VARIATIONS IN THE RETURN TO SKILLS ACROSS BACHELOR'S DEGREE OCCUPATIONS

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ABSTRACT

Utilizing a data set created by the author that merges data by detailed occupation on employment, earnings, educational attainment, and the importance of 35 separate job skills, the relationship between the importance of each of these skills and average salary in the private sector is explored for 84 different occupations identified as bachelor's degree dominant occupations. The analysis reveals that several job skills commonly regarded as important do not correlate across the selected occupations with private sector average salary. The largest impact skills are those which involve extensive abstract reasoning and mathematical rigor. For several of these skills, there are substantial differences in forecasted average salary for an occupation if the skill's importance rises from the 25th to the 75th percentile of its ranking across occupations. These results help to explain the observed large differences in average salary across occupations associated with bachelor's degree workers.

INTRODUCTION AND LITERATURE REVIEW

One factor contributing to rising income inequality in the U.S. economy has been a widening gap between the earnings of college-degree holding workers and workers with just a high school diploma, often referred to as the college wage premium. Acemoglu and Autor (2011) carefully document the rise in the college wage premium. They estimate the earnings of the average college graduate exceeded earnings of the average high school graduate by about 49.2% in the late 1970s. This premium trended upward strongly the past 30 years, however, and as of 2008 they estimate the college premium to have grown to 97.4%. They comprehensively review several potential causes of the widening inequality, a more concise summary can be found in Steelman and Weinberg (2005).

The rapid growth of the college earnings premium is due less to strong college earnings growth in and of itself, however, and more to the flat or declining real earnings for workers with only high school diploma or less. Greenstone and Looney (2011) concisely summarize the losses and stagnation in earnings since the 1970s for males without a bachelor's degree. Since the early

1970's the inflation adjusted earnings of the median wage high-school dropout who works full time has declined by 38%, and the inflation adjusted earnings for the median male with only a high school diploma has declined by 26%. These declines actually understate the declines in earnings for less educated males since it compare full-time workers over time and there has been a substantial decline in labor force participation for males with no education beyond high school. Since the early 1970's, the share of completely unemployed men without a high school diploma rose 23% points from 11% to 34% (Greenstone & Looney, 2011). The rate of exit from the labor force was also large for males with high school diplomas only as the share of them not working at all rose 18% points from 4% to 22%. The combined impact of declining real wages for full-time workers, and much higher rates of exit from the labor force, results in a 66% decline since the early 1970's in median real earnings for all high school dropout men. High school graduate males have fared only slightly better; the median earnings for all high school only (no other schooling) males fell 47% since the early 1970's (Greenstone & Looney, 2011). Julian and Kominski (2011) construct synthetic work-life earnings estimates by race/ethnicity, education, and gender and find large differences in estimated lifetime earnings by educational attainment. For full-time year-round workers, they estimate white non-Hispanic males with a high school diploma have work-life earnings of $1.7 million while white non-Hispanic males with bachelor's degree only have work-life earnings of $2.8 million. The same comparison for white non-Hispanic females is $1.2 million versus $2.0 million, and similarly large gaps by education are estimated for other race/ethnicity groups (Julian & Kominski, 2011).

The large declines in earnings for less than college educated males accounts for much of the growth in both the college earnings premium, and the large widening of earnings distribution across full-time workers. Acemoglu and Autor (2011) track over time the inflation adjusted real earnings for high wage workers, defined as the wage at the 90th percentile for full-time workers in each year, and find it has risen approximately 50% since the early 1970's. Real earnings when evaluated at the median across full-time workers, however, only rose by about 16% and real earnings evaluated at the 10th percentile only rose about 9%. While the premium for college educated workers over high school graduate only workers has risen in recent decades, another contributor to the widening gap between earnings at the median and 90th percentiles is the dispersion in earnings across bachelor's degree holding workers. One consequence of this dispersion has been increasing concern that college graduates are taking "high school" jobs.

