bachelor's degrees cannot calculate change from a menu. Seventeen percent of young college graduates read at a level below the typical eleventh-grader (Kirsch and Jungeblut 1986). How can someone with high-school or lower reading and math levels be considered "underemployed" or "overeducated" in a secretarial, carpentry, or retail sales job? For such individuals, the problem is "undereducation," not "underemployment."[2]

The fourth problem is that for most occupations, the question "Does it require a college degree?" does not have a "yes" or "no" answer. It is a matter of degree. Some employers structure their management jobs in ways that make the skills normally developed in college absolutely essential; at other employers such skills are very helpful, and at still others the skills are of little advantage. The magnitude of the college graduate productivity advantage also depends on the quality of the alternative labor supply. If the competence of those who ended their schooling with high school deteriorates, as it did during the 1970s (Bishop 1991), the demand for college graduates will increase. The correct answer to the question of whether a

[1] Let us make the standard assumption that measurement error is random (that is, uncorrelated over time and uncorrelated across questions). Then, 18.3 to 27.3 percent of respondents reporting a PTM occupation in one interview reporting a non-PTM occupation in another interview implies that 0.8526 to 0.9039 of the individuals who are truly in a PTM occupation report themselves in a PTM occupation $\{(1 - .273)^{.5} = .8526\}$. The estimated proportion of true college graduates who report having less than a college degree is 0.9539 to 0.9721 $\{(1 - .09)^{.5} = .9539\}$. Thus, the estimated proportion of true college graduates with PTM jobs who underreport either their occupation or schooling ranges between 0.1213 and 0.1867 $\{.1867 = (1 - .8526 * .9539)\}$.

[2] Robst's (1995) analysis of PSID data indicates that the prestige ranking of the college one attends also has large effects on the probability of being "underemployed." Those who attended colleges in the bottom fifth of the prestige ranking had twice the likelihood of being counted as "underemployed" of those who attended colleges in the top quartile.

Figure 1

The Job Requirements View

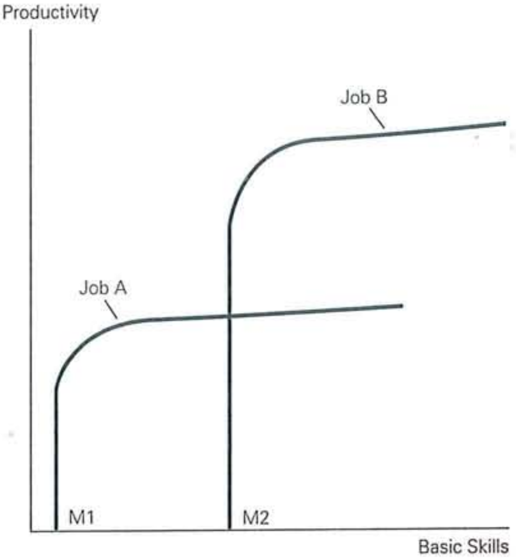
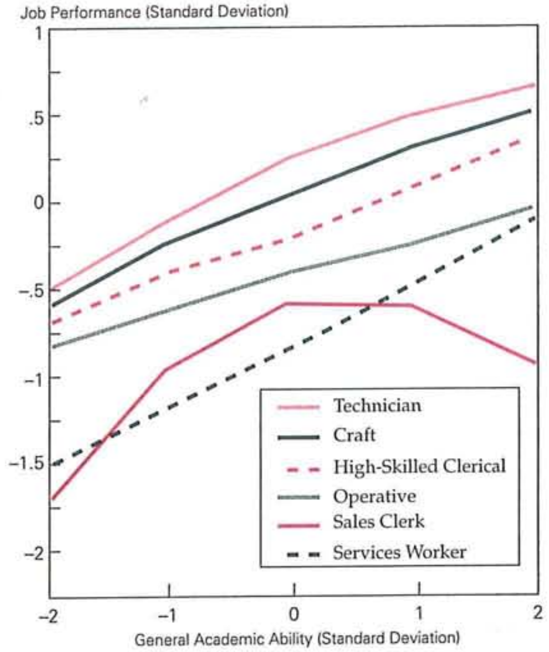


Figure 2

Effect of General Academic Ability on Job Performance



college degree is required is "It depends." It depends on circumstances that analysts and researchers have little knowledge of and no ability to forecast a decade ahead.

The BLS projection exercise apparently assumes that occupations have specific educational or basic skill "requirements." This job requirements view of the world is illustrated in Figure 1. Job A requires a basic skill level of at least M_1 while job B requires basic skills at or above M_2. Exceeding these skill thresholds, however, very quickly yields no further increases in productivity. Once the threshold is reached, diminishing returns set in with a vengeance. People working in job A who have an M_2 skill level are classified as "underemployed." Is this how basic skills influence job performance? Let us test the job requirements hypothesis.

The job requirements view predicts that everyone in job A will have at least the M_1 skill level, and that as a result of diminishing returns, the steep productivity increase near the M_1 skill level quickly becomes a very gentle slope as the individual's skill increases. In other words, the relationship between test scores and job performance should have a convex shape (a large negative second derivative). The job requirements view also implies that the impact of basic skills tests on job performance should diminish as schooling increases.

Data collected by the U.S. Department of Labor's Employment Service to validate the General Aptitude Test Battery were used to test these hypotheses. This data set contains data on job performance, the nine GATB "aptitudes," and background data on 36,614 individuals in 159 different occupations. Professional, managerial, and high-level sales occupations were not studied but the sample is quite representative of the 71.1 million workers in the rest of the occupational distribution. It ranges from drafters and laboratory testers to hotel clerks and knitting-machine operators. A total of 3,052 employers participated. (See Box 1, "Description of the Job Performance Study," below.)

The results are presented in Figure 2 and Table 3.[3]

[3] Selection effects generate a negative bias in coefficients on years of schooling. In a selected sample like accepted job applicants or job incumbents, one cannot argue that these omitted unobservable variables are uncorrelated with the included variables that were used to make initial hiring decisions and, therefore, that

Table 3
A Test of the Job Requirements Model[a]

	General Academic Ability	General Academic Ability Squared	GAA When Schooling over 12 Years	Psychomotor Ability	Psychomotor Ability Squared	Years of Schooling	R^2/ Number of Observations	Mean of: General Academic Ability	Mean of: Psychomotor Ability
All Workers	.227***	−.0096	.057***	.122***	−.017***	−.017***	.1329	.00	.00
	(.009)	(.007)	(.014)	(.007)	(.005)	(.004)	31,399		
Occupational Groups									
Technicians	.265***	−.033	.030	.116***	−.018	.030*	.1188	.49	.19
	(.043)	(.026)	(.026)	(.026)	(.017)	(.016)	2,384		
High-Skill Clerical	.223***	.012	.033	.112***	.003	.022	.1611	.53	.42
	(.037)	(.028)	(.046)	(.030)	(.017)	(.017)	2,570		
Low-Skill Clerical	.323***	.013	.024	.115***	−.019	−.010	.1354	.21	.18
	(.028)	(.021)	(.039)	(.020)	(.015)	(.012)	4,122		
Plant Operators	.181***	−.030	.062	.135***	−.032	.003	.2063	.30	−.16
	(.066)	(.043)	(.098)	(.048)	(.027)	(.031)	651		
Craft Workers	.236***	−.007	.018	.098***	−.010	−.011	.1481	.12	−.11
	(.016)	(.012)	(.026)	(.013)	(.008)	(.007)	10,061		
Operatives	.177***	−.002	.050	.168***	−.019*	−.032***	.1433	−.38	−.03
	(.017)	(.013)	(.036)	(.014)	(.010)	(.008)	8,167		
Service Workers	.340***	.005	.070	.148***	−.032*	−.021	.1559	−.31	−.24
	(.037)	(.026)	(.063)	(.028)	(.019)	(.017)	1,927		
Sales Clerks	.175*	−.173***	.109	.197***	−.070*	−.015	.1172	.19	.08
	(.090)	(.063)	(.129)	(.066)	(.042)	(.037)	416		

*Probability less than .10 on a two tail test.
**Probability less than .05 on a two tail test.
***Probability less than .01 on a two tail test.
[a]The other variables included in the models but not shown were age, age squared, occupational experience, occupational experience squared, plant experience, plant experience squared, and dummies for female, black and Hispanic. Standard errors are in parentheses under the coefficient.
Source: Analysis of GATB Revalidation Data in the U.S. Employment Service's Individual Data file.

For general academic ability, the hypothesis of diminishing returns was rejected in seven of the eight occupation groups. The exception was sales clerks, where the squared term on general academic ability was significantly negative and general academic ability had a positive effect on performance only when the test scores were no more than one-half a standard deviation above the mean.

