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The Impact of Degree Field on the Earnings of Male and Female College Graduates

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Abstract [1]

Since the gender demographics across majors have dramatically changed over the last few decades, a re-examination of the relationship between gender, undergraduate major selection, and compensation levels once in the workforce is important. This article will focus on how the salaries of college graduates have changed over the last decade. The analyses will explore the extent to which undergraduate major selection contributes to any male-female salary gap. A comparison of regression models for 1993 and 2001 describes the extent to which the selection of major remains a significant factor among those individuals who have entered the workforce.

[1] This article is intended to promote the exchange of ideas among researchers and policy makers. The views expressed in it are part of ongoing research and analysis and do not necessarily reflect the position of the U.S. Department of Education.

Introduction

Numerous reports have examined differences in earnings potential according to occupation, while others have reported on salary differences by gender. The most widely used data for these statistics come from the Bureau of Labor Statistics and the Census Bureau. The Department of Education frequently utilizes the Current Population Survey in its long-term trend analysis of median earnings by gender and education level (see the *Condition of Education*, and *Digest of Education Statistics*, various years). While these analyses have revealed a narrowing disparity between males' and females' earnings, the data are limited because they offer little detail about how these gaps may vary by type of college major, nor can they provide information about the prior labor force experience that men and women bring into the labor force upon graduation. Studies based on these surveys have not provided separate analyses of those who have gone directly into the workforce from college and those who enrolled in a graduate program immediately following undergraduate graduation.

Since the gender demographics across majors have dramatically changed over the last few decades, a re-examination of the relationship between gender, undergraduate major selection, and compensation levels once in the workforce is important. This paper will focus on how the salaries of college graduates have changed over the last decade. The analyses will explore the extent that undergraduate major selection contributes to any male-female salary gap. A comparison of regression models for 1993 and 2001 describes the extent to which the selection of major remains a significant factor among those individuals who have entered the workforce.

New 2001 data from the National Center for Education Statistics (NCES) *Baccalaureate and Beyond Longitudinal Study* (B&B) provide the opportunity to examine the relationship between gender, undergraduate major selection, and compensation levels once in the workforce. The release of these new data also enables the examination of how degree patterns have changed over time and the evolving relationship of various college majors to salary outcomes for males and females. This paper draws on results from the B&B survey to help shed light on the impact of college major on earnings in both 1994 and 2001 and highlight those areas in which salary earnings for males and females remain significantly different.

Previous Research

Researchers have long studied the extent to which gender differences play a role in postsecondary educational choices and subsequent earnings. Over the last 30 years, women have made significant gains in postsecondary educational attainment, in terms of both their enrollment rates and degree completion (*Trends in Educational Equity of Women and Girls 2004*). The proportion of females enrolled in undergraduate schools rose from 42 percent in 1970 to 56 percent in 2000, while the proportion of females enrolled in graduate schools increased from 39 percent in 1970 to 58 percent in 2000. Females accounted for 47 percent of first-professional students enrolled in 2000, compared to 9 percent in 1970. (*Digest of Education Statistics 2002*, tables 188-190). Although women now constitute a sizeable majority of students on campus, enrollment rates of males and females in specific majors or graduate programs vary significantly (Clune et al., 2001; McCormick et al. 1999). For example, males

remain more likely than females to major in engineering and computer science, while females are more likely to major in education, or nursing and other health related fields.

Educational choices, such as major or program of study, have pronounced effects on the subsequent vocations that students enter (Gianakos and Subich, 1988; Eccles, 1994). Different programs of study provide individuals with different skill sets that translate into differential compensation in the workforce. There is some evidence that females may be more likely than males to prepare for jobs in fields that have historically shown less economic promise (Jacobs, 1989). Some research has indicated that between 40- 50% of the salary gap between male and female recent college graduates can be explained by gender differences in choice of major (Daymont and Andrisani, 1984; Weinberger, 1998; Gerhart, 1990). Other study found that gender differences in choice of major accounts for only 1% of the salary gap between males and females (Joy, 2003). However, this study included a full treatment of industry classifications in the regression in addition to the college majors. A number of the majors are highly correlated with industry, such as education majors employed in the education sector. Since the sample sizes in quite a number of the majors are relatively limited, this sort of problem could make it more difficult to distinguish which part of any salary difference is due to major selected and those due to industry of occupation. Data from the newly released 2000/01 Baccalaureate and Beyond Longitudinal Study reveal large ranges among the majors similar to previous studies (Gianakos and Subich, 1988; Eccles, 1994).

Previous analyses based on earlier Baccalaureate and Beyond studies revealed gender differences in major selection, and discrepancies in males' and females' salaries even among those in the same field (Horn and Zahn 2001). Horn and Zahn's (2001) analysis of the 1993/94 *Baccalaureate and Beyond* data found significant gender differences in salary for all types of majors except the humanities, health, and engineering/architecture. These findings were based on individuals who had not enrolled in graduate school by 1997.