Hecker (1992) estimated that 20% of college graduates in the 1980s accepted jobs that did not require a college degree for entry into that work. Shelley (1994) also concluded that there likely would be more college graduates in the 1990s and early 2000s than there would be net new jobs requiring a college degree for entry into the work. This viewpoint was contested by Tyler et al. (1995), who examined the data at a more detailed level and concluded that 25-34 year old male college graduates in 1989 were doing as well as their 1979 counterparts and that 25-34 year old female college graduates in 1989 were doing better than their 1979 counterparts. Fortunately for college graduates in the latter 1990s, the strong labor market at that time reduced concerns about underemployment of college graduates. The substantial weakening of the labor market since 2007, however, has restored this issue to a more prominent position. Barton (2008) and Bennet and Wilezol (2013) are representative examples of recent work questioning the wisdom of many students pursuing a college degree.

One factor widely agreed to play a role in the widening earnings inequality has been the evolution over time of the skill requirements for jobs in the U.S. economy. Better understanding

this issue has been of long-standing interest to economists, business leaders, and government officials. The large shifts in the composition of employment that began in the 1970s and accelerated in the 1980s led to considerable research as seen in the works of Rumberger (1981), Howell and Wolf (1991), and Katz and Murphy (1992) with more recent empirical work including Jones (2009). Examining changes from 2002 to 2008 in earnings by occupation, Jones (2009) clearly documents a positive correlation between an occupation's 2002 earnings level and its wage growth. The higher an occupation's 2002 percentile ranking on wages, the higher its wage growth from 2002 to 2008. The role of variation in skill intensities across higher and lower wage growth jobs is discussed in general terms by Jones (2009), but no analysis is done matching skill requirement measures to earnings.

One reason to examine the impact of various skill's importance in explaining earnings variation across occupations is the growing concern with labor market mismatches between workers and their jobs. Yakusheva (2010) finds that the quality of the match between an individual's degree field and his/her occupation impacts the size of the college earnings premium. People whose occupations better match their degree fields earn significantly higher returns to post-secondary schooling. Kalleberg (2008) identifies several types of potential mismatches including skills mismatches. Over the 1993-2002 period Kalleberg estimates that 20.3% of males and 19.8% of females were over qualified for their jobs where over qualified is defined as having an educational attainment three or more years greater than the requirements for the job held. Similarly, by defining under qualified as an educational attainment three or more years less than the requirements for the job, Kalleberg (2008) estimates 7.2% of males and 6.7% of females were under qualified for their jobs. Kalleberg (2008) also discusses several options for obtaining a better sorting of workers to jobs. One option is to improve the information set for workers so they more efficiently sort themselves. The findings presented here will be useful to recent, or soon to be, bachelor's graduates as they can be used to identify occupations that require a bachelor's degree and utilize skills the job candidate believes are part of his/her relative skill set.

Another reason to examine skill requirements by occupation is the recognition that individuals with different skill sets may prefer different types of organizational career fields. Mayrhofer, et al. (2005) find that business school graduates displaying high flexibility, self-promotion, and self-monitoring attributes are more likely to aspire to post-organizational careers while individuals less skilled in these attributes are more likely to prefer a more traditional organizational career pattern.

This research contributes to the literature on the impact of skill requirements upon earnings, and to the literature on "Is College Worth It?," by focusing the analysis solely upon linkages between various skill requirements and average salary in the private sector just for those occupations designated as jobs held primarily by bachelor's degreed only individuals. A better understanding of the variations in returns to these skills across jobs accessible to recent bachelor's graduates will contribute to our analysis of the causes of earnings dispersion and provide potentially valuable guidance to students as they select major fields of study as different fields of study emphasize the development of different skills.

METHODOLOGY AND FINDINGS

From the U.S. Department of Labor sponsored Occupational Information Network (O*NET, 2012), measures of the importance of 35 different skills for successfully working in each of several hundred specific occupations was obtained. To ease comparisons across skills, the skills data was converted into its percentile equivalents. As an example, consider the occupation "Advertising and Promotion Managers." This occupation has a reported value in the data set for the skill Active Learning of 66.3. This means that the Active Learning skill is more important to Advertising and Promotion Managers than it is to 66.3% of the 648 occupations in the constructed data set, and less important than it is to 33.7% of the 648 occupations. So, for any of the 35 skills a rise of one point in the skill's value for an occupation is interpreted as a one percentile point increase in the importance of that skill for that occupation versus all 648 occupations (O*NET, 2012).