For psychomotor skills, however, the hypothesis of diminishing returns was accepted at the 10 percent level for operatives, service workers and sales workers, and for all workers combined. The second derivatives are not so large, however, that the sign of the relationship reverses within the range of actual data. For all workers and for operatives, the derivative of performance with respect to the psychomotor test scores at one standard deviation above the mean of the test is 52 to 57 percent of the derivative when test scores are one standard deviation below the mean. For service workers, the derivative one standard deviation

coefficients on included variables are unbiased. When someone with 10 years of formal schooling is hired for a job that normally requires 12 years of schooling, there is probably a reason for that decision. The employer saw something positive in that job applicant (maybe the applicant received particularly strong recommendations from previous employers) that led to the decision to make an exception to the rule that new hires should have 12 years of schooling. The analyst is unaware of the positive recommendations, does not include them in the job performance model and, as a result, the coefficient on schooling is biased toward zero. This phenomenon also causes the estimated effects of other worker traits used to select workers for the job such as previous relevant work experience to be biased toward zero. Consequently, the results presented should not be viewed as estimates of the structural effect of schooling on worker productivity. The test score results are not similarly biased, however, because firms using aptitude tests similar to the GATB for selecting new hires were excluded from the regression.

Box 1
Description of the Job Performance Study

The workers in the study were given the GATB test battery and asked to supply information on their age, education, plant experience, and total experience. Plant experience was defined as years working in that occupation for the current employer. Total experience was defined as years working in the occupation for all employers. The dependent variable was an average of two ratings (generally two weeks apart) supplied by the worker's immediate supervisor. The Standard Descriptive Rating Scale obtains supervisory ratings of five aspects of job performance (quantity, quality, accuracy, job knowledge, and job versatility) as well as an "all-around" performance rating. Firms with only one employee in the job classification were excluded, as were individuals whose reported work experience was inconsistent with their age.

Because wage rates, average productivity levels, and the standards used to rate employees vary from plant to plant, mean differences in ratings across establishments have no real meaning. Therefore, normalized ratings deviations were predicted by deviations from the job/establishment's mean for gender, race, Hispanic, age, age squared, plant experience, plant experience squared, total occupational experience, total occupational experience squared, schooling, and test composites.

Deviations of rated performance ($R^m_{ij} - R^m_j$) from the mean for the establishment (R^m_j) were analyzed, where the subscript i refers to the individual and j refers to the job and establishment combination. The variance of the job performance distribution was also standardized across establishments by dividing ($R^m_{ij} - R^m_j$) by the standard deviation of rated performance, $SD_j(R^m_{ij})$, calculated for that firm. Separate models were estimated for each major occupation. They were specified as follows:

$$1)\quad \frac{R^m_{ij} - R^m_j}{SD_j(R^m_{ij})} = \beta_0 + \beta_1(T_{ij} - T_j) + \beta_2(T_{ij} - T_j)^2$$

$$+ \beta_3(S_{ij} - S_j) + \beta_4(X_{ij} - X_j) + \beta_5(D_{ij} - D_j) + v_2$$

where R_{ij} = rating standardized to have a zero mean and standard deviation of 1.

T_{ij} = a vector of test score composites—general academic ability and psychomotor ability.

S_{ij} = years of schooling.

X_{ij} = a vector of age and experience variables—age, age squared, total occupational experience, total occupational experience squared, plant experience and plant experience squared.

D_{ij} = a vector of dummy variables for black, Hispanic, and female.

T_j, S_j, X_j and D_j are the means of test composites, schooling, experience variables, and race and gender dummies for the job/establishment combination.

General Academic Ability was constructed by averaging the GATB's G and N composites. Consequently, it is a weighted average of four subtests: a timed arithmetic computation test with a weight of 0.25, an arithmetic reasoning test with a weight of 0.41, a vocabulary test with a weight of 0.17, and a spatial relations test with a weight of 0.17. Squared terms and an interaction with schooling greater than 12 were included in the model to test for ceiling effects and other nonlinearities.

above the mean is 37 percent of the derivative at one standard deviation below the mean.

These results suggest that the job requirements model has some validity for psychomotor skills but not for the basic academic skills that are the primary objective of schooling. Both this analysis and studies conducted by others have found that the underlying relationship between basic academic skills and performance in a specific job is smooth, continuous, and close to linear (Hunter 1983).

The Record of BLS Projections of the Demand and Supply for College Graduates

Despite the difficulties, since 1970 the BLS has published biennial projections of the supply-demand balance. The starting point of its projections are its forecasts of occupational employment growth. It then projects changes in the proportion of particular occupations that "require a college degree," the number of bachelor's degrees to be awarded per year, and the

Table 4

BLS Projections of the Supply/Demand for College Graduates and Subsequent Changes in the College Wage Premium

	Projected Growth in Underemployed College Graduates						
Date Published (1)	Projection Period (2)	Annual Average (000s) (3)	10-Year % Change in Share Underemployed (4)	Actual 10-Year % Growth of Share Underemployed (5)	Underemployed College Grad % Share—BLS (6)	Implied Predicted Change in CG/HSG Wage Ratio (7)	Actual Change in CG/HSG Wage Ratio (Percentage Points) (8)
1970	1968–80	8	−4.2	6.7	10.6	Rise	−6.7
1972	1970–80	20	−4.3	7.3	11.3	Rise	−7.6
1974	1972–85	62	−3.5	5.3	14.4	Rise	+14.2
1976	1974–85	86	−2.9	3.7	15.4	Rise	+18.9
1978	1976–85	300	5.5	1.7	17.7	Decline	+23.2
1980	1978–90	275	3.5	2.2	17.3	Decline	+26.5
1982	1980–90	300	4.1	1.3	18.6	Decline	+23.6
1984	1982–95	300	4.2	.3	19.7	Decline	
1986	1984–95	200	1.2		19.1	Small Decline	
1988	1986–2000	100	−2.3		19.4	Small Rise	
1990	1988–2000	150	−.5		19.5	Stable	
1992	1990–2005	406	6.1		19.9	Big Decline	
1994	1992–2005	330	5.0		20.0	Decline	

Source: The record of past BLS forecasts of the supply-demand balance is taken from an unpublished BLS memorandum and from Shelley (1992; 1994). Columns 4 and 5 are the projected and actual growth over the succeeding 10-year period of the share of college graduates who are "underemployed." The BLS estimates of the share of college graduates underemployed given in column 6 are taken from Hecker (1992). They are for the year that begins the projection period. For occupations outside the professional, technical, managerial, and sales representative category, worker reports of qualifying training requirements from the 1983 survey of training received were used to estimate the proportion of jobs in the occupation that required a college degree. The data on subsequent changes in the ratio of college and high school wages for workers with one to five years of experience are taken from Katz and Murphy (1990).

annual rates of flow into and out of jobs by workers with a college degree. Comparisons are then made between the projected number of job openings "requiring a college degree" and the projected flow of college graduates seeking work, producing estimates of the number of "underemployed" college graduates. Column 3 of Table 4 presents BLS's projection of the annual increase in the number of "underemployed" college graduates during the projection period. Column 4 presents the projected 10-year change in the share of college graduates who are "underemployed."

Quite clearly the BLS effort to project the supply-demand balance for college graduates has been a failure. Compare the predicted changes in the share of college graduates underemployed (Column 4) to the actual changes (Column 5). At the beginning of the 1970s, BLS projected a decline in the share of college graduates who were underemployed during the subsequent decade. Instead, the share underemployed grew substantially. Changes in the relative wage of young college graduates provide an additional ex post criterion for evaluating the accuracy of BLS's projections of supply-demand balance (Columns 7 and 8). If the projection had been correct, the relative wage of college graduates should have also risen during the period. Instead, the college premium fell 6.7 to 7.6 percentage points by 1980 (Column 8).

At the end of the 1970s, BLS was projecting large surpluses of college graduates during the 1980s. According to the projection made in 1978, the surplus of college graduates was going to grow at a rate equal to 30 percent of the annual flow of bachelor's degrees awarded and the "underemployment" share was going to rise 5.5 percentage points by the end of the decade. The rise in the "underemployment" share was instead only 1.7 percent. If the projections had been correct, relative wages of college graduates should have fallen; instead they rose by 23 to 26 percentage points.

In reality, demand responds to supply and supply responds, with a lag, to demand. An increase in the supply of college graduates with computer science degrees, for example, lowers wages for the group, and this allows some companies to undertake projects not feasible before and it induces other companies to keep development work in the United States rather than moving it abroad. Wage rates and job-finding difficulties influence enrollment decisions and choice of major, so supply responds to demand. Getting "college-level" jobs also depends on personal qualities—initiative, work habits, and the like—of the graduates. The BLS projection model has oscillated between predicting large decreases and large increases in the share of college graduates who are "underemployed" because it omits feedback loops and other key determinants of employment patterns. If one wants to project shares of college graduates in "non-college" jobs, a better approach is to estimate a historical model (or system of equations) using variables that can be forecasted into the future.

The evidence suggests that the BLS's methods of translating occupational projections into projections of the demand-supply balance for college graduates are seriously flawed. But the problems are not limited to the way in which occupational employment distributions are translated into numbers of college-level jobs. The BLS's occupational projections are also seriously flawed. The BLS systematically under-projects the growth of skilled jobs and over-projects the growth of unskilled jobs.

Biases in BLS Projections of the Growth of Managerial and Professional Jobs

A myth is abroad in the land that job growth is coming (or will come) primarily from low-skill jobs ("McJobs"). In 1987, Levin and Rumberger, for example, stated:

> In summary, the evidence suggests that new technologies are unlikely to have a profound effect in upgrading the education and skill requirements of jobs, and that most new jobs or job openings will be in occupations that require relatively low skills and education (1987, p. 344).

