

APPENDIX B

ADDITIONAL INFORMATION ON FACTORS AFFECTING UNEMPLOYMENT

INTRODUCTION

This appendix contains information on a number of variables examined in the process of preparing this report, but judged to be of less interest to readers than the variables presented. These variables are included in this appendix for those with a more specialized interest in this topic, especially researchers interested in performing additional analyses of unemployment.

For ease of presentation, variables discussed in this Appendix have been classified into three groups:

- those examined during exploratory work that were excluded from the multivariate analysis;
- those included in the preliminary multivariate analyses but eliminated for lack of statistical significance from the final model; and
- those found to be statistically significant during the multivariate analysis, but judged to be of relatively low interest to most readers due to the weakness of their association with unemployment and a lack of prior research suggesting they have a significant association with unemployment.

VARIABLES EXCLUDED FROM THE MULTIVARIATE ANALYSIS

Pursuit of Additional Degrees and Courses After Receipt of the Doctorate

At the start of the analysis, the relationship between unemployment and the pursuit of additional formal education after receipt of a doctorate was examined. It was hypothesized that receiving another degree after the first doctorate and/or taking additional courses since the last degree would increase marketability. However, the observed unemployment rate was actually higher for those who pursued additional education subsequent to the doctorate,

although only the additional course work data were statistically significant.³⁷ It is important to note that the 1993 SDR did not ask whether the individual had ever had a postdoctoral appointment. A determination of whether a postdoctoral appointment was associated with higher or lower subsequent unemployment, therefore, was not possible.

Presumably, the relatively high unemployment rate associated with additional training at the doctoral level is attributable to respondents who had trouble finding suitable employment in their degree fields and decided to pursue additional training. If this interpretation is correct, it would not be reasonable to include these education and training variables in a regression model designed to estimate unemployment from a series of independent variables.

The survey also contained a series of questions about work-related training received during the preceding year. For three of these variables—management training, technical training, and general professional training—there is a statistically significant relationship in the expected direction; for example, those who had training are less likely to be unemployed than those who did not receive training. Only the category “Other Work-Related Training” was not associated with unemployment. However, individuals who are employed are more likely to have access to free, work-related training than those without employment. It would, therefore, be incorrect to infer that the association between training courses and unemployment is attributable to the actual training courses causing unemployment. Accordingly, these training variables were also excluded from the analysis.

³⁷ Statistical significance is a function of the size of the sample as well as the strength of a relationship. Since few individuals receive a degree subsequent to their first doctoral degree, the lack of statistical significance may be attributable to the small sample size rather than to a lack of association between the variables.

Spouse's Work Status

Spouse's work status may well affect the likelihood of being unemployed. Individuals with spouses who have demanding careers may be constrained in their own career choices. On the other hand, having a spouse who is not employed may exert pressure to accept a suboptimal job. Among married respondents, unemployment was lowest for those who had spouses employed part-time (1.0 percent). Those with spouses employed full-time, or not employed, had unemployment rates of approximately 1.5 percent (table B-1). The pattern was similar for men and women (table A-1).

Among those who had employed spouses, the type of work done by the spouse might constrain the individual's career choices and thus affect the unemployment rate. One question on the 1993 SDR that permitted exploration of this issue was whether the spouse's job required expertise equivalent to a bachelor's degree in one of the following areas: natural science or engineering, social science, or another field. Having a spouse employed in the social sciences (1.0 percent) or in non-B.A. fields (0.8 percent) was associated with slightly lower unemployment rates than was having a spouse employed in the other fields.

Although these interrelationships were statistically significant, the difficulty in interpreting multiple complex interaction effects, such as the simultaneous consideration of the interaction effect of gender and spouse's work status on unemployment and the interaction effect of gender and marital status on unemployment, led to a practical limitation on the number of interaction effects included. The interaction effects between gender and spouse's work status were considered to be of less interest than the interaction effects studied in the analysis. Adding the spouse work status variables to the basic regression model used in this analysis indicated that little explanatory power was lost by deleting these variables.

Professional Association Activities

Professional society membership and attendance at professional society meetings were associated with low unemployment rates (table B-2). Individuals who attended no professional association meetings in the preceding year had an unemployment rate of 4.1 percent, compared to 1.0 percent for those who attended at least one meeting. Those who had no professional association memberships had an unem-

Table B-1. Unemployment rates for doctoral scientists and engineers, by spouse's work status: 1993

Spouse's Work Status	Population Size	Unemployment Rate -- by Percent
Has spouse who is not employed.....	113,550	1.5
Employed:		
Full time.....	193,090	1.5
Part time.....	67,750	1.0 *
Employed:		
Science.....	87,690	1.6
Social Science.....	63,890	1.0 *
Other B.A. field.....	88,600	1.6
No B.A. field.....	20,650	0.8 *

*Difference between unemployment rate observed in group and total unemployment rate excluding those in the group is statistically significant at .05 level.