This skills data by occupation then was then matched with U.S. Bureau of Labor Statistics data on the educational distribution by occupation. Lastly, that merged data file was merged with U.S. Bureau of Labor Statistics data on employment and earnings by occupation (BLS, 2012). The final data file contained for each of 648 different occupations the data on 2011 employment and the distribution of annual salaries for full-time workers, the educational attainment distribution, and for each of the 35 skills that occupation's percentile rank for that skill versus all 648 occupations.

In order to focus most closely upon the linkages between the importance of various skills and the earnings for occupations accessible to bachelor's degree graduates, this research confines itself to a subset of 84 of the 648 occupations. These 84 occupations were designated as "Bachelor's Degree" occupations by the Bureau of Labor Statistics. This designation means that across the categories of Less than High School Diploma, High School Diploma, Some College, Associate's, Bachelor's, Master's, and Doctoral or Professional, the largest percentage of workers in the occupation have a bachelor's degree and no higher educational degrees.

Summary statistics from the Bachelor's Degree data set for variables relevant in the analysis to follow are presented in Table 1. The variable Bachelors is the percentage of workers in the occupation with a bachelor's degree and no higher degree. LessBach is the percentage of workers with less than a bachelor's degree while MastersPlus is the combined percentage of workers in the Masters and Doctoral or Professional education categories. Total Employment is self-explanatory and Average Salary is the annual private sector average salary. For each occupation, there also is data on private sector earnings at the $10^{th}/25^{th}/50^{th}/75^{th}/90^{th}$ percentile within that occupation. Lastly, for each of the 35 skills, the value at various percentile ranks across the 84 occupations for that skill is provided. For instance, consider the reported skill values by percentile rank for the skills Critical Thinking and Repairing. If the 84 Bachelor's occupations are ranked in descending order based on their value for the skill Critical Thinking, the occupation at the 10^{th} percentile (occupation ranked 76^{th} of 84) has a value of 50.2. This value means that when this occupation is compared against all 648 occupations in the data set, the importance of Critical Thinking is larger for that occupation than it is for 50.2% of the 648 occupations. Critical Thinking for a "bottom tenth" bachelor's occupation is found to be more important than for approximately half of all occupations. Contrast this result with the skill Repairing, where the reported skill value at the 10^{th}, 25^{th}, and 50^{th} percentiles = 0. When a skill is

of no importance at all to an occupation, it receives a score of 0. This means that when the 84 Bachelor's occupations are ranked in descending order based on importance of the skill Repairing, the bottom half the occupations have a zero value. Repairing is not a skill associated with the Bachelor's occupations.

TABLE 1: DISTRIBUTION OF VALUES ACROSS THE 84 "BACHELOR'S DEGREE" OCCUPATIONS

Variable	90th Pctl	75th Pctl	50th Pctl	25th Pctl	10th Pctl
Bachelors	57.0%	51.6%	46.6%	39.1%	30.3%
LessBach	50.0%	42.1%	25.0%	18.6%	11.9%
MastersPlus	47.2%	33.9%	23.8%	14.7%	8.3%
Total Employment	182,484	93,240	35,280	13,680	5,050
Average Salary	$96,463	$85,568	$67,465	$50,410	$43,511
SKILLS					
Active Learning	90.1	84	75.7	66.3	58.2
Active Listening	90.1	79.4	67.8	59	49.4
Complex Problem Solving	96.1	88.7	81.7	67.3	58.1
Coordination	90.33	80.2	64.6	50	34.4
Critical Thinking	94.4	87.3	78.5	60.2	50.2
Equipment Maintenance	62.1	42.3	0	0	0
Equipment Selection	67.6	52.3	34.4	0	0
Installation	80.8	59.5	0	0	0
Instructing	95.2	85.1	70.7	57.8	32.7
Judgment and Decision Making	92.5	87.1	74.3	64.2	53.1
Learning Strategies	95.74	83.6	65.6	51.9	39.7
Management Financial Resources	94.1	86.7	70	49.3	14
Management Material Resources	94.36	85.4	57	36.6	17.4
Management Personnel Resources	89.59	85.1	69.2	50.2	38
Mathematics	96.4	92.7	81.1	43.2	24.4
Monitoring	89.4	80	60.1	42.975	18.2
Negotiations	87.6	78.2	69.7	51.1	39.2
Operation and Control	60.67	45.675	32.4	14.8	0
Operation Monitering	66.7	55.4	41.1	19.6	8.43
Operations Analysis	97.2	92.7	80.6	54	26.08
Persuasion	88.8	78.6	71.5	51.1	41.8
Programming	94.4	89.3	73.3	40.6	40.6
Quality Control Analysis	83.6	65.8	41.4	14.5	2.6
Reading Comprehension	93.8	87.6	79.4	72.1	59
Repairing	62.94	46.6	0	0	0
Science	95.5	90.2	79.2	42.6	26.79
Service Orientation	89.6	73.125	46.6	36.9	25.42
Social Perceptiveness	91.4	81.2	60.2	38.3	22.8
Speaking	88.2	80.2	65.2	57	41.2
Systems Analysis	97.32	90.1	81.4	69.7	56.7
Systems Evaluation	95.5	90.775	81.4	68.4	53.9
Technology Design	98.1	90.5	66.1	34.3	24.1
Time Management	88.5	81.7	73.1	49.1	38.39
Troubleshooting	79.5	61.6	34.35	0	0
Writing	93.36	85.9	79.7	68.1	54.76