In 1990, Mishel and Teixeira predicted:

> Growth in skill levels from occupational upgrading will actually *slow down* in the 1990s. In fact, future growth rates in skill levels are likely to be only one-fourth to one-third as fast as those in the recent past (1990, p. 1).

In 1995, Basil Whiting, a former deputy assistant secretary in the Department of Labor, wrote:

> Labor Department projections show that most new jobs in the economy at the turn of the century will not be those of technicians but rather in the more prosaic and lower-paid fields of hospitality, retail sales, clerical work, janitoring and other service occupations (Whiting and Sayer 1995, p. 11).

All of these writers based their forecasts on BLS occupational projections. Levin and Rumberger justified their reliance on BLS projections, as follows:

> On the basis of their past record they are still likely to provide a better indication of how the overall job market will look in the future than generalizations from a few casual observations, guesswork, or simple extrapolations of past trends. The point is that none of the latter devices has come close to the accuracy of the BLS forecasts in a world where—by their nature—no forecasts will be perfect (1987, p. 338).

How good is the past record of BLS projections of job growth? BLS projected in 1981 that professional, technical, and managerial jobs, which were 24.9 percent of the nation's jobs in 1978, would account for 28 percent of employment growth between 1978 and 1990 (see Table 5, line 3). Operatives, laborers, farm laborers, and service workers, 37 percent of employment in 1978, had been projected to account for 35.4 percent of employment growth during the period. Columns 4 and 6 of Table 5 tell us what actually happened: Professional, technical, and managerial jobs accounted for 53.6 percent of 1978–90 job growth and operative, laborer, and service jobs accounted for only 8.7 percent of the growth.

The passage of time has produced two additional opportunities to compare projected growth to actual growth: BLS's 1983 and 1985 projections of occupational employment growth through 1995. BLS projected in 1983 that professional, technical, and managerial jobs (PT&M) would account for 30.7 percent of job growth from 1982 to 1995. In fact, PT&M jobs accounted for 53 percent of employment growth. Operative, laborer, and service jobs (OL&S) were projected to account for 30.8 percent of job growth, but in reality accounted for only 15.7 percent of job growth.

For the 1984 to 1995 period, BLS projected that PT&M employment would account for 38.8 percent of employment growth and that OL&S would account for 28.7 percent of growth. Here again, they were far off the mark. For the 1984 to 1995 period, PT&M accounted for 58.3 percent of job growth, and OL&S accounted for 15.9 percent (row 5 of Table 5). Figure 3 presents a comparison of projected and actual growth by broad occupational category (rather than occupational shares of total growth, as in Table 5) for the 1984–95 period. As before, modest growth (22 percent over 11 years) was projected for professional and managerial jobs. Actual growth rates were much larger: 35 percent for professional jobs and 51 percent for managerial jobs. The BLS projection for technical jobs

Table 5
Growth Shares of High-Skill and Low-Skill Jobs: Projections Compared to Subsequent Changes

When Published	Projection Period	Percent Professional-Technical-Managerial		Percent Operative-Laborer-Service	
		Projected	Actual	Projected	Actual
Bureau of Labor Statistics Former Projection Method					
	1950–60	—	31.2	—	27.7
1. 1969	1960–75	34.7	37.3	28.9	23.1
2. 1971	1970–80	33.8	38.1	28.4	20.1
Bureau of Labor Statistics Revised Projection Method					
3. 1981	1978–90	28.0	53.6	35.4	8.7
4. 1983	1982–95	30.7	53.0	30.8	15.7
5. 1985	1984–95	38.8	58.3	28.7	15.9
6. 1987	1986–2000	37.9	63.7*	27.8	15.7*
7. 1989	1988–2000	40.8	70.1*	24.6	11.0*
8. 1991	1990–2005	40.9	74.2*	27.1	10.5*
9. 1993	1992–2005	40.6	58.1*	31.6	16.2*
10. 1995	1994–2005	45.9	—	30.2	—
Bishop/Carter Logit Regressions—1990–2000					
11. Model: Time-Unemp-Trade-PCShare		69.8	74.2*	1.9	10.5*
Bishop Linear Regressions—1990–2005					
12. M1—Time-Unemp-Trade-PCShare		68.1	74.2*	.3	10.5*
13. M2—Time-Unemp-Trade		57.2	74.2*	10.6	10.5*
14. M3—Time-Unemp.		52.5	74.2*	6.1	10.5*
15. Bishop—Table 6 Model—1995–2005		61.4	—	12.1	—

Source: The record of the 1960–75 and 1970–80 BLS projections of occupational shares and actual outcomes is taken from Carey (1980) and Carey and Kasunic (1982). Later projections come from Carey (1981); Silvestri, Lucasiewicz and Einstein (1983); Silvestri and Lucasiewicz (1985, 1987, 1989, 1991); Silvestri (1993) and BLS (1996). They are based on Occupational Employment Survey estimates of occupational shares in the initial year. CPS data on occupational employment from January issues of *Employment and Earnings* and Klein (1984) are used to estimate actual growth shares. Estimates of the level of high-skill employment are higher in CPS data and this accounts for about 5 percentage points of the difference between projected and actual growth shares. For projection periods ending after 1995, an "actual" growth share (indicated by an asterisk) is reported for the shorter period from the baseline year up to August 1995. The logit regression model is from Bishop and Carter 1991b, Table 2. The linear regression predictions of employment growth are from Bishop (1992b). The projection in the bottom row uses the regressions in Table 6 and assumes that in 2005 the unemployment rate is 5.5 percent, the trade deficit equals 1.4 percent of GDP, and PC use is 80 percent above its 1990 value.

matched the actual growth of 29 percent, however. For the operative, laborer, and service categories, each component was overestimated.

Why Have BLS Projections Been So Far Off the Mark?

BLS occupational projections contain many possible sources of error. Projections of final demand shares may be wrong. The input-output matrix is often quite old, and this contributes to errors in projecting value-added shares. For example, unanticipated changes in the federal deficit and exchange rates made export and import shares of industry output particularly difficult to predict in the 1980s. Industry-specific productivity growth may also be in error, resulting in incorrect predictions of industry employment.

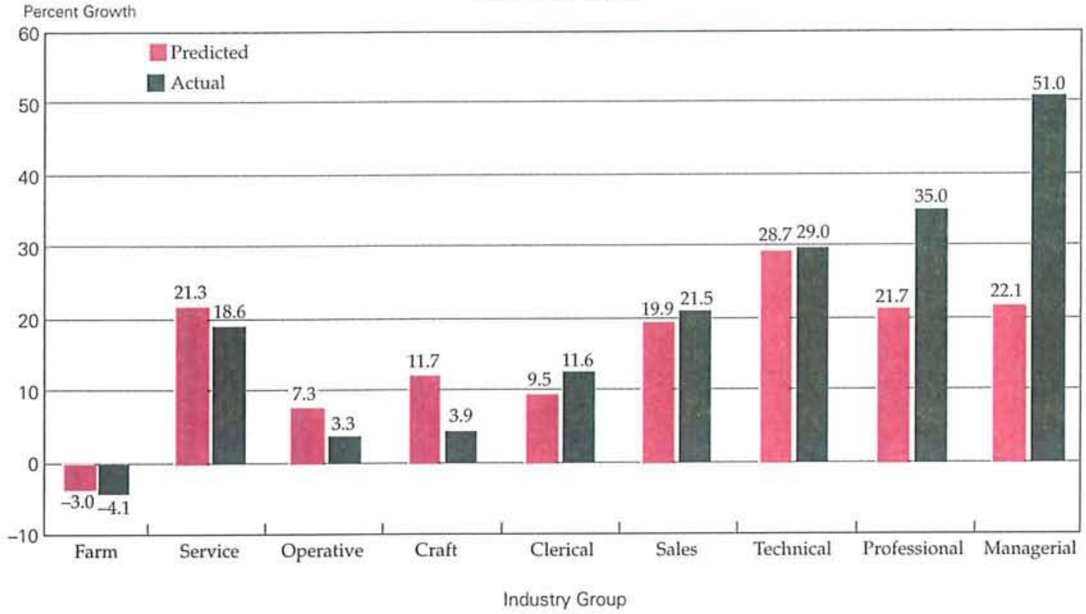
Substantial changes also have occurred in the occupational composition of specific industries, and this has often been a major source of error in occupational projections. BLS derives occupational employment demand by multiplying projected industry employment totals by an assumed, industry-specific, occupational share vector. Adjustments are made to these vectors when BLS studies of the introduction of new technology indicate that changes can be anticipated by the end of the forecast period.[4] Since studies cannot be funded for every industry and for every technological innovation, and the effects of these changes are difficult to foresee 10 years in advance, many of the changes that will occur in the composition of occupational demand within industries are missed by BLS projections.

The BLS obtains its estimates of the occupational composition of employment in specific industries from a survey of establishments, the Occupational Employment Statistics (OES). When the BLS made the projections of 1990 occupational employment in 1981, only one wave of OES survey data was available for most states and industries. The projections for the 1984–95 period were made more difficult by a 1982–83 change in the occupational classification system. Comparability over time is also threatened by the periodic

[4] This characterization of how occupational staffing patterns were projected is based on U.S. Bureau of Labor Statistics, *Handbook of Methods*, Bulletin 2134–1, 1982, p. 143, and conversations with Ron Kutscher, Associate Commissioner responsible for projections.