¹ See the Technical Notes for an explanation of the adjustment methodology used in calculating standardized unemployment rates.

NOTE: Detail may not add to total because of rounding.

SOURCE: National Science Foundation/SRS, 1993 Survey of Doctorate Recipients.

Table B-2. Unemployment rates for doctoral scientists and engineers, by professional association activities: 1993

Professional Association Activities	Population Size	Unemployment Rate -- by Percent
Attended a professional association meeting within the last year		
No.....	95,220	4.1 *
Yes.....	375,250	1.0 *
Number of national professional association memberships		
0.....	58,000	3.7 *
1.....	94,790	1.9
2.....	111,980	1.4 *
3.....	85,390	1.1 *
4.....	49,590	1.2 *
5.....	32,540	0.6 *
6.....	17,560	1.0 *
7.....	5,610	1.1
8.....	5,600	0.7 *
9 or more.....	9,410	0.6 *
All individuals**	470,500	1.6

* Difference between unemployment rate observed in group and total unemployment rate excluding those in the group is statistically significant at .05 level.

** Includes individuals for whom information on professional associations was not available.

¹See the Technical Notes for an explanation of the adjustment methodology used in calculating standardized unemployment rates.

NOTE: Detail may not add to total because of rounding.

SOURCE: National Science Foundation/SRS, 1993 Survey of Doctorate Recipients.

ployment rate of 3.7 percent. Rates tended to decline as the number of memberships increased—those with 9 or more memberships had an unemployment rate of 0.6 percent. However, it seems reasonable to hypothesize that this association is at least partially attributable to employer contributions to, and encouragement of, professional society activities. Therefore, these two variables were excluded from the multivariate analysis.

Other Variables

The 1993 SDR includes a number of variables related to the reasons for taking certain actions, such as obtaining training. These were ultimately not included, because it seemed likely that associations between these variables and unemployment are indicative of actions individuals took in response to their employment situation, rather than factors that affect

the likelihood of being unemployed. It would, therefore, be misleading to include them in a model designed to identify factors leading to unemployment.

VARIABLES ELIMINATED DURING THE MULTIVARIATE ANALYSIS FOR LACK OF STATISTICAL SIGNIFICANCE

Occupational Characteristics

Broad occupational groups were used in the primary analysis of occupation in the doctoral science and engineering population. However, within each of these groups, subfields may have had different unemployment rates. Small sample sizes for these subfields precluded reasonably reliable estimates of subfield unemployment rates. Characteristics of detailed 1988

occupations associated with unemployment status in 1993 were examined. The characteristics of the detailed occupations were derived from the SRS/NSF 1993 National Survey of College Graduates (NSCG), a survey of individuals who reported having bachelor's or higher degrees in the 1990 Census.

Two of the three variables examined did not have a statistically significant association with unemployment after controlling for the other variables in the preliminary multivariate analyses and were, therefore, deleted from the final model. These variables were the salary level of the 1988 occupation and the percent of those in the NSCG survey employed in the 1988 occupation who had a doctoral degree. For both of these variables, individuals employed in the lower-ranked (i.e., lower salary or lower percentage of doctoral individuals) occupations in 1988 were more likely to be unemployed in April 1993. Although these relationships were not statistically significant when examined in the logistic regression equation, the direction of the relationship is consistent with the general observation of this report that indicators of previous interruptions in suitable full-time work were associated with more unemployment in 1993.

Prior Retirement

As expected, previous retirement negatively affected current employment. The unemployment rate was 3.4 percent among those who had previously retired, compared to 1.5 percent for those who had not previously retired. However, when previous retirement was included in the multivariate analysis, it was not statistically significant. Thus, the observed relationship between previous retirement and unemployment appears to be explained by the control variables.

Birth in a Rural Area

There is little difference in the unemployment rates of individuals who lived in rural areas while growing up and those who did not. Both groups had unstandardized unemployment rates of approximately 1.6 percent. After controlling for the other variables, the regression analysis did not show statistically significant differences between these two categories.