The considerable heterogeneity across occupations is seen in the dispersion of values for the variables in Table 1. While all 84 occupations are designated as Bachelor's dominated, the occupation at the 90th percentile (8th of 84) when ranked by percent of workers with only Bachelor's is just 57.0%, implying that 43% of workers in one of the most Bachelor's dominated occupations do not have a Bachelor's education classification. If the educational attainment values at the 50th percentile of the Bachelor's occupations rankings are used to represent a typical such occupation, then we see that the typical Bachelor's occupation has approximately half the workers with a terminal bachelor's degree and a quarter each with less than or more than a Bachelor's degree. When sorted on share with Bachelor's degree, the median occupation has 46.6% of its workers with a Bachelor's degree. When sorted on share LessBach, the median occupation has 25.0% of its workers with less than bachelor's degree, and when sorted on MastersPlus the median occupation has 23.8% of its workers with more than a bachelor's degree. Total employment and private average salary variables show much more variation with 25% of the 84 occupations having fewer than 13,680 employees nation-wide, while the top 25% of the 84 occupations have more than 93,240 employees in each occupation.

Private average salary at the 10th percentile for these occupations is $43,511, less than half the 90th percentile value of $96,463. The wide dispersion of average salaries is shown in Figure 1. There is a steep decline in average salary within the top decile to just under $100,000 by the 90th percentile. Next, there is a steady decline from the 90th to 60th percentiles with salary in the upper $60,000's by the 60th percentile. From the 60th to 30th percentile, private average salary is nearly flat. The average salary then steadily declines from the 30th percentile to the lowest earning occupation at just under $40,000. Clearly, there is a wide range of average salaries across these 84 occupations. As seen in the values for each of the skill variables in Table 1, there also is considerable variation in the importance of these skills. To demonstrate, consider the skill Coordination which has a value of 50 at the 25th percentile of the 84 occupations. The 75th percentile value for Coordination in Table 1, however, is 80.2. Comparing the 25th to 75th or 10th to 90th percentiles for each of the 35 skills in Table 1, wide variation in the skills' importance is evident.