Figure 3

Evaluation of BLS Projections of Job Growth 1984 to 1995



changes in the industry-specific list of occupations that respondents receive on their questionnaire. The *Handbook of Methods* describes what is done when data are thought to be of doubtful comparability: "When an occupation is added, deleted or changed in definition from one OES survey to the next, extrapolated trends are not developed: the current-year ratios for these occupations are held constant in the preliminary projected matrix" (BLS 1982, p. 143).

Given these data problems and BLS's focus on projecting over 500 different occupations, it is easy to see why BLS chose not to systematically extrapolate past trends in occupational staffing ratios derived from OES or other data into the future, but rather to rely on the judgment of analysts who can take data quality problems into account. Systems that rely on the judgment of analysts are inherently conservative, however. Unfortunately, occupational staffing ratios are seldom stable over periods of 10 years or more, and it is better to start with an assumption that trends are stable than that the ratios themselves are stable.

It does not appear that problems in extrapolating changes in occupational staffing ratios have become less serious as experience with the OES survey has accumulated. The PT&M share of projected job growth has not increased much in later projections, and the 1987 and 1989 projections seem as wide of the mark as the 1985 projection (Table 5). With 64 percent of the projection period already completed, the actual PT&M share of job growth is running 25.8 percentage points above the share projected in 1987. With 58 percent of the projection period already completed, the actual PT&M share is running 29.3 percentage points above the share projected in 1989.

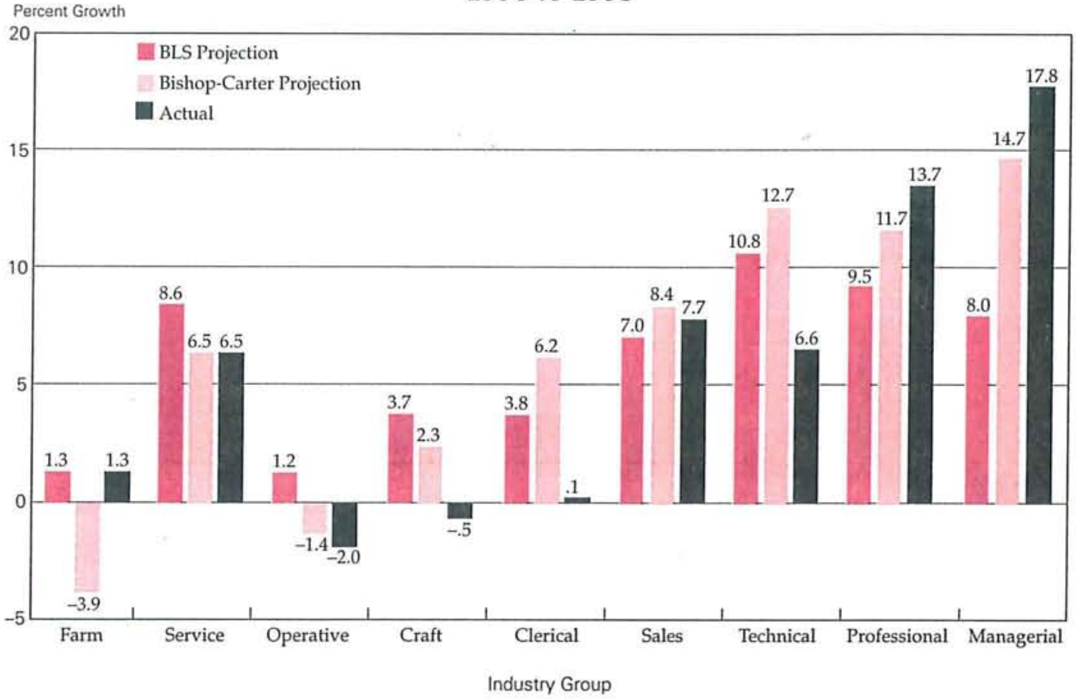
Can Other Projection Methods Succeed Where the BLS Method Has Failed?

Ron Kutscher, the Associate Commissioner at BLS responsible for projections, has said "One could never hope that a projection of the future is entirely accurate" (1991, p. 253). A natural response to the criticisms of BLS methods is to ask, "Can one do better?" Shani Carter and I attempted to do better in a 1991 paper. We showed that both a simple linear extrapolation of occupational share trends for the 1972–80 period and a regression-based projection did a better job of predicting 1990 shares than the BLS (Bishop and Carter 1991b).

Hindsight is always better than foresight, however. A projection constructed by someone with

Figure 4

Comparison of 1991 Projections of Job Growth with Actual Growth 1990 to 1995



knowledge of the actual outcome will generally be better than projections developed without such knowledge. Probably the only really fair test of the validity of alternative forecasting methodologies is to look back at projections published in the past and compare results.

This section of the paper offers such a test. The 1991 regression-based projections of Bishop and Carter are compared to the BLS projections published in the same year.[5] Summary results on the high-skill and low-skill shares of projected and actual job growth are presented in rows 8 and 11 of Table 5. Projected shares of job growth through 2000 will be compared to shares of actual job growth through 1995. Professional, technical, and managerial jobs actually accounted for 74 percent of job growth between 1990 and 1995. Operatives, laborers, and service workers accounted for 10.5 percent. Bishop and Carter's (B&C) projections clearly come closer to the 1990–95 reality than the BLS projections. B&C projected a 70 percent PT&M share of job growth and a OL&S share of 2 percent. BLS by contrast projected a PT&M share of 41 percent (46 percent when translated into CPS data) and an OL&S share of 27 percent.

In a paper published in early 1992, Bishop presented projections based on a variety of linear specifications, rather than a logit specification (Bishop 1992b). Summary results for these projections are shown in rows 12 through 14 of Table 5. These projections also outperform the BLS projections. The best of the projections for the professional, technical, and managerial category have the same four variables on the right-hand side as the preferred model of Bishop and Carter (1991a). In this preferred model, occupational shares are a function of a time trend, the unemployment rate, the merchandise trade balance as a share of GDP, and the share of workers with computers on their desks.

Let us take a more disaggregated look at how the projections are doing, one-third of the way through the 15-year projection period. Which occupations were accurately projected by both methodologies? Which occupations surprised both B&C and BLS? Figure 4

[5] The regression equations used for this exercise are found in Table B2 of Bishop and Carter (1991a).

compares actual growth during the 1990–95 period to projected growth. (The 15-year projections were sized to a five-year period by the simple expedient of dividing percentage growth projections by 3.) Both projections missed three important developments: sharp slowdowns in the growth of craft jobs, clerical jobs, and technical jobs. In areas of disagreement about growth rates—for managers, professionals, operatives and laborers, and service workers—the B&C methodology produced more accurate predictions. For a description of the B&C model and its stability, see Box 2.

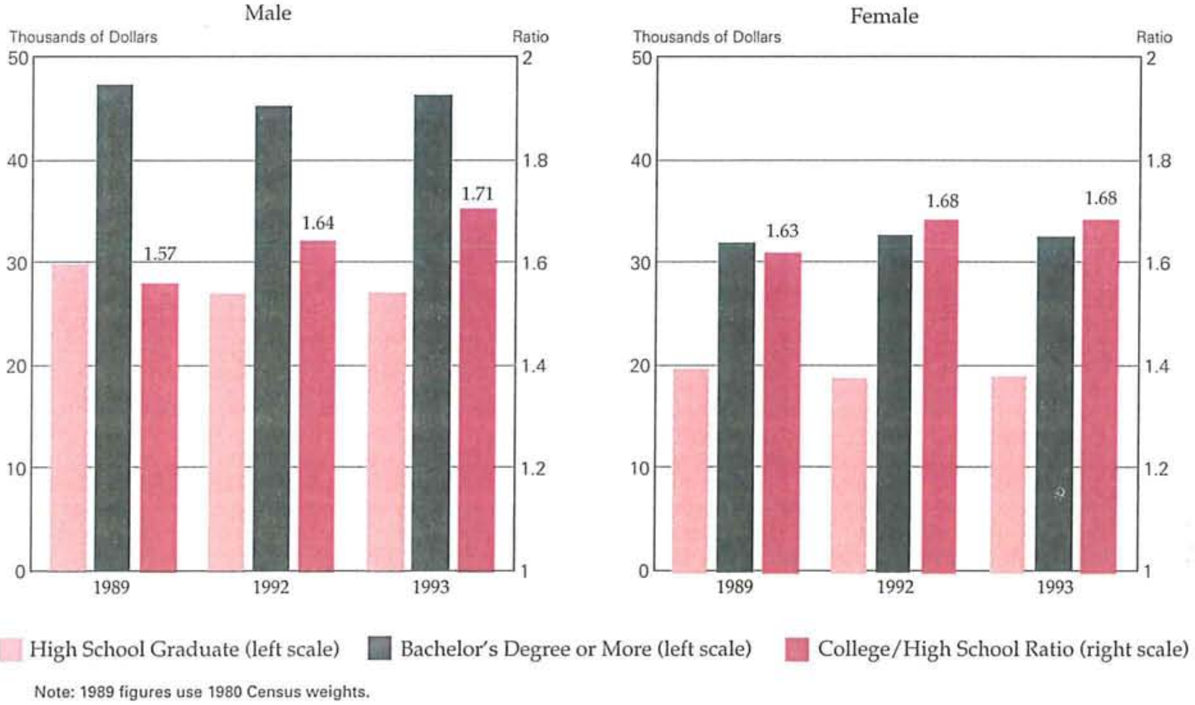
Are the Wage Premiums Paid for Skill Continuing to Rise?