In addition to gender differences in major selection, several other factors may contribute to the earnings gap between males and females. Some research has indicated that women have comparatively less job experience than men and that their salaries reflect this differential exposure to the workforce (O'Neill and Polachek, 1993). Because of their greater time allocation to domestic tasks, women may choose professions that require a shorter-term commitment to career development (Stanley and Jarrell, 1998). By focusing on full-time employed recent college graduates, this analysis seeks to avoid some of the issues of differential exposure to the labor force and time allocation to domestic tasks that may impact on salary differences.

Data Source and Methods

The paper draws primarily on 1993/94 and the new 2000/01 data from the National Center for Education Statistics (NCES) *Baccalaureate and Beyond Longitudinal Study* (B&B: 93/94 and B&B:00/01). These surveys provide the opportunity to reexamine the relationship between gender, undergraduate major selection, and compensation levels once in the workforce. Results from these studies can clarify the impact of college major on potential earnings in 1994 to 2001 for males and females, one year after college graduation.

The first portion of the analysis in this paper will present descriptive statistics on the proportion of males and females in each college major type for 1992-93 and 1999-2000. This analysis is based on universe data collected through the NCES Integrated Postsecondary Education Data Survey (IPEDS). Degree data are collected by gender from

all degree-granting Title IV eligible institutions in the country. The response rate for this sector was 93 percent in 1992-93 and 97 percent in 1999-2000. In both survey years, data for the relatively small number of institutions that did not respond to the survey were imputed. These data were used to analyze the difference in degree completion of males and females between 1992-93 and 1999-2000 because they enable more precise comparisons than through the B&B survey. The B&B samples for some majors are relatively small, and the resultant large standard errors preclude detection of small changes over time. In contrast, degrees conferred data are based on college administrative records and are not subject to respondent social desirability or recall bias as are survey respondents.

The remaining portions of the paper are based on the Baccalaureate and Beyond Longitudinal Study, which provides comprehensive data on both college and post-college experiences of college graduates. Participants were randomly selected from the participant pool of the National Postsecondary Student Aid Study (NPSAS) and first surveyed during their senior year of college. Follow-up surveys were conducted one year after bachelor's degree completion. For this analysis, the 1994 and 2001 follow-up surveys were used as they give detailed information on both 1992-93 and 1999-2000 college graduates, respectively. In 1994, approximately 92 percent (10,080 individuals) of the graduates responded to the Baccalaureate and Beyond Longitudinal Study 93/94 First Follow-up survey (B&B:1993/94). This rate combined with an institutional response rate of 88 percent and a NPSAS response rate of about 89 percent resulted in an overall response rate of 72 percent (Baccalaureate and Beyond Longitudinal Study 93/94 First Follow-up Methodology Report.). The 2001 Baccalaureate and Beyond Longitudinal Study (B&B:2000/01) was based on the nationally representative sample of NPSAS:2000. Students in the NPSAS sample who had completed a bachelor's degree between July 1, 1999 and June 30, 2000 formed the basis for the B&B:00/01 survey. The overall response rate for B&B:00/01 was 74 percent, combining the response rates from the postsecondary institutions and both the individual NPSAS and B&B:00/01 response rates. Data on approximately 10,000 respondents are available for analysis through B&B:00/01. This analysis was based on the restricted-use data set from the 2001 follow-up survey, which was released during the winter of 2003 by the National Center for Education Statistics.

For the purposes of this analysis, a number of assumptions were made and adjustments were applied to refine the analysis. If more than one major is reported, students were coded according to the first, or primary, major listed. College majors are then aggregated into groups by type of college major in order to meet statistical reliability standards. For example, accounting, finance, and marketing majors were made part of the broader category of business. Certain fields were collapsed to make the degree categories consistent between 1992-93 and 1999-2000. Since the intention of this paper is to look at salary outcomes, only individuals with current full-time employment were included. The inclusion of part-time employment would make interpretation of results much more difficult for a number of reasons, such as the economic value of free-time associated with voluntary part-time employment. The analysis sample was further restricted to exclude individuals who had participated in education beyond the bachelor's degree. This exclusion was made so that the observed differences in college experience could be attributed to undergraduate majors only. It should be acknowledged that excluding those students pursuing first-professional and graduate studies may result in observing patterns of compensation in this study that might be different from those that could be detected in the long-term when all students would have completed their graduate studies. It is known that persons with advanced degrees generally are paid more than those with bachelor's degrees (*Digest, 2002,*

page 449), but we do not know how this might be correlated with the field of study of the advanced degree holder's undergraduate degree.

For the purposes of average salary comparisons, recipients from U.S. Service Schools were excluded from the analyses. Also, persons with annual incomes of less than $1,000 or more than $500,000 were excluded. The impact of these exclusions resulted in 5,093 respondents in the analysis for B&B:93/94 and 5,529 respondents in the analysis for B&B:99/2000. For purposes of computing multiple regression equations, further income exclusions were imposed. Only persons with incomes between $10,000 and $100,000 were included in the analysis. This resulted in the exclusion of a further 150 cases from B&B:93/94 and 121 cases from B&B:99/2000. While these outlier cases (about 2 percent) had little impact on the salary averages, they did have a negative impact on the regression results by substantively reducing model fit. Our assumption is that most of these cases involved people who had unusual characteristics that were not captured by the model. Thus, the outlier cases involve situations beyond the scope of this analysis, which is to look at gender differences in income that could be attributed to field of study.