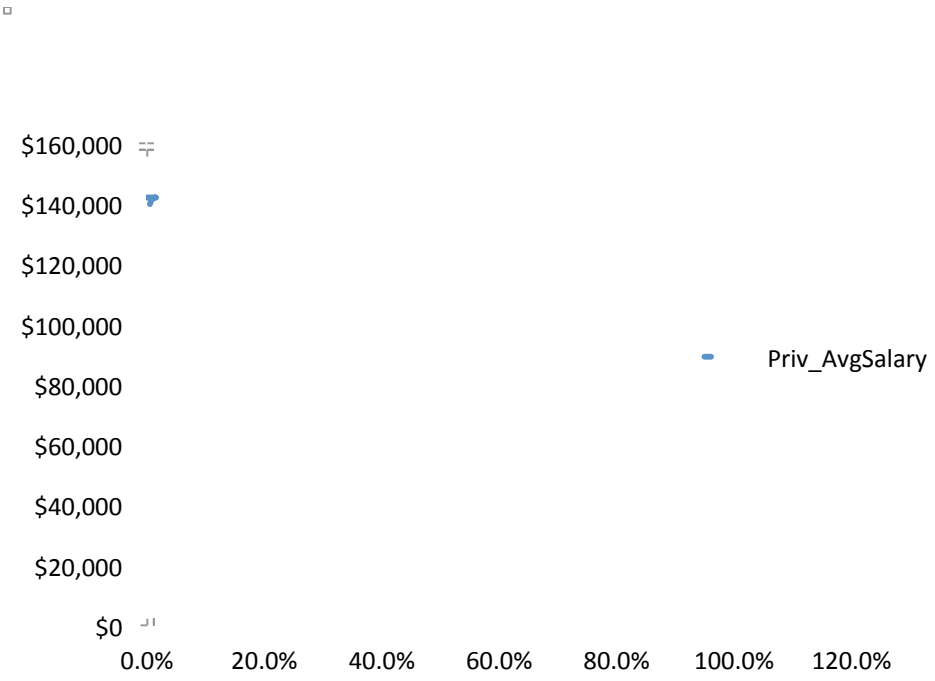

FIGURE 1: PRIVATE AVERAGE SALARY BY CUMULATIVE % TOTAL EMPLOYMENT FOR 84 BACHELOR'S DEGREE OCCUPATIONS

To investigate the impact of variation in a skill's importance on average salaries, the occupations were first sorted from highest to lowest based on average salary and then divided into quartiles. For each skill, t-tests for differences in sample mean values across each of the possible quartile pairings were done and the p-values for each of these t-tests are reported in Table 2. The null hypothesis always is that mean skill values are equal across the two income quartiles being compared. A p-value < 0.10 implies rejection of the null hypothesis which then supports the view that there are differences in the importance of that skill between the two income quartiles.

TABLE 2: P VALUES FOR TESTS OF DIFFERENCE IN SAMPLE MEAN VALUES FOR SKILL VARIABLE BY PRIVATE AVERAGE INCOME QUARTILE

	Qtl1 vs Qtl2	Qtl1 vs Qtl3	Qtl1 vs Qtl4	Qtl2 vs Qtl3	Qtl2 vs Qtl4	Qtl3 vs Qtl4	# of p<.10
Active Learning	0.027	0.000	0.016	0.075	0.354	0.167	4
Active Listening	0.251	0.329	0.070	0.129	0.148	0.035	2
Complex Problem Solvings	0.012	0.000	0.000	0.096	0.004	0.072	6
Coordination	0.404	0.179	0.022	0.119	0.011	0.137	2
Critical Thinking	0.036	0.000	0.000	0.014	0.018	0.330	5
Equipment Maintenance	0.144	0.219	0.102	0.397	0.384	0.301	1
Equipment Selection	0.050	0.131	0.008	0.308	0.168	0.081	3
Installation	0.159	0.010	0.013	0.090	0.106	0.472	3
Instructing	0.279	0.417	0.202	0.365	0.125	0.181	0
Judgment and Decision Making	0.153	0.002	0.001	0.023	0.014	0.421	4
Learning Strategies	0.476	0.228	0.215	0.240	0.202	0.100	1
Management Financial Resources	0.311	0.154	0.003	0.290	0.010	0.040	3
Management Material Resources	0.186	0.268	0.039	0.397	0.170	0.118	1
Management Personnel Resources	0.440	0.204	0.306	0.177	0.360	0.116	0
Mathematics	0.079	0.007	0.000	0.168	0.000	0.005	5
Monitoring	0.154	0.183	0.395	0.417	0.258	0.306	0
Negotiations	0.311	0.458	0.466	0.291	0.319	0.498	0
Operation and Control	0.432	0.472	0.466	0.404	0.467	0.439	0
Operation Monitering	0.040	0.027	0.002	0.443	0.086	0.101	5
Operations Analysis	0.025	0.003	0.000	0.118	0.005	0.070	5
Persuasion	0.375	0.448	0.296	0.328	0.218	0.332	0
Programming	0.321	0.172	0.000	0.344	0.002	0.002	3
Quality Control Analysis	0.126	0.173	0.002	0.389	0.050	0.018	3
Reading Comprehension	0.223	0.009	0.004	0.083	0.024	0.161	4
Repairing	0.121	0.100	0.058	0.441	0.321	0.379	2
Science	0.011	0.020	0.000	0.489	0.117	0.148	3
Service Orientation	0.043	0.176	0.001	0.269	0.034	0.016	4
Social Perceptiveness	0.385	0.467	0.012	0.369	0.010	0.021	3
Speaking	0.220	0.170	0.181	0.403	0.071	0.057	2
Systems Analysis	0.042	0.030	0.000	0.337	0.005	0.025	5
Systems Evaluation	0.024	0.028	0.000	0.369	0.020	0.067	5
Technology Design	0.119	0.038	0.043	0.290	0.301	0.492	2
Time Management	0.384	0.479	0.257	0.358	0.180	0.262	0
Troubleshooting	0.026	0.009	0.002	0.357	0.122	0.184	3
Writing	0.180	0.303	0.178	0.396	0.416	0.338	0
NOTE: Qtl1 is Top Quartile of 84 Bachelor's Occupations when sorted by Private Average Salary, Qtl2 is 2nd highest, etc…; Null Hypothesis is = Mean Skill Values Between Quartiles							