The wage differential between college graduates and high school graduates grew more slowly after the mid to late 1980s than it did in the preceding decade. It still appears to be growing, however. In Katz and Murphy's (1990) data, the weekly wage differential for workers with one to five years of work experience stabilized at a high level beginning around 1985, but the differential for workers of all other experience levels continued to grow through 1990, the latest year of their data series (Murphy and Welch 1993). In Mishel and Bernstein's (1992) data, the differential for workers of all experience levels rose 7.8 percent between 1987 and 1990 and then fell 2.9 percent in 1991. Figure 5 presents the most recent data on the wage premium received by those with four or more years of college. For males, the wage premium rose from 57 percent in 1989 to 64 percent in 1992 and 71 percent in 1993. For females, the premium rose from 63 percent in 1989 to 68 percent in both 1992 and 1993.

The 1991–92 recession caused many companies to cut back their hiring of college graduates. The unemployment rate among managers and professionals, 2.0 percent in the first quarter of 1989, rose to 3.5 percent in September 1992 and then fell to 2.6 percent during

Figure 5

Median Real Earnings, by Education Level
Full-Time, Year-Round Workers Age 25+



Note: 1989 figures use 1980 Census weights.

Box 2: Bishop and Carter's Model of Occupational Employment Growth

It is assumed that the growth of occupational employment shares follows a logistic growth path. B&C assumed that the logistic function had a ceiling of 20 percent. The logit was assumed to have a ceiling in order to build in a slowdown in the rate of growth for three large, fast-growing occupations—managers, professionals, and sales workers. The ceiling was set at 20 percent because that fit the data slightly better than higher ceilings. In the preferred model, the log of the ratio of the j^{th} occupation's share of employment in year t to 0.2 minus that same occupational share, $[S_{jt}/(.2 - S_{jt})]$, is assumed to depend on the year (T_t), the unemployment rate (U_t), and one or more structural variables, (X_t), intended to capture the influence of the economic changes that have occurred in the 1980s. The independent variables have been defined relative to their projected value in the year 2005.

$$\text{2)}\quad \log[S_{jt}/(.20 - S_{jt})] = a_0 + a_1(T_t - 2005) + a_2(U_t - .055) + a_3(X_t - X_{2005}) \qquad t = 1972 \ldots 1989$$

For the three smallest occupations, farm workers, protective service workers, and private household workers, X_t is a trend shift variable for the years after 1980. For the other 10 occupations, the X variables were the ratio of the merchandise trade deficit to GNP ($TRADEF_t$) and the ratio of personal computers used in business to civilian employment ($PCUSE_t$).[6] The advantage of deviating all independent variables from their projected level in the year 2005 is that the intercept term, a_0, then provides an estimate of the forecasted logit of 5 times the j^{th} occupation's share of employment in the year 2005.[7]

Bishop and Carter's regression model of employment growth was estimated on data on employment shares from 1972 to 1989 (Bishop and Carter 1991a). Most of the estimated parameters were

1994. This setback was not the beginning of a crash in the market demand for college graduates; it was a temporary effect of the recession. Blue-collar workers were hurt much more by the recession than managers and professionals. The unemployment rate of operatives and laborers, which was 7.7 percent in the first quarter of 1989, rose to 11.4 percent in July 1992 and was still 9.0 percent during 1994. BLS data on median weekly earnings can also be brought to bear on the issue of recent trends in wage premiums for skill. Between the second quarter of 1991 and the second quarter of 1995, the annual rate of increase of nominal wages was 1.4 percent for operatives and laborers, 1.6 percent for service workers, 1.7 percent for craft workers, 1.2 percent for clerical workers, 3.3 percent for technicians, 2.9 percent for managers and 3.7 percent for professionals. In summary, the very latest data on trends in occupational wage differentials suggest that skill differentials continue to widen.

The latest data on employment growth have similar implications. Between October 1994 and October 1995, professional jobs grew by 753,000 and managerial jobs by 837,000, while service jobs rose by only 31,000 and all other jobs declined by 346,000.

[6] The estimates of the number of PCs in use in business were made by Future Computing/Datapro Inc. and can be found in Table 1340 of *The Statistical Abstract*, p. 179. They are derived by cumulating the numbers of machines sold. A very low scrap rate of 3.4 to 6 percent, depending on the year, was assumed. Where possible, vendor reports were used to allocate sales of computers between categories of end user—business, education, and home. Quite often, however, rules of thumb were used to make these allocations. Future Computing is no longer in business so more detailed information on how the series was constructed and data for 1989 are not available. CPS surveys in 1989 and 1993 provide data on the proportion of workers who use computers at work (NCES 1993c, p. 434, and 1994, p. 439). The proportionate growth rate produced by comparing the two surveys was applied to the 1989 value of the PC use variable from Future Computing. Projections of PC use for succeeding years were made by extrapolation. Projections were based on an assumption that the unemployment rate in 2005 would be 5.5 percent and the merchandise trade deficit would be 1.4 percent of GDP.

[7] B&C estimated a number of alternative models in order to test the sensitivity of results to changes in functional form and specification and in the scenario projected for the year 2000. Such tests were needed because only 18 years of data were available on which to estimate the forecasting model, and theory did not yield only one plausible specification. The results of some of these tests are detailed in Bishop and Carter (1990). While specification and scenario did affect projected occupational shares, all of the specifications yielded substantially larger increases in skilled jobs than the BLS projections. Other findings were robust with respect to specification and scenario as well.

remarkably stable when six additional years were added to the analysis.[8] Coefficients on the time trend hardly changed at all. All of the changes in coefficients on unemployment and trade deficit were within the estimated one-standard-error confidence interval. The intercept coefficients changed the most. The right-hand-side variables have been defined in such a way that the intercept term provides an estimate of the projected occupational share in the year 2005 under an assumption of 5.5 percent unemployment, a zero trade deficit, and an 80 percent higher share of workers using PCs than in 1990. By comparing these intercept coefficients, we can get a rough idea about how the new data have changed the forecast for 2005. For some occupations—professionals, craft, transportation operatives, protective service workers—the updated forecast for 2005 is the same as the old forecast. Compared to B&C's 1991 forecast, the revised forecast predicts more rapid growth for farm workers (6.7 percent), factory operatives (9.6 percent), other service workers (2.7 percent), and laborers (5.5 percent). The revised forecast predicts 3.8 percent less growth for managers, 4.9 percent less growth for sales workers, and 3.3 percent less growth for clerical workers.[9]

The updated regressions predict slower growth for managerial and technical employment than the 1991 B&C regressions and faster growth of operatives, laborers, and service workers. This means that instead of predicting that PT&M will account for 70 percent of employment growth to 2005, the updated projections now forecast that PT&M will account for 60 percent of job growth. The updated model projects that the operative, laborer, and service worker share of 1990–2005 job growth will be 12 percent, up from the 2 percent of the 1991 projection. The new estimates imply a slower rise in skills than before, but they still imply a faster rise in skills than BLS projections. Predictions of the growth of professional jobs are now comparable with BLS's 1993 and 1995 projections. For managerial jobs, however, there is a big difference. The updated projections of managerial job growth are about 4.5 million greater than BLS's 1993 projection.

Is the Supply Response Large Enough to Flood the Market with New BAs?

The one event that could invalidate my prediction of continued high wage premiums for college graduates is a massive increase in the number of college graduates trained in well-paid fields like science, engineering, and business. How likely is such a flood?

The high economic payoffs to college during the late 1980s and the 1990s have increased enrollment in college and the proportion of high school graduates who complete at least one year of college (Figure 6). Non-completion rates have remained high, however, so enrollment increases during the 1980s have had only a modest effect on the share of 25- to 29-year-old high school graduates who have completed a four-year degree or more. Many adults have gone back to school and completed their degree, however, and this has resulted in a substantial increase in the ratio of BAs awarded to the number of 22-year-olds—from 22.5 percent in 1980 to 31.0 percent in 1992 (Figure 7). This ratio is projected to increase further to 35.3 percent in the year 2000, a 57 percent increase over 1980 (NCES January 1995b).

The proportionate increase in the total number of BAs awarded, however, is much smaller because the low birth rates of the 1960s and '70s mean that fewer individuals are in the 20- to 30-year-old age cohort that typically receives most of the BAs. As a result, the

[8] The estimates are available from the author upon request.