Additionally, students over the age of 25 were excluded from the sample since any prior work experience could inflate salaries and thus potentially inflate the averages if these individuals tend to cluster in specific types of majors or occupations.

The salary of the respondent at the time of each of the two follow-up surveys (1994 and 2001) was the dependent variable used in the analyses. For both years, composite variables for annual income were used. These composite variables were computed by survey staff to annualize salaries for those persons who reported hourly, weekly, biweekly, or monthly incomes. Further analyses were conducted to determine if characteristics, other than gender and college major, reduce the disparity observed between the salaries of males and females once they enter the labor market.

Unless otherwise noted, all statements cited in the text about differences between two or more groups or changes over time were tested for statistical significance and substantive difference using equivalency tests. All statements were tested for statistically significance at the .05 level. Several test procedures were used, depending on the type of data interpreted and the nature of the statement tested. The most commonly used test procedures were: t-tests and equivalence tests. All statements were tested for statistical equivalence, and in most cases involving percentages, a delta, or difference, of $1000 was used to determine equivalence. Equivalence tests determine whether two statistics are substantively equivalent. This is accomplished by using a hypothesis test to determine whether the confidence interval of the difference between sample estimates is greater or less than a pre-set delta. The delta value is the magnitude of the difference required for the estimates to be judged substantively different.

Results

The Baccalaureate and Beyond Longitudinal Study was designed to reflect the demographics of postsecondary institutions as obtained from universe data. In 1992-93, females earned the majority of bachelor's degrees (54 percent). In continuation of the long-term trend, the proportion of degrees awarded to females increased to 57 percent in 2000 (*Digest*, 2002, table 246). The general increase in the proportion of bachelor's degrees was reflected in most, though not all, fields of study. For example, there was no decline in the male proportion of degrees in computer sciences, which was found to be one of the two most highly compensated majors in 2001. Engineering was among the most heavily

compensated field in both years and was above 80 percent male for both years. In both 1993 and 2000, a higher proportion of females received degrees in the following majors: education, health professions, humanities, life sciences, social and behavioral sciences, and other professional/technical (Table 1). Except for education, the proportion of each of these degrees earned by females increased during this period. In contrast, males constituted a majority in such fields as business and management, computer science, engineering, physical sciences and mathematics, and vocational/technical majors.

Table 1
Percent of bachelor's degrees conferred by institutions of higher education, by sex and field of study: 1992-93 and 1999-2000

	1992-93		1999-2000	
Field of study	Female	Male	Female	Male
Total	54.3	45.7	57.2	42.8
Business and management	47.2	52.8	49.7	50.3
Computer sciences	28.1	71.9	28.1	71.9
Education	78.4	21.6	75.8	24.2
Engineering	14.4	85.6	18.5	81.5
Health professions	83.1	16.9	83.8	16.2
Humanities	61.1	38.9	62.1	37.9
Life sciences	51.4	48.6	58.3	41.7
Physical sciences/mathematics	39.3	60.7	43.0	57.0
Social/behavioral sciences	57.1	42.9	62.8	37.2
Vocational/technical	33.2	66.8	39.3	60.7
Other professional/technical	57.1	42.9	58.8	41.2
Unknown	—	—	60.9	39.1

— Not available.

NOTE: Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), "Completions" survey, 1992-93 and 1999-2000.

The degree data may also be viewed from another perspective. Since the overall number of degrees to females has increased more rapidly than for males, the proportion of females in most fields as grown. However, a percentage distribution of females alone can help reveal areas where proportionately more or fewer females are majoring. This change has an important impact if proportionately more females are majoring in fields that are more, or less, highly compensated. Among the highly compensated fields in 2001, the proportion of females graduating in computer science rose from 1.1 percent to 1.4 percent, and the proportion of females graduating in engineering rose from 1.8 percent to 1.9 percent. During the same time period, the proportion of males graduating in computer science rose from 3.3 to 4.9 percent and the proportion in engineering declined from 12.6 percent to 11.1 percent. The proportion of females graduating in education declined from 13.4 to 11.6, while the proportion of males rose from 4.4 to 4.9 percent (Table 2).

Table 2
Percentage distribution of bachelor's degrees conferred by institutions of higher education, by sex and field of study:1992-93 and 1999-2000

	1992-93		1999-2000	
Field of study	Female	Male	Female	Male
Total	100.0	100.0	100.0	100.0
Business and management	19.3	25.6	18.1	24.4
Computer sciences	1.1	3.3	1.4	4.9
Education	13.4	4.4	11.6	4.9
Engineering	1.8	12.6	1.9	11.1
Health professions	8.9	2.1	9.3	2.4
Humanities	16.5	12.5	16.0	13.0
Life sciences	3.8	4.3	5.2	5.0
Physical sciences/mathematics	2.0	3.7	1.9	3.3
Social/behavioral sciences	22.1	19.6	22.1	17.4
Vocational/technical	1.3	3.2	1.6	3.3
Other professional/technical	9.8	8.7	10.7	10.0
Unknown	—	—	0.2	0.2

— Not available.
NOTE: Detail may not sum to totals due to rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), "Completions" survey, 1992-93 and 1999-2000.