Citizenship

Because many government and government-contractor jobs require U.S. citizenship and because employment is a prerequisite for certain types of visas, it is not surprising that permanent residents had a higher unemployment rate (2.2 percent) than temporary residents (1.4 percent) or U.S. citizens (1.6 percent) in 1993.

The relative advantage of being a U.S. citizen was also observed in the 1972 NSF report. In 1971, the unemployment rate was 2.5 percent for U.S. citizen scientists (compared with 4.2 percent for non-U.S. citizens) and 3.0 percent for U.S. citizen engineers (compared to 4.6 percent for non-citizens). However, controlling for other variables reduced the observed association between citizenship status and unemployment, causing them to be statistically non-significant.

Interaction Between Race/Ethnicity and Whether Born in the United States

Prior work on salary differentials by race/ethnicity indicated that it is helpful to examine separately salary levels by race/ethnicity, for individuals born in the United States and those born in other countries.³⁸ Therefore, after race/ethnicity was deleted from the analysis, the possibility of the interaction effect between race/ethnicity and whether the person was born in this country was examined. The relationship was not statistically significant (though these data included only those who received their doctorates from U.S. institutions).

OTHER VARIABLES IN THE FINAL MODEL NOT DISCUSSED IN THE BODY OF THE REPORT

1988 Occupation Characteristics

Certain characteristics of the 1988 detailed occupational fields were examined to determine whether or not they contributed to the explanation of unemployment in 1993. Only one characteristic was

³⁸ NSF 96-311.

statistically significant—the percent of college-educated individuals in the detailed occupation reported in the 1993 NSCG as employed involuntarily out-of-field.³⁹ Those employed in occupations that had involuntarily out-of-field rates exceeding 6 percent had a 4.3–percent unemployment rate, compared to an unemployment rate of only 1.2 percent for those in occupations having 1 to 2 percent involuntarily out-of-field rates (chart B-1).

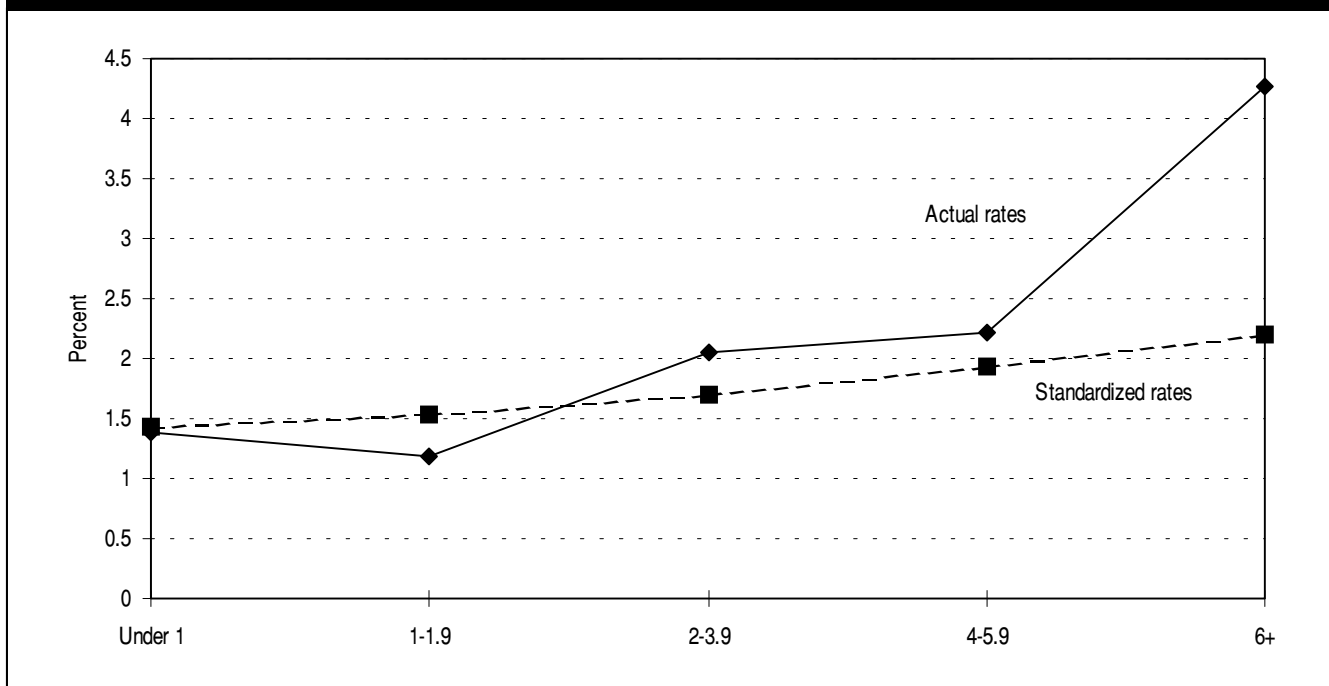
The impact of this variable, however, was significantly diminished by the controls. Standardized unemployment rates ranged from 1.4 percent for those in 1988 occupations characterized by a 0.5–percent involuntary out-of-field rate to 2.2 percent for those in occupations characterized by a 7.0–percent involuntary

out-of-field rate. Because of the difficulty in explaining this relatively complex measure and the small impact, this variable was not discussed in the body of the report.