Of the 35 skills, Complex Problem Solving is the only one for which the null of equal mean skill values is rejected for each of the six possible pairings of income quartiles. The null of equal mean skill values between two income quartiles also is rejected in five of the six possible pairings for several skills. These skills are Critical Thinking, Mathematics, Operation Monitoring, Operations Analysis, Systems Analysis, and Systems Evaluation.

In contrast 11 of the 35 skills have p-values < 0.10 for none or only one of the six possible income quartile pairings, which does not support the view that there are meaningful differences in the importance of these skills across the income quartiles. The skills showing no to minimal linkage with average salary differences across the 84 occupations are: Equipment Maintenance, Instructing, Learning Strategies, Management Material Resources, Management Personnel Resources, Monitoring, Negotiations, Operation and Control, Persuasion, Time Management, and Writing. While these 11 skills clearly are important in many occupations, they do not appear

on average to be more important in the higher paying occupations than they are in lower paying occupations.

To better quantify the association between variation in a skill's importance and private average salaries across the 84 Bachelor's occupations, the following simple regression was conducted for each of the 35 skills:

$$\text{Private Avg. Salary} = b0 + b1*\text{LessBach} + b2*\text{MastersPlus} + b3*\text{Skill}$$

The variables LessBach and MastersPlus are included to capture the variations across occupations in the share of workers with less than or more than a bachelor's degree. The main focus of this analysis is on estimates of b3, but Table 3 contains the estimates of b1 and b2 as well. There is an almost exact match between the 11 skills in Table 2 with no or one rejection of the null of equal mean skill values and the 12 skills in Table 3 for which we cannot reject the null that b3 = 0. Management of Material Resources is the only of the 11 skills from Table 2 for which the null that b3 = 0 is rejected in Table 3. Active Listening and Speaking are the two of 12 skills in Table 3 for which we cannot reject b3 = 0 that were not identified in Table 2 as having no linkage with average salary. The 23 skills for which the null of b3 = 0 is rejected are shown in descending order based on size of b3. Note that for skills Social Perceptiveness, Coordination, and Service Orientation, a rise in the importance of these skills is associated with a decline in private average salary as a one percentile point rise in the skill's importance is associated with a decline in private average salary of $163, $186, and $264 respectively. For the 20 skills having a positive association between the importance of the skill to an occupation and the occupation's average salary, there is wide variation in the b3 estimates. Each percentile point rise in the importance of Complex Problem Solving is associated with a $689 rise in average salary, while Critical Thinking, Systems Analysis, and Judgment and Decision Making all have b3 estimates larger than $450. In contrast, the bottom several positive b3 skills have values close to, or below $200.

Since it is possible that some of the skills with large b3 values in Table 3 are associated with skills showing minimal variation across the 84 Bachelor's occupations, the forecasted impact upon an occupation's private average salary from moving the skill's value from the 25th to 75th percentile ranking across these 84 occupations is computed. These results are presented in Table 4. The rank ordering in Table 4 is similar to Table 3, but Programming, Troubleshooting, and Mathematics now are the top three skills. Raising these skills' importance from the 25th to 75th percentile value for the 84 Bachelor's occupations increases forecasted average salary by more than $16,000. These gains are roughly twice the gains estimated for the skills in the bottom range of positive values: Repairing, Active Learning, and Reading Comprehension. The lifetime impact of the salary gains associated with increasing the skill's importance from the 25th to 75th percentile is approximated by assuming a 5% discount rate and that the annual salary change occurs for 40 years. The highest salary gaining skills add more than $250,000 in present value to lifetime earnings while the lowest salary gaining skills add less than $150,000 in present value.