Salary Outcomes

By analyzing the results of both the 1994 and 2001 follow-up surveys, changes in college major preference noted above and resulting labor market outcomes as measured by salary can be analyzed. In addition to college majors, other independent variables, such as demographic variables, which have been found to be related to earnings in other studies (Joy, 2003), were included in analyses.

Participants in the B&B: 93/94 and B&B:00/01 reported their salary annualized at their current rate, rather than the actual earnings over the previous 12 months. The field of study chosen plays an important role in immediate salary outcomes. The average salaries of 1992-93 graduates employed full-time in 1994 (in constant 2001 dollars) ranged from $22,532 in the life sciences and $23,444 in education to $38,276 in the health sciences (Table 3). Results from the 1994 cohort indicate that males, who were employed full-time and who had not enrolled in graduate school, generally had a higher annual salary compared to females across all academic majors ($31,848 versus $27,047). This amounts to a difference of about $4,800, or 18 percent. Despite relatively large standard errors in many disciplines because of the limited sample sizes, males were found to have higher incomes than females in a number of disciplines. These disciplines included: business and management, computer sciences, education, physical sciences and mathematics, social/behavioral sciences, vocational/technical, and other professional/technical. There was no field where the salary for females was significantly higher than the salary for males. In several areas, the differences between males and females salaries were $5,000 or more (Table 3). Large salary discrepancies also existed between males and females who majored in physical sciences and mathematics, business and management, and computer sciences. The overall gender difference in salaries was driven by significant differences in 7 out of the 11 individual fields of study.

Table 3. Salary difference between male and female as a percentage of female salary (in constant 2001 dollars) of 1993-94 bachelor's degree recipients employed full-time one year after graduation, by sex and field of study: 1994

Field of study	Total		Male		Female		Difference between male and and female	Salary difference between male and female as a percentage of female salary	Difference is statistically significant	T statistic
Total	$29,284	(306.9)	$31,848	(523.7)	$27,047	(346.1)	$4,801	17.8	Yes	7.6
Female adjusted[1]	†	†	†	†	$28,060	†	$3,788	13.5	†	†
Business and management	31,662	(773.0)	34,161	(1,201.2)	28,694	(887.0)	5,466	19.1	Yes	3.7
Computer sciences	32,478	(1,011.5)	34,285	(1,225.4)	29,116	(1,696.3)	5,169	17.8	Yes	2.5
Education[2]	23,444	(472.9)	26,858	(1,227.6)	22,320	(452.6)	4,538	20.3	Yes	3.5
Engineering	36,808	(606.7)	36,551	(660.3)	38,476	(1,545.1)	-1,925	-5.0	No	1.1
Health professions	38,276	(858.7)	40,133	(1,873.7)	37,881	(958.2)	2,252	5.9	No	1.1
Humanities	25,046	(713.2)	25,287	(1,163.2)	24,905	(902.3)	382	1.5	No	0.3
Life sciences	22,532	(1,629.1)	27,175	(1,266.5)	26,675	(2,936.7)	499	1.9	No	0.2
Physical sciences/mathematics	29,177	(1,278.4)	31,953	(1,380.4)	26,071	(1,995.1)	5,882	22.6	Yes	2.4
Social/behavioral sciences	26,036	(629.8)	28,704	(1,237.0)	24,071	(565.3)	4,633	19.2	Yes	3.4
Vocational/technical	28,000	(2,726.9)	31,130	(3,647.3)	20,495	(1,421.9)	10,636	51.9	Yes	2.7
Other professional/technical	26,834	(743.2)	29,083	(1,535.7)	25,003	(701.1)	4,080	16.3	Yes	2.4
Unknown	29,883	(2,453.0)	33,608	(3,632.9)	26,683	(2,916.8)	6,925	26.0	No	1.5

† Not applicable.

[1]Average salary for females, weighted by the number of males earning degrees in each field of study area.

[2]Most educators work 9- to 10-month contracts.

NOTE: Reported salaries of full-time workers under $1,000 and $500,000 or higher were excluded from the tabulations. Data exclude bachelor's recipients from U.S. Service Schools and graduates living at foreign addresses at the time of the survey. Excludes graduates who had ever enrolled in graduate schools. Standard errors appear in parentheses.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1993/94 Baccalaureate and Beyond Longitudinal Study (B&B:93/94).