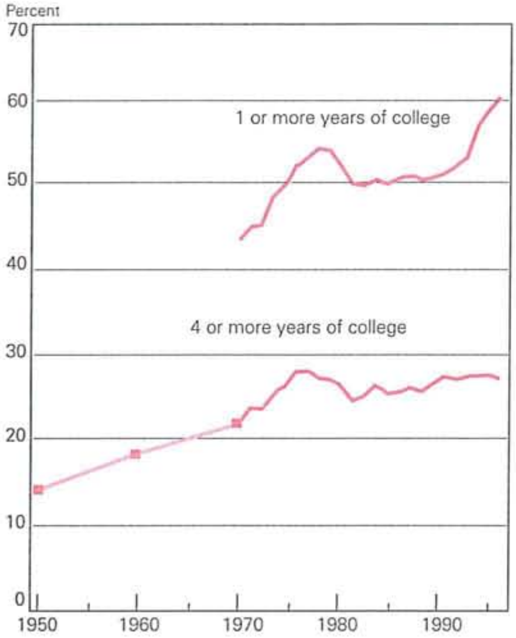
[9] The addition of 1990–95 data significantly changed the projections of employment in 2005 for three key occupations. *Managerial Workers*: In the 1991 paper the growing use of PCs appeared to be the primary explanation of the accelerating growth of managerial jobs during the 1980s. Despite the continued rise in PC use, the recession of the early 1990s caused a larger than expected slowdown in the growth of managerial jobs. B&C forecasts overpredicted managerial jobs by 2 to 4 percent between 1990 and 1993 but then got back on track when unemployment fell to 5.5 percent in 1994 and 1995. The updated estimate of the model gives unemployment a more important role and PC use a less important role in the determination of managerial jobs. *Clerical Workers*: The 1991 B&C model overpredicted the growth of clerical jobs in the early 1990s, underestimating the negative effect of the PC revolution. The updated regression reflects this by giving PC use a bigger role in the determination of clerical employment. *Factory Operatives*: In the 1991 B&C model PC use had a large, statistically significant, negative effect on operative employment. Operative jobs did not decline nearly as much as the model predicted, so the updated regression model assigns less weight to PC use and the result is an increase in projected employment of factory operatives.

number of BAs awarded as a percentage of total employment fell from 1.09 percent in 1974 to 0.95 percent in 1980 and 0.96 percent in 1992. It is projected to fall even further, to 0.88 percent in 2000 and 0.86 percent in 2005. Relative to the stock of college graduates, the number of new BAs has declined even more precipitously. Thus, despite the technology-driven shift in employer demand in favor of college-educated workers, the ratio of new graduates to total employment has not risen.

To make matters worse, the number of college graduates retiring from the labor force is increasing every year, as the veterans who went to college under the GI bill retire from the work force. As a result, the ratio of workers with a college degree to those with a high school degree or less is projected to grow no more rapidly in the 1990s than it did during the 1980s (Bishop 1992b, Table 4).

Figure 6

Percent of 25- to 29-Year Old High School Graduates Who Have Completed at Least One, or at Least Four, Years of College



Is the Rapid Growth of College-Level Jobs since 1970 an Aberration?

Still another way to test the reasonableness of our projections of continued strong growth of demand for college graduates is to look at trends in managerial and professional jobs abroad and in the supply of well-educated workers in other industrialized nations. Let us define the rate of increase in skills as the difference between the growth rate of professional, technical, and managerial (PT&M) jobs and the growth rate of manual jobs (service, craft, operative, laborer, and farm occupations). For the United States, the rate of skill increase was 1.6 percent per year during the first half of the twentieth century, 1.9 percent per year between 1950 and 1970, 2.8 percent per year between 1970 and 1981 and 2.5 percent per year during the 1980s.

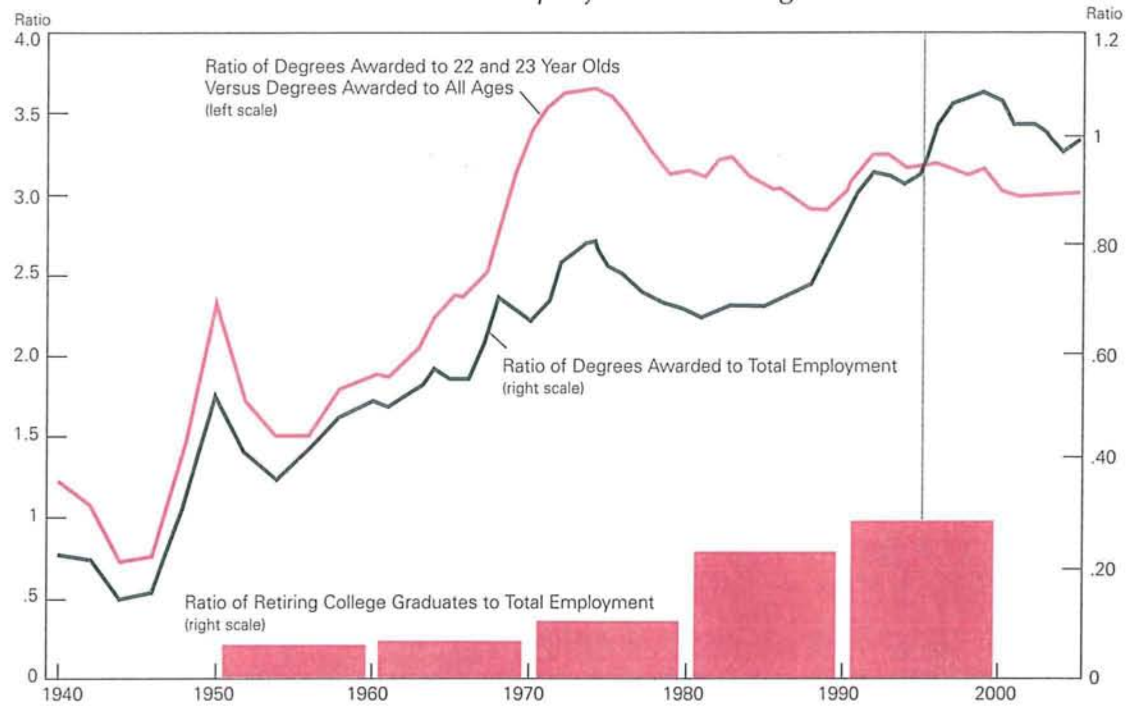
The rise in skills is proceeding even more rapidly in Europe and East Asia (Table 6). The Japanese rate was 4.3 percent per year in the 1970s and 3.3 percent per year in the 1980s, the German rate was 3.7 percent per year in the 1970s and 2.5 percent in the 1980s. Finland's rate was 6.4 percent per year in the 1970s and 5.1 percent per year in the 1980s, Korea's 4.2 percent per year in the 1970s and 6.0 percent per year in the 1980s. Three countries—Canada, Norway, and the United Kingdom—now have proportionately more professional, technical, and managerial workers than the United States, and other countries are close behind.

The supply of college-educated workers has been increasing rapidly all over the world. During the 1970s and 1980s, the share of the population of working age who were university graduates grew at an annual rate of 3.3 percent in the United States, 3.6 percent in Japan, 2.8 percent in Germany, 5.6 to 5.8 percent in Sweden and Norway, 3.1 percent in Belgium and 4.0 percent in Canada (OECD 1989).

The share of the work force that has graduated from university is higher in the United States than in any other country (columns 4 and 5 of Table 6). But many Europeans would argue that the bachelor's degrees awarded at the second- and third-rank American colleges and universities that educate the vast bulk of students reflect a lower standard than the French *licence* or the Dutch *Doctoraal examen*. High school graduation standards are also higher in Europe and Asia. Completing secondary school requires 14 years rather than 13 years of attendance in some countries. In others, high standards result in many students having to repeat grades. In many cases, the material Americans study in the freshman year of college is taught to Asians and Europeans in secondary school.

Figure 7

Trends in the Receipt of Bachelor's Degrees



Any U.S. lead in the share of the work force with college education is also a legacy of policy initiatives that are 30 to 50 years old. The share of 25- to 29-year-olds who have graduated from college is no higher now than it was 17 years ago. In terms of flows—that is, numbers currently in school—the nations of Northern Europe and East Asia have either caught up or surged ahead. Using age-specific school enrollment rates, the OECD has calculated the expected number of full-time equivalent years of schooling (K to 12 or post-secondary) received between ages five and 29. These estimates are presented in the last column of Table 6. For the United States, the figure is 14.8 years. The comparable figure is 15.9 in West Germany and France, 15.8 in Belgium, 15.4 in Canada and Finland, 15.6 in Norway and Denmark, and 16 in the Netherlands.

In sum, the rapid growth of college-trained workers and of college-level jobs is not uniquely American. American youth are neither more nor better educated than their counterparts in Japan and Northern Europe. Thus, the "America is so well educated, much of it must be unnecessary" argument offered by Louis Uchitelle and others is based on a premise that is no longer valid, if it ever was.

Policy Implications of These Findings

Professional, technical, managerial, and high-level sales workers currently (October 1995) account for 38.4 percent of United States employment, 42.2 percent of hours worked, and about 59 percent of the earnings received by all workers.[10] By comparison, craft workers, operatives, and laborers outside of

[10] *Employment and Earnings* (November 1995, pp. 27, 34). High-skill sales workers include sales representatives outside of retail and services and proprietors and supervisors in the retail and service industry. The median weekly wage for full-time managerial and professional workers is 46 percent above the overall median. High-skill sales workers' wages are 30 percent above and technicians' wages 14 percent above the overall average. These ratios are multiplied by the occupation's share of hours worked to calculate the share of earnings going to these high-skill occupations.