TABLE 3: SUMMARY OF REGRESSIONS OF PRIVATE AVERAGE SALARY ON EDUCATION AND SKILL

Private Avg Salary = b0 + b1*LessBach + b2*MastersPlus + b3*Skill							
		b1		b2		b3	
Skill	b1 =	p-value	b2 =	p-value	b3	p-value	R2
none	-581.0	0.009	-389.9	0.110			0.09
			Sorted on Values for b3				
Complex Problem Solvings	-279.0	0.164	-235.2	0.272	688.5	0.000	0.31
Critical Thinking	-428.8	0.037	-319.0	0.153	547.0	0.000	0.25
Systems Analysis	-511.0	0.012	-408.9	0.068	466.6	0.000	0.25
Judgment & Decision Making	-460.9	0.032	-382.1	0.101	457.7	0.003	0.18
Reading Comprehension	-339.2	0.150	-223.4	0.363	432.5	0.017	0.15
Systems Evaluation	-500.0	0.017	-407.2	0.075	410.6	0.001	0.18
Active Learning	-485.7	0.028	-398.0	0.095	395.8	0.025	0.14
Programming	-458.0	0.028	-225.4	0.325	354.9	0.000	0.23
Operation Monitering	-512.6	0.013	-323.4	0.151	353.0	0.000	0.23
Mathematics	-388.9	0.053	-242.0	0.268	331.5	0.000	0.29
Operations Analysis	-409.4	0.055	-146.5	0.539	283.8	0.001	0.20
Troubleshooting	-483.2	0.020	-287.5	0.205	273.3	0.000	0.23
Mngmt Financial Resources	-577.8	0.006	-340.6	0.139	251.1	0.001	0.20
Science	-506.1	0.018	-449.8	0.056	240.3	0.004	0.14
Quality Control Analysis	-476.0	0.027	-300.6	0.201	214.5	0.004	0.17
Installation	-576.7	0.006	-379.1	0.098	210.7	0.001	0.21
Equipment Selection	-535.5	0.014	-342.5	0.149	205.1	0.017	0.15
Technology Design	-579.3	0.007	-395.3	0.094	191.3	0.011	0.12
Mngmt Material Resources	-603.5	0.006	-404.5	0.089	188.3	0.017	0.15
Repairing	-585.1	0.007	-408.2	0.088	173.8	0.030	0.11
Social Perceptiveness	-540.4	0.014	-322.5	0.184	-162.5	0.068	0.12
Coordination	-621.3	0.005	-427.1	0.078	-185.7	0.074	0.12
Service Orientation	-438.6	0.044	-211.4	0.380	-263.7	0.005	0.17
	Skills For Which Fail to Reject Null That b3 = 0						
Equipment Maintenance	-577.9	0.009	-387.9	0.110	120.4	0.139	0.11
Active Listening	-576.2	0.010	-362.1	0.138	-177.9	0.208	0.10
Instructing	-571.4	0.011	-349.5	0.160	-88.5	0.391	0.09
Speaking	-595.8	0.008	-382.9	0.118	-110.8	0.393	0.09
Persuasion	-577.5	0.010	-393.1	0.108	-100.1	0.414	0.09
Time Management	-621.7	0.007	-440.0	0.085	-85.2	0.482	0.09
Operation and Control	-576.6	0.010	-379.8	0.122	70.9	0.506	0.09
Negotiations	-595.5	0.008	-406.5	0.100	-66.7	0.566	0.09
Learning Strategies	-576.0	0.010	-368.7	0.137	-57.8	0.573	0.09
Mngmt Persnl Resources	-565.3	0.012	-379.9	0.123	54.6	0.609	0.09
Monitoring	-570.4	0.011	-392.9	0.110	43.6	0.649	0.09
Writing	-579.9	0.012	-390.0	0.113	3.4	0.983	0.09

DISCUSSION AND CONCLUSION

By confining the analysis to the 84 occupations identified by the Bureau of Labor Statistics as being bachelor's degree dominated, this research provides insights into the sources of variation

in private sector average salaries in occupations accessible to bachelor's graduates who do not go on to obtain advanced degrees. This approach, however, means that the findings from this study cannot be generalized to occupations classified as being less than, or more than, bachelor's degree dominated. Another limitation of this study is that since it is entirely cross-sectional, no analysis can be done on the trends in the returns to different skills over recent decades. Nonetheless, there are several findings that add to our understanding of the associations between the skill characteristics of occupations and workers' earnings.