Table 4. Salary difference between male and female as a percentage of female salary (in constant 2001 dollars) of 1993-94 bachelor's degree recipients employed full-time three years after graduation, by sex and field of study: 1997

Field of study	Total	Male	Female	Difference between male and female	Salary difference between male and female as a percentage of female salary	Difference is statistically significant	T statistic
Total	$38,060 (348.7)	$42,582 (615.1)	$33,942 (356.8)	$8,639	25.5	Yes	12.1
Business and management	41,203 (754.7)	45,427(1,181.0)	36,174 (799.8)	9,253	25.6	Yes	6.5
Computer sciences	47,922(2,129.5)	50,306(2,725.3)	43,759(3,639.7)	6,547	15.0	No	1.4
Education[1]	29,210 (738.0)	31,851(1,588.8)	28,231 (813.7)	3,620	12.8	Yes	2.0
Engineering	48,713 (959.3)	48,496(1,075.5)	50,299(1,353.0)	-1,804	-3.6	No	1.0
Health professions	43,399 (873.5)	45,473(2,823.7)	42,961 (879.6)	2,512	5.8	No	0.8
Humanities	32,247 (787.6)	33,920(1,291.1)	31,271 (990.2)	2,650	8.5	No	1.6
Life sciences	32,560 (990.6)	35,306(1,753.4)	30,015 (921.5)	5,290	17.6	Yes	2.7
Physical sciences/mathematics	39,995(1,598.8)	44,271(2,633.1)	35,129(1,522.7)	9,142	26.0	Yes	3.0
Social/behavioral sciences	35,980 (988.8)	41,798(1,881.1)	31,447 (924.4)	10,350	32.9	Yes	4.9
Vocational/technical	34,230(1,528.4)	37,037(1,983.2)	27,165(1,730.6)	9,872	36.3	Yes	3.8
Other professional/technical	36,619(1,314.3)	41,261(2,839.4)	32,669 (906.7)	8,592	26.3	Yes	2.9
Unknown	39,611(2,717.1)	42,319(4,444.5)	37,137(2,671.9)	5,182	14.0	No	1.0

[1]Most educators work 9- to 10-month contracts.

NOTE: Reported salaries of full-time workers under $1,000 and $500,000 or higher were excluded from the tabulations. Data exclude bachelor's recipients from U.S. Service Schools and graduates living at foreign addresses at the time of the survey. Excludes graduates who had ever enrolled in graduate schools. Standard errors appear in parentheses.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1993/97 Baccalaureate and Beyond Longitudinal Study (B&B:93/97).

Table 5. Salary difference between male and female as a percentage of female salary of 1999-2000 bachelor's degree recipients employed

full-time one year after graduation, by sex and field of study: 2001

Field of study	Total		Male		Female		Difference between male and and female	Salary difference between male and female as a percentage of female salary	Difference is statistically significant	T statistic
Total	$35,588	(303.9)	$39,394	(534.9)	$32,480	(386.5)	$6,914	21.3	Yes	10.5
Female adjusted[1]	†	†	†	†	$34,574	†	$4,820	13.9	†	†
Business and management	40,242	(909.5)	41,667	(1,187.4)	38,681	(1,450.0)	2,986	7.7	No	1.6
Computer sciences	48,871	(1,402.1)	52,155	(1,633.5)	40,895	(2,387.4)	11,260	27.5	Yes	3.9
Education[2]	28,188	(430.7)	29,322	(1,046.4)	27,785	(402.7)	1,537	5.5	No	1.4
Engineering	47,035	(920.2)	47,101	(1,040.3)	46,770	(1,716.8)	331	0.7	No	0.2
Health professions	39,237	(1,307.8)	44,730	(5,067.1)	37,460	(768.7)	7,270	19.4	No	1.4
Humanities	31,772	(792.7)	35,403	(1,987.8)	29,281	(632.2)	6,122	20.9	Yes	2.9
Life sciences	32,177	(914.8)	35,821	(1,425.6)	29,154	(1,331.0)	6,667	22.9	Yes	3.4
Physical sciences/mathematics	35,637	(1,405.2)	39,482	(2,109.7)	31,097	(983.0)	8,385	27.0	Yes	3.6
Social/behavioral sciences	31,440	(690.4)	35,424	(1,163.6)	28,991	(707.8)	6,433	22.2	Yes	4.7
Vocational/technical	32,657	(1,545.2)	36,160	(2,050.2)	27,082	(1,295.2)	9,078	33.5	Yes	3.7
Other professional/technical	33,325	(834.6)	35,822	(1,518.6)	31,367	(922.8)	4,455	14.2	Yes	2.5
Unknown	---	---	---	---	---	---	---	---	---	---

† Not applicable.

---Not available.

[1]Average salary for females, weighted by the number of males earning degrees in each field of study area.

[2]Most educators work 9- to 10-month contracts.

NOTE: Reported salaries of full-time workers under $1,000 were excluded from the tabulations. Data exclude bachelor's recipients from U.S. Service Schools and graduates living at foreign addresses at the time of the survey. Excludes graduates who had ever enrolled in graduate schools. Standard errors appear in parentheses.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2000/01 Baccalaureate and Beyond Longitudinal Study (B&B:2000/01).

Results from the 1997 follow-up of the 1994 cohort also indicated large salary gaps between males and females across all academic majors. The overall gap had increased to $8,639, or 25.5 percent. Although the analysis was still restricted to full-time employees, never enrolled in graduate school, it is not known the extent to which differential employment history between males and females might have contributed to the growing salary difference. Males who majored in business and management, education, physical science or mathematics, social/behavioral science, vocational/technical and other professional/technical degrees still had higher salaries than their female peers in those same areas. The apparent salary gap between males and females who studied computer science, however, was no longer measurable by 1997. Yet, a gap appeared in life science where females had lower salaries than their male counterparts (Table 4). In 1997, significant differences between male and female salaries were observed in 7 out of 11 fields.