Table 6
Occupational Upskilling in OECD Countries

	Annual Rate by Which Professional-Technical-Managerial Grew More Rapidly than Manual Workers		Professional-Technical-Managerial Share in 1990 (Percent)	Percent 25- to 64-Year Olds[a] in 1992 with		Years of School Expected at age 5[a]
	1970–1981[b]	1981–1990[c]		BA/MA+	NonUniv/ AA Deg	
Austria	2.3	2.0	24.0	12	11	15.1
Belgium	3.9	3.1	25.8	9	11	15.8
Canada	3.5	3.9	30.2	15	26	15.4
Denmark	6.6	2.5	28.0	13	6	15.6
Finland	6.4	5.1	28.6	10	8	15.45.9
France	—	—	—	10	6	15.9
(West) Germany	3.7	2.5	19.9	12	10	15.9
Greece	6.1	3.8	14.3	10	3	13.7
Ireland	6.0	2.1	20.3	8	9	14.6
Japan	4.3	3.3	14.9	19	—	14.6
Korea	4.2	6.0	8.7	—	—	—
Malaysia	—	3.0	9.5	—	—	—
Netherlands	4.5	4.3	28.1	21	0	16.0
Norway	5.5	3.9	30.0	12	13	15.6
Singapore	3.8	4.8	20.3	—	—	—
Spain	3.3	5.9	12.8	8	13	15.2
Sweden	3.0	—	—	12	12	14.7
United Kingdom[d]	3.3	3.9	31.5	11	8	14.0
United States[e]	2.8	2.5	29.3	24	7	14.8

[a]OECD, *Education at a Glance*, 1995, pp. 20, 127. The OECD calculates expected years in school by summing, from age 5 through age 29, age-specific school or college attendance rates (full-time equivalents) taken from national census or household surveys. Since the calculation starts with age 5, kindergarten and nursery school attendance is counted as a year in school.

[b]Manual occupations include farming, fisheries, craft, operatives, laborers and service workers. Source: *Yearbook of Labour Statistics* for 1971, 1976, 1981 and 1991, International Labour Organization, Table 2B and Table 3C. Data availability problems resulted in somewhat different time periods being used for Belgium—1970–83, Canada—1971–81, Denmark 1965–81, Greece—1961–81, Ireland—1966–83, Japan—1970–80, Germany—1970–82, and Netherlands—1971–81.

[c]Source: ILO, *1991 Handbook of Labour Statistics*, Table 3. Absent data meant that shorter time periods were used for some countries: Austria 1984–89, Belgium 1983–89, Federal Republic of Germany 1982–89, Greece 1981–88, Ireland 1983–88, and Malaysia 1981–87.

[d]Growth rates were calculated for 1971 to 1978 and 1978 to 1989. Source: *MSC Manpower Report 1980*, p. 8 and *Labour Force Survey 1988 and 1989*, Office of Population Censuses and Surveys, Table 5.11.

[e]Source: Deborah Klein, "Occupational Employment Statistics for 1972–82," *Employment and Earnings*. Jan. 1984. 13–16; and later January issues of *Employment and Earnings*. Because of a change in occupational coding in 1972, the trend was calculated for the 1972–81 period.

construction receive only about 19 percent of the compensation paid in the economy. The competitiveness of the American work force is in reality more a function of the cost and quality of managerial, professional, and technical workers than it is of the blue-collar factory workers who are normally the focus of discussions of competitiveness.

The short-run consequence of a shortage of highly qualified workers is higher wage premiums for the skilled. The long-run consequence may be loss of comparative advantage in industries that make heavy use of managerial, professional, and technical workers. The high cost of hiring managerial and professional workers in the United States is already inducing firms to look elsewhere for these skills. For example, many software companies now economize on expensive American programmers and systems analysts by contracting with subsidiaries in Bulgaria, Russia, and India to develop code for new programs.

In 1991, Hewlett-Packard picked a Frenchman to head its troubled PC division and moved the division's headquarters to his home town of Grenoble, France. Since then, HP has staged a dramatic comeback in the PC market. Manufacturing time was cut, pricing became more aggressive and, as a result, HP moved from fourteenth to sixth largest PC producer in the world. Production, which had been spread across 12 plants, was concentrated into just two, one of which is in Grenoble (*The Economist* 1993). Hewlett-Packard is not alone. In 1991 and 1992, Du Pont moved the headquarters of its electronics division to Tokyo and its agricultural products division and part of its fiber and polymer business to Switzerland. IBM moved its networking systems division headquarters to the United Kingdom (Lublin 1992). Is this the start of a trend?

During the 1980s, 18- to 64-year-old college graduates with a business major earned nearly three times what high school graduates of the same gender earned (Kominski and Sutterlin 1992). Since social rates of return to college are now at postwar highs, substantial increases in supply are desirable. This would simultaneously reduce the supply of unskilled workers, so skill premiums should fall and unskilled wages should rise. It would not be a tragedy if a major increase in college completion rates lowered the wage premium paid business B.A.s over high school graduates to only 100 percent rather than 200 percent. Indeed, competitiveness would improve and income inequality would decline.

The competitiveness of the American work force is in reality more a function of the cost and quality of managerial, professional, and technical workers than it is of the blue-collar factory workers who are normally the focus of discussions of competitiveness.

Substantial increases have already occurred in the proportion of young people getting college degrees, but these have not been sufficient to stop the seemingly inexorable rise in the college wage premium. Still bigger increases in college enrollments have been prevented by a rapid escalation of tuition charges at public colleges and the limited availability of need-based financial aid (Bishop 1992a). During the 1980s, tuition charges rose 48 percent more than student ability to pay out of current earnings.

Legislators and college presidents often justify the escalation of college tuition as only fair, given the high wages graduates receive as adults. Setting tuition high is claimed to be a way of helping those who cannot afford college at the expense of rich college graduates. This is a myth. The promised increases in financial aid are never sufficient to hold college students from low-income families harmless. The primary outcomes are fewer students, fewer graduates, and higher wages for those who complete college. College enrollment and graduation rates are highly responsive to tuition levels. Regression models (Bishop 1992a) imply that raising public college tuition by 50 percent ($893 per year) would lower the enrollment of 18- to 19-year-old women by 16 percent, lower the enrollment of 20- to 24-year-old women by 21 percent, and lower the number of B.A.s awarded to women by 11.8 percent.[11]

Elasticities of demand for and supply of college graduates are such that a 12 percent reduction in the supply of college graduates increases their wage relative to that of high school graduates by about 5.8 percent, or $1886 per year in 1992 dollars.[12] In the new long-run equilibrium that results, the present dis-

[11] Average public college tuition charges were $1787 in 1992–93 (NCES 1993c, p. 309). A regression predicting the ratio of BAs awarded to women divided by the mean number of high school diplomas received by women 4 to 10 years previously was used to predict the impact of a 50 percent increase in public college tuition from its 1988 level (Bishop 1991). The ratio of tuition to the forgone earnings of female college students (the wage of female high school graduates with 1 to 5 years of work experience times .75) was assumed to be .1355, its actual level in 1988. The higher tuition policy is assumed to increase this permanently to .20325. The proportionate change in BA awards was calculated by multiplying (.20325 − .1355) × (the coefficient on the tuition variable) × (1 minus the ratio of BAs to high school diplomas in 1989) = (.06775) × (−2.72) × (1 − .362) = 11.75 percent.

[12] The relative supply of college graduates is defined as $ln[(BAs/HSG)/(1 - BAs/HSG)] = ln[BAs/(HSG - BAs)] = E_s$. The effect of the 50 percent increase in tuition on E_s, TP, is $-.1843 = .06775 \times (-2.72)$. Using a logarithmic approximation of the model predicting E_s in Bishop (1991), we have a formula for the relative supply curve: $E_s = .89 \times ln(W_{CG}/W_{HSG})/.75 + TP + S$, where S captures the effect on supply of other exogenous variables. Following Blackburn, Bloom, and Freeman (1989), I assume an elasticity of relative demand of −2, so the relative demand curve is $E_d = -2.0 \times ln(W_{CG}/W_{HSG}) + D$, where D is a variable reflecting other influences on relative demand for college graduates. Setting $E_d = E_s$, and reorganizing terms to get an expression for the relative wage, we have $ln(W_{CG}/W_{HSG}) = (TP + S - D)/(-2.0 - .89/.75) = (TP + S - D)/3.19$. The long-run impact of the tuition increase on relative wages is $(-.18428)/(3.19) = .0578$ or 6 percent. If the elasticity of relative demand had been assumed to be −4, the equilibrium increase in relative wages would have been 3.55 percent. Even with this very high elasticity of substitution, the long-run effect of a high tuition policy is to help college graduates and hurt those who do not go to college. Since a 12 percent change in the flow of new BAs takes many years to have comparable effects on the stock of BAs, short-run effects on relative wages would be small, so when the policy is introduced the first few cohorts of college graduates lose out initially, because the wage increase starts out being small. After eight years or so, however, college graduates benefit from the policy change.

counted value of after-tax earnings over the course of the graduate's career goes up $23,100, much more than the $3574 of additional tuition payments.[13] Those who graduate from college gain from a high-tuition policy. Two groups lose: those who are prevented from attending and graduating from college and those who never planned to go to college in the first place. They suffer a decline in their real wage because the number of high school graduates competing for the limited number of low- and medium-skilled jobs has gone up.