First, the study establishes the wide variation in private sector average earnings across the 84 bachelor's dominant occupations. This results helps to explain that Acemoglu and Autor's (2011) findings of widening earnings gaps between the 90^{th} and 50^{th} percentiles of full-time workers is a function of more than just differences in educational attainment across workers. These findings provide more detailed insights on the links between skill intensities and wages than is found in other recent literature such as Jones (2009). Second, the sizable variation in private average salary across these occupations is shown to correlate strongly with the perceived importance to an occupation of several skills that emphasize abstract reasoning and mathematical skills. Third, other skills widely regarded as important, such as Active Listening, Speaking, Persuasion, and Negotiations, are not found to correlate significantly across these 84 occupations with private sector average salary. While these skills undoubtedly matter for success in many occupations, the variation in their perceived importance for an occupation does not help explain variation in average salaries for this set of occupations.

Assuming there is a correlation between the measured perceived importance of the skills in this data set to higher paying occupations, and the actual importance of individuals having these same skills in order to be successful in these higher paying occupations, then the findings can provide some guidance to students. Individuals not interested in pursuing advanced degrees, but interested in achieving higher salaries, would be advised to focus upon improving their capabilities with the skills listed in the upper regions of Tables 3 and 4. For current or prospective undergraduates, this suggests analyzing prospective major fields of study in part by how well these majors will help students develop the higher return skills identified in Tables 3 and 4.

Future extensions of this work could include analyzing these occupations for different years to see if there are any discernible trends in the returns to different skills. Also, the returns to different skills could be examined for other educational attainment categories identified by the Bureau of Labor Statistics such as Associate Degree, Long-Term on the Job Training, and/or Moderate-Term on the Job Training. The returns to skills estimated for occupations in these categories could be helpful to individuals deciding between pursuing a bachelor's degree or an alternate career path.

TABLE 4: PREDICTED CHANGE IN PRIVATE AVERAGE SALARY IF MOVE FROM 25TH TO 75TH PERCENTILE FOR SELECTED SKILL

Private Avg Salary = b0 + b1*LessBach + b2*MastersPlus + b3*Skill				
		Change from	Forecasted Change	40 Year
		25th to 75th Ptile	Private Avg Salary	Annuity
	b3 =	in Skill Value	From Skill Change	Value
Programming	354.9	48.7	$17,285	$296,587
Troubleshooting	273.3	61.6	$16,837	$288,907
Mathematics	331.5	49.5	$16,410	$281,585
Critical Thinking	547.0	27.1	$14,822	$254,340
Complex Problem Solvings	688.5	21.4	$14,734	$252,824
Operation Monitering	353.0	35.8	$12,637	$216,842
Installation	210.7	59.5	$12,536	$215,108
Science	240.3	47.6	$11,439	$196,280
Quality Control Analysis	214.5	51.3	$11,006	$188,856
Operations Analysis	283.8	38.7	$10,984	$188,481
Technology Design	191.3	56.2	$10,753	$184,506
Equipment Selection	205.1	52.3	$10,725	$184,038
Judgment & Decision Making	457.7	22.9	$10,482	$179,863
Systems Analysis	466.6	20.4	$9,519	$163,345
Mngmt Financial Resources	251.1	37.4	$9,392	$161,156
Mngmt Material Resources	188.3	48.8	$9,190	$157,688
Systems Evaluation	410.6	22.4	$9,188	$157,661
Repairing	173.8	46.6	$8,101	$139,001
Active Learning	395.8	17.7	$7,005	$120,196
Reading Comprehension	432.5	15.5	$6,703	$115,024
Social Perceptiveness	-162.5	42.9	-$6,970	($119,597)
Coordination	-185.7	42.9	-$7,966	($136,693)
Service Orientation	-263.7	36.2	-$9,552	($163,908)
NOTE: Analysis Reported Only for Those Occupations Where Null of b3 = 0 was Rejected				
Annuity Value Computed Using r = 5%, T = 40 yrs, & the Given Forecasted Salary Change				

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