In general, the average salaries for 1999-2000 graduates in 2001 were higher than those earned by the 1992-93 graduates. The average salary for bachelor's degrees rose during this period from $29,284 to $ 35,588, an increase of 22 percent after adjustment for inflation. In addition, there is some evidence that the gap between male and female salaries widened. The average salary for males rose by 24 percent and the average for females rose by 20 percent. The overall gap widened from $4,801 in 1994 to $6,914 in 2001. There continued to be salary differences favoring males in specific fields of study in 2001. The salary gap between males and females who majored in computer sciences was $11,260 (approximately a 10 percentage point increase in the gap). Males who studied humanities, life sciences, physical sciences and mathematics, and social/behavioral sciences also had higher salaries than their female peers. Salary gaps favoring males were also evident among those who majored in vocational/technical fields and other professional/technical fields (Table 5). Across the 11 fields of study areas, male salaries were significant higher in 7 fields, while the female salaries were no higher in any of the fields.

Some similarities in the patterns of salary gaps were evident among 1994 and 2001 cohorts. In both years, there was an apparent male advantage across all academic majors. Even though nominal difference suggested higher male salaries in almost every field for both years (except engineering in 1994), many of these differences are not statistically significant because of large standard errors due to relatively small sample sizes. With respect to the number of disciplines where salary gaps were measured, there were the same number of areas in 1994 and 2001 in which males had higher earnings compared to females. In both 1994 and 2001, males who studied computer science, physical sciences and mathematics, social and behavioral sciences, vocational/technical, and other professional/technical disciplines had higher annual salaries than females. In 1994, males majoring in business and management and education had higher salaries than females, but there were no differences detected in the salaries of males and females who studied these fields in 2001. There were no differences between males and females who studied the humanities and life sciences in 1994, but males majoring in these disciplines in 2001 had higher annual salaries than their female peers.

Regression equations were developed to examine gender differences in salary and whether choice of major impacted salary differences for both the 1994 and 2001 cohorts. Regression model is as follows:

$$Y= \beta_0+ \Sigma \beta_1X_1 + \Sigma\beta_2X_2 +\Sigma\beta_3X_3 + \Sigma\beta_4X_4$$

Where $\Sigma (X_1)$= demographic variables, $\Sigma (X_2)$= school characteristic variables,

$\Sigma (X_3)$= academic variables, and $\Sigma (X_4)$= employment variable.

The dependent variable was the salary of college graduates one year after graduation. Independent variables included demographic variables, school characteristic variables, academic variables, and one employment variable. Demographic variables included gender, age, marital status, number of hour worked weekly, and whether the individual had one or more children. Variables pertaining to school characteristics included bachelor degree attainment, control of institution (public/private), and whether the university attended was a research university. Academic variables were grade point average, and dummy variables indicating graduates in these disciplines: business and management, computer sciences, education, engineering, health professions, humanities, life sciences, mathematics, physical sciences, social/behavioral sciences, or vocational/technical areas.

Results from the regression analysis are presented in Table 6 in constant 2001 dollars. The intercept value is the baseline salary of individuals who received a bachelor's degree in 1994 and 2001. This significant intercept value indicates the value of a bachelor's degree has grown between 1994 and 2001 in terms of the compensation level one receives after obtaining a bachelor's degree (from $19,227 to $25,668). Gender differences in salary are apparent in both 1994 and 2001, with the dummy variable for being male having a value of $2,635 in 1994 and $3,240 in 2001. Being age 24 or over was found to have a positive impact on salaries for both years, probably reflecting more work force experience in the case of the older graduates. Having children was found to be positively associated with higher salaries in both years. School characteristics variables were found to influence salary. Graduating from a private college was associated with higher salary averages in both 1994 and 2001. High grade point average, defined as a GPA over 3.0, was significant in both 1994 and 2001. This corroborates research conducted on salaries and institutional types in other data sets (Snyder & Freeman, 2004). The positive salary impact for graduating from a research university rose from 1994 to 2001. Working more than 40 hours per week had a large impact on salaries in both 1994 and in 2001.

With regards to the impact of choice of academic major on compensation levels, results indicated some shifts in their influence on compensation levels between 1994 and 2001. Completion of a business and management degree had a positive impact on salaries in both years, with higher salary outcomes evident in 2001 ($4,553 versus $1,777). Individuals majoring in computer sciences also had significant salary gains, with a value of a computer science degree increasing substantially between 1994 and 2001 ($4,120 versus $12,772). Similar results were evident among those who majored in engineering. The economic payoff of certain majors seemed to decrease between 1994 and 2001. The salary gains associated with a health related major were significantly lower in 2001 than in 1994 ($5,424 vs. $9,897). Overall, results indicated that choice of academic major has a significant impact on subsequent earnings for both 1994 and 2001 cohorts. Even after controlling for a number of important demographic, work activity, and college-related variables, major was found to have a significant relationship to salary in 6 out of 11 fields of study in both years. In a number of these cases the salary differentials were large, ranging from -$4,392 to +$12,772.