The implication of this discussion is that low tuition levels in public colleges (and tax deductions for college tuition) are both an effective and a fair way of increasing the supply of college graduates. Other ways of increasing the supply of college graduates are expanded financial aid; higher academic standards in high school, to reduce college drop-out rates; expansion of advanced placement programs, so as to shorten the time required to earn a degree; and preference for immigrants with high-level scientific and technical training over immigrants with little education and few skills.

[13] I seek to calculate the long-run impact of the policy of raising public college tuition charges by 50 percent and keeping them high. Mean earnings of college graduates were $32,629 in 1992, so a 5.8 percent increase is $1886 per year. The marginal tax rate (netting out deductions) on these earnings is assumed to be 35 percent, so at a 5 percent real rate of discount, the PDV at age 21 is $1886. $\times$ .65 $\times$ 17.89 = $21,931 where 17.89 = $(1/.05)(1 - e^{45r})$ because the individual is assumed to work continuously until age 66.

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Discussion

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I agree with the basic argument of John Bishop's paper, that college will continue to be a good investment in the years to come. I would like to address four questions raised by his paper. The first three might be asked by readers of media reports about hard times for college graduates. Many of these reports, as Bishop points out, are based on projections made by the U.S. Bureau of Labor Statistics. My responses to the questions posed by hypothetical readers are based on a paper that John Tyler, Frank Levy, and I recently published. The questions are as follows:

- Why are so many college graduates anxious about their economic positions, given that they are faring so much better than high school graduates?
- Is there any group of college graduates whose labor market experiences during the 1980s fit the gloomy prediction of the BLS?
- How can John Bishop's optimistic picture of the attractiveness of investing in college be reconciled with everyone's experience of knowing a college graduate from the class of 1994 or 1995 who is working at a coffee bar?
- How can states most effectively help low-income high school graduates pay for college?

Why Are Recent College Graduates (Especially Males) Anxious?

The first line of Table 1 lists the median earnings for 25- to 34-year-old male college graduates in the years 1979, 1989, and 1993, all in 1993 dollars. The second line lists comparable information for 25- to 34-year-old male high school graduates. The third line lists the college graduate/high school graduate earnings ratio, showing clearly the growth in the education-related earnings premium. However, another look at the top line shows that the median earnings of young male college graduates grew only 2 percent between 1979 and 1989 and fell by 4 percent during the subsequent four years.

As the figures in the second line make clear, the education-related earnings differential rose because of the dramatic decline in the earnings of high school graduates. The median income of 25- to 34-year-old high school graduates in 1993 was $20,000; this is less than three-fourths of the median earnings (in 1993 dollars) for the comparable group in 1979. Thus, while young college graduates are certainly better off relative to high school graduates today than was the case in 1979, young male college graduates do not have significantly higher incomes today than their counterparts did 15 years ago. This is one factor that contributes to their anxiety. Another is that most have larger college debt burdens than did their counterparts 15 years ago. This is a consequence of the rapid tuition increases, particularly at public colleges, that Bishop describes in his paper.

Is There Any Group of College Graduates Whose Labor Market Experiences Fit the Stories of the Media Jeremiads?

Table 2 lists two indicators of economic well-being in 1979 and 1989 for four groups of college graduates: 25- to 34-year-old women, 25- to 34-year-old males, 45- to 54-year-old women, and 45- to 54-year-old males. The two indicators are median earnings (in 1993 dollars) and the percentage of the group holding jobs classified as "high school jobs" by economists at the BLS. As the numbers make clear, young

Table 1
Median Earnings of 25- to 34-Year-Old Males and Females, in 1993 Dollars

		1979	1989	1993
Males	College Graduates	$31,579	$32,336	$31,000
	High School Graduates	$27,427	$22,791	$20,000
	Earnings Ratio: Coll. Grad/ H.S. Grad	1.15	1.42	1.55
Females	College Graduates	$19,593	$24,252	$24,340
	High School Graduates	$13,719	$13,858	$14,000
	Earnings Ratio: Coll. Grad/ H.S. Grad	1.43	1.75	1.74

Source: The 1979 and 1989 earnings figures were calculated from the 1980 and 1990 Public Use Microdata 1 Percent Samples of the U.S. Census of Population and Housing. The 1993 earnings figures were calculated from the March 1994 Current Population Survey.

Table 2

Indicators of Economic Well-Being in 1979 and 1989 for Four Groups of Four-Year College Graduates

Cohort	1979	1989	Percent Change
Young Women (25 to 34)			
Median Earnings (1993 $)	$19,593	$24,252	23.8
Percent in Jobs Requiring High School Education	28.2	25.2	−3.0[a]
Young Men (25 to 34)			
Median Earnings	$31,579	$32,336	2.4
Percent in Jobs Requiring High School Education	25.0	23.2	−1.8[a]
Older Women (45 to 54)			
Median Earnings	$21,552	$26,561	23.2
Percent in Jobs Requiring High School Education	27.6	23.6	−4.0[a]
Older Men (45 to 54)			
Median Earnings	$52,886	$50,814	−4.1
Percent in Jobs Requiring School Education	14.5	17.9	3.4[a]

[a]In percentage points.

Note: Data are for college graduates who worked at least one week during 1979 or 1989. All statistics reported in this table were calculated from the 1980 and 1990 Public Use Microdata 1 Percent Samples of the U.S. Census of Population and Housing.

women improved their position over the decade of the 1980s; young men held their own; older women improved their position. The one group in a worse average economic position in 1989 than the comparable group in 1979 is the 45- to 54-year-old men. As Bishop explains in his paper, there are reasons to be cautious in interpreting changes over time in the percentage of a group employed in what the BLS refers to as "high school jobs." But the decline over the 1980s in the median real earnings of older male college graduates is unequivocal. The difference between the declining economic position during the 1980s of older men and the stable or improving position for other groups of college graduates is missing from most BLS studies, because they tend to group all college graduates together in their analyses.

What about the College Graduates Working in Coffee Bars?

Figure 1 displays the median earnings of male high school graduates and male college graduates from the ages of 22 to 30, in 1989 and in 1993. The very low median earnings for college graduates at age 22 and 23 are consistent with everyone's anecdotes about college graduates working in coffee bars. But the earnings at age 30 are consistent with the earnings figures reported earlier. So the story is that it does take many college graduates a couple of years to find their way into jobs that have career potential. But it does happen. Moreover, it happened in 1993 as well as in 1989. In fact, the projected earnings profiles for college graduates in the two years are remarkably similar.

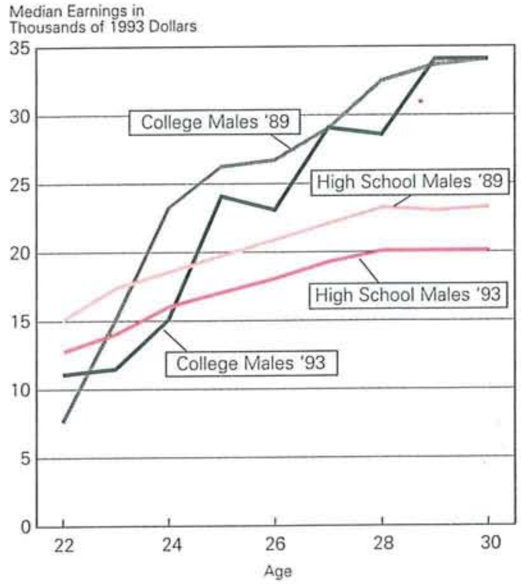
In contrast, the charted earnings profiles for male high school graduates are much more shallow, illustrating that not only do they have low earnings at age

The deterioration in the earnings of male high school graduates that took place during the 1980s has continued into the 1990s.

Figure 1

"Coffee Bars Story" for Males

High School vs. College Graduates, 1989 and 1993



22, they also have quite low earnings at age 30. Note also that at each age level, the median earnings of male high school graduates are lower in 1993 than in 1989, illustrating that the deterioration in the earnings of male high school graduates that took place during the 1980s has continued into the 1990s.

How Can States Most Effectively Help Low-Income High School Graduates Pay for College?

In closing, I would like to comment on Bishop's argument that the escalation of tuitions at public colleges and universities should stop because it is keeping many students from college, especially students from low-income families, who could benefit from this investment. I share his concern with the problem. However, I wonder whether a better response than arguing for tuition rollbacks might not be found. Currently, the states contribute about $40 billion to public post-secondary education. Over 90 percent is used to subsidize tuition rates. Given the fiscal situations in most states, this amount is unlikely to increase over the coming years, which means that it will be difficult even to maintain current tuition levels, never mind reduce them.

It seems to me that a better policy would be to allow tuitions to increase and use a significant part of the increased revenue for need-based financial aid, targeted to low-income students, whose enrollment decisions are especially sensitive to costs. This will work only if the availability of such aid is well publicized, and if significant steps are taken to simplify the application process for student aid. But these steps seem manageable, and targeting more of state financial assistance to low-income students seems important to do, given the tight fiscal situation.

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