Parental Education

Family background is likely to influence the probability of unemployment. Therefore, it is conceivable that parents’ educational level has an effect on the likelihood of being unemployed. Although the analysis confirmed a statistically significant relationship between parental education and unemployment, the nature of this relationship is weak and difficult to describe (table B-3). Individuals whose parents had less than a high

Chart B-1. Unemployment rates of persons with doctoral degrees in science and engineering, by percent of those in 1988 occupation who were involuntarily out-of-field: 1993



NOTE: See the Technical Notes for an explanation of the adjustment methodology used in calculating standardized unemployment rates.

SOURCE: National Science Foundation/SRS, 1993 Survey of Doctorate Recipients.

³⁹ The occupation characteristics were based on information obtained from the 1993 National Survey of College Graduates. See the Technical Notes for additional information.

Table B-3. Unemployment rates for doctoral scientists and engineers, by parental education: 1993

Parental Education	Population Size	Actual Unemployment Rate	Standardized Unemployment Rate ¹
		by Percent	
Less than high school.....	55,200	2.3 *	1.9
High school.....	107,200	1.5	1.6
Some college.....	65,260	2.1 *	2.1
2-year college.....	18,270	1.3	1.2
4-year college.....	87,330	1.4	1.5
Some graduate school.....	20,280	1.3	1.4
Master's.....	53,650	1.2 *	1.3
Doctorate.....	62,500	1.6	1.7
All individuals**	471,000	1.6	1.6

* Difference between unemployment rate observed in group and total unemployment rate excluding those in the group is statistically significant at .05 level.

** Includes individuals who did not know parents' educational level.

¹See the Technical Notes for an explanation of the adjustment methodology used in calculating standardized unemployment rates.

NOTE: Parental education is defined as the education level of the more highly educated parent. Detail may not add to total because of rounding.

SOURCE: National Science Foundation/SRS, 1993 Survey of Doctorate Recipients.

school education or some college had unemployment rates above 2 percent, compared to the 1.2 to 1.6 percent rates for those in the other categories.

Interaction Between Marital Status and Race/Ethnicity

Although race/ethnicity did not have a statistically significant association with unemployment, there was an association between race/ethnicity, marital status, and unemployment (table B-4). Unemployment rates indicate that for non-Hispanic whites, Hispanics, and

non-Hispanic blacks, unemployment rates are higher for unmarried individuals than for married individuals. However, there was little difference in the rates for married and unmarried Asians.

Foreign Research Experience

Experience conducting research outside of the United States, or interest in this experience, is another work-related variable that could affect employability. Although this variable was statistically significant in the multivariate analysis, its impact was minor.

Table B-4. Unemployment rates for doctoral scientists and engineers, by marital status and race: 1993

Marital Status/Race	Population Size	Actual Unemployment Rate	Standardized Unemployment Rate ¹
		by Percent	
Married -- total**	374,390	1.4 *	1.4
Non-Hispanic white.....	313,690	1.4 *	1.4
Non-Hispanic black.....	6,380	0.9 *	0.9
Asian.....	45,550	1.9	1.5
Hispanic.....	7,390	1.8	1.8
Not married -- total**	96,110	2.4 *	2.4
Non-Hispanic white.....	83,010	2.4 *	2.4
Non-Hispanic black.....	3,380	2.1	2.4
Asian.....	7,120	1.7	1.3
Hispanic.....	2,210	2.3	2.4
All individuals**.....	470,500	1.6	1.6

* Difference between unemployment rate observed in group and total unemployment rate excluding those in the group is statistically significant at .05 level.

** Includes Native Americans who are not shown because of small cell sizes.

¹See the Technical Notes for an explanation of the adjustment methodology used in calculating standardized unemployment rates.

NOTE: Detail may not add to total because of rounding.

SOURCE: National Science Foundation/SRS, 1993 Survey of Doctorate Recipients.