Table 6
Regression analysis on salary results for the 1994 and 2001 Baccalaureate and Beyond cohorts

Independent variable	1994 (adjusted r^2=.2798)			2001 (adjusted r^2=.2384)		
	Estimate	Standard error	t- value	Estimate	Standard error	t- value
Intercept	19,227.3	690.7	27.84***	25,668.2	831.8	30.86***
Demographic variables						
Male	2,634.7	404.2	6.52***	3,239.5	458.2	7.07***
Age (greater than 23)	3,757.2	509.1	7.38***	2,640.2	504.6	5.23***
Marital status, married	1,229.2	470.2	2.61**	675.0	519.5	1.30
Having one or more children	2,891.1	765.3	3.78***	2,085.9	839.3	2.49*
School characteristic variables						
Degree related to job	2,977.0	397.8	7.48***	626.2	440.4	1.42
Private institution	1,680.9	432.6	3.89***	1,486.6	459.5	3.24**
Research institution	1,095.8	402.2	2.72*	2,608.2	434.9	6.00***
Academic variables						
High grade point average	803.6	402.0	2.00*	1,320.9	431.6	3.06**
Business and management	1,776.6	725.4	2.45*	4,552.9	805.5	5.65***
Computer sciences	4,119.7	1,102.9	3.74***	12,772.0	1,300.1	9.62***
Education	-3,832.6	698.0	-5.49***	-4,391.7	835.3	-5.26***
Engineering	7,384.8	827.6	8.92***	12,290.7	946.0	12.99***
Health professions	9,896.6	965.0	10.26***	5,424.0	930.3	5.83***
Humanities	-1,059.2	768.2	-1.38	-1,849.8	810.9	-2.28*
Life sciences	-1,904.8	836.1	-2.28*	-705.4	969.5	-0.73
Physical sciences/math.	518.2	1,779.2	0.29	608.0	1,558.9	0.39
Social/behavioral sciences	-359.1	786.6	-0.46	-1,098.8	796.7	-1.38
Vocational/technical	15.4	2,302.0	0.01	-700.6	1,508.0	-0.46
Job variables						
More than 40 hours per week	5,730.8	418.4	13.70***	4,842.3	421.8	11.48***

* Statistically significant at .01

** Statistically significant at .001

*** Statistically significant at .0001

SOURCE: U.S. Department of Education, National Center for Education Statistics, Baccalaureate and Beyond Longitudinal Study (B&B:93/94) and Baccalaureate and Beyond Longitudinal Study (B&B:00/01).

After controlling for various factors found to be correlated with salary outcomes, this paper and previous research efforts have found significant variation in salaries that can

be attributed to gender and college major selection. A further analysis was conducted to determine the approximate magnitude of the salary difference between males and females that can be attributed to the fact that males and females pursue different majors while in college. This analysis does not explore the issue of gender bias in occupations, nor does it provide a projection of labor market outcomes under the assumption of a redistribution of males and females by degree field. It does illuminate the extent to which differences in distribution of degree majors for males and females lead to different average salaries for all fields, and how this may have changed over time. The average female salary for 1994 and 2001 was recalculated by multiplying the average salary for females in each major by the number of male graduates in each field, and then computing the average based on the weighted number of males. This formula enables one to estimate the extent to which the overall average salary for females is influenced by the different portions of females, compared to males, majoring in each field. For 1994, the computation gave an adjusted female average of $28,060, reducing the difference between the male and female averages from $4,801 to $3,788 (Table 3). This is a reduction of about $1,013, or about 21 percent, which can be attributed to the impact of different college majors by males and females. Applying the same methodology to the 2001 salary data yields an adjusted salary for females of $34,574. This lowers the male/female difference from $6,914 to $4,820. This is a reduction of $2,094, or 30 percent, that can be attributed to differences in the distribution of male and female college majors. This indicates that a portion of the increase in the salary gap observed between males and females between 1994 and 2001 can be attributed to changing patterns of salary outcomes and college majors. If a percent change in average salary for females is based on the adjusted figures for 1994 and 2001, the results are in overall increase for female salaries of 23.2 percent, which is much closer to the male figure of a 23.7 percent increase, than the 20.1 percent for the unadjusted figures for females noted above.

Choice of college major involves a number of personal considerations by every student, and potential salary is only one of those considerations. While a few majors have shown consistently high or low patterns of compensation (engineering and education), other majors have varied significantly (computer science and health). Although the selection of majors does have an important bearing in salary outcomes for males and females, the regressions for 1994 and 2001 found significant differences in male/female salaries even after controlling for college major. The evidence suggests that college major may help explain that the gap expanded due to labor market returns between 1994 and 2001 for specific majors. One example of this is a relative salary declines in the predominantly female field of health, and an increase in salary in the predominately male field of computer science. Some of the increase in the gap can be attributed to the changes in compensation patterns by degree field and the changes in the distribution of male and females in these fields. However, some of the gap is due to differences in male/female salaries within specific fields of study.

References

Berger, Roger L. and Jason C. Hsu. (1996). Bioequivalence trials, intersection-union tests and equivalence confidence sets. *Statistical Science*,1, 4, pp. 283-319.

Bradburn, Ellen M., Berger, Rachael, Li, Xiaojie, Peter, Katharin, Rooney, Kathryn (2003). A Descriptive Summary of 1999-2000 Bachelor's Degree Recipients 1 Year Later, With an Analysis of Time to Degree (NCES 2003-165) U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Brown, Charles, and Mary Corcoran. 1997. Sex-Based Difference in School Content and the Male-Female Wage Gap. *Journal of Labor Economics*, Vol. 15, No. 3 (July), 431-65.

Clery, S.B., Lee, J.B., & Knapp, L.G. (1998). *Gender Differences in Earnings Among Young Adults Entering the Labor Market* (NCES 98-086). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Clune, M.S., Nun? ez, A.M., & Choy, S.P. (2001). *Competing Choices: Men's and Women's Paths After Earning a Bachelor's Degree* (NCES 2001-154). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Daymont, Thomas N., and Paul J. Andrisani. 1984. Job Preferences, College Major, and the Gender Gap in Earnings. *Journal of Human Resources*, Vol. 19, No. 3 (Summer), pp. 408-28.

Eccles, J.S. (1994). Understanding women's educational and occupational choices. *Psychology of Women Quarterly*, 18, 585-609.

Gerhart, Barry. 1990. Gender Differences in Current and Starting Salaries: The Role of Performance, College Major, and Job Title. *Industrial and Labor Relations Review*, Vol. 43, No. 4 (April), pp. 418-33.

Gianakos, I., & Subich, L.M. (1988). Student sex and sex role in relation to college major choice. *The Career Development Quarterly, 36*, 259-268.

Horn, L.J., & Zahn, L. (2001). *From Bachelor's Degree to Work: Major Field of Study and Employment Outcomes of 1992-93 Bachelor's Degree Recipients Who did Not Enroll in Graduate Education by 1997* (NCES 2001-165). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Joy, L. (2001). Salaries of Recent Male and Female College Graduates: Educational and Labor Market Effects. *Industrial & Labor Relations Review*,56,4, 606-621.

Macpherson, D. and B. T. Hirsh (1995) "Wages and Gender Composition: Why Do Women's Jobs Pay Less?" *Journal of Labor Economics*, 13, 426-471.

McCormick, A., Nuñez, A.M., Shah, V., & Choy, S.P. (1999). *Life After College: A Descriptive Summary of 1992–93 Bachelor's Degree Recipients in 1997* (NCES 1999-155). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Stanley, T.D. and Stephen B. Jarrell. 1998. "Gender Wage Discrimination Bias? A Meta-Regression Analysis." *Journal of Human Resources* 33(4):947-973.

U.S. Department of Education, National Center for Education Statistics (forthcoming, 2004). *Trends in Educational Equity of Girls and Women 2004*. Washington, DC: U.S. Government Printing Office.

U.S Department of Education, National Center for Education Statistics. (2002). *The Digest of Education 2002* (NCES 2003-060). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

U.S Department of Education, National Center for Education Statistics. (2000). *The Condition of Education 2000* (NCES 2000-062). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

U.S Department of Education, National Center for Education Statistics. (1996). Baccalaureate and Beyond Longitudinal Study 93/94 First Follow-up Methodology Report. (NCES 96-149). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Weinberger, Catherine 1998. Race and Gender Wage Gaps in the Market for Recent College Graduates. *Industrial Relations,* Vol. 37, No. 1 (January), pp. 67-84.

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Appendix 1

Number of cases before and after exclusions in the analysis of degree recipients

of the Baccalaureate and Beyond Survey: 1992-93/94 and 1999-2000/2001

Field of study	1992-93 graduates in 1994				1999-2000 graduates in 2001			
	Total	Male	Female	Percent female	Total	Male	Female	Percent female
Full Sample	10,041	4,365	5,676	56.5	10,016	3,841	6,175	61.7
Sample for cross tabulations	5,093	2,277	2,816	55.3	5,529	2,266	3,263	59.0
Sample for regressions	4,943	2,205	2,738	55.4	5,406	2,210	3,196	59.1
Excluded for cross tabulations								
Salary <=$1,000	2,289	1,081	1,208	52.8	2,080	768	1,312	63.1
Salary >=$500,000	4	3	1	25.0	---	---	---	---
Postbaccalaureate enrollment	3,003	1,315	1,688	56.2	2,798	1,013	1,785	63.8
Not full-time employee	3,082	1,276	1,806	58.6	2,434	776	1,658	68.1
Non-respondent on gender[1]	23	†	†	†	†	†	†	†
No field of study data	23	---	---	---	†	†	†	†
Additional exclusions for regressions								
Salary<=$10,000	3,025	1,342	1,683	55.6	2,593	919	1,674	64.6
Salary>=$100,000	37	21	16	43.2	45	31	14	31.1

† Not applicable.

---Not available.

[1]Computer assisted telephone interview non-respondents for 1994 were excluded. All data were imputed for 2001.

NOTE: Details do not add to totals because people may be excluded for multiple reasons.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1993/94 Baccalaureate and Beyond Longitudinal Study (B&B:93/94) and 2000/01 Baccalaureate and Beyond Longitudinal Study (B&B:2000/01).

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