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ACHIEVEMENT, TEST SCORES AND RELATIVE WAGES

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ACHIEVEMENT, TEST SCORES AND RELATIVE WAGES

During the postwar period the US has experienced large gyrations in the academic achievement of high school graduates and in the return to a college education. The test scores of students completing high school which had been rising continuously since World War I, peaked in 1965-67 and declined 1.25 grade level equivalents by 1979. At that point a recovery began which has returned test scores to the levels achieved in 1966.[1] Trends in the payoff to college have followed a remarkably similar path. The college wage premium was quite low in the years immediately following World War II but once the market had digested the large cohort of GI Bill graduates, the college premium grew substantially during the 1950s and early 60's. For men with 1 to 5 years of post-school work experience the wage premium appears to have peaked at 41 percent in the middle 1960's after which a slow decline set in with a trough occurring in the late 1970s at 28 percent. Since then the college premium for men with 1-5 years of experience has boomed and it has now reached 70 percent.[2]

This article examines the causal connections between these two phenomena: changes in the academic achievement of high school graduates and changes in the payoff to college. Four specific questions are addressed. The questions and the answers generated by our examination of the data are outlined below:

1. Did the postwar cycles in the payoff to college contribute to the rise, then fall, then rise of academic achievement levels of students completing their high school education? **Apparently, yes. The timing of the peaks and the troughs of these two series is remarkably coincident in the postwar period and students living in communities with high rates of return to college are more likely to take college preparatory courses in high school.**

2. Did the test score decline slow the growth of the aggregate supply of well educated workers? Did it contribute to the recent general escalation in the payoff to college? **Yes. If a grade level equivalent metric is used for the calculation, the test**

score decline caused almost as large a deceleration in the growth of workforce quality during the 1980s as the slowdown in the growth of mean years of schooling. The deceleration in the growth of both the quantity and quality of schooling is one of the reasons why the college premium rose during the 1980's.

3. What has happened to the academic achievement of college graduates? Did the relative quality of college graduates fall during the 1970s and grow during the 1980s and did this in turn contribute to recent increases in the payoff to college for recent cohorts of college graduates? **Yes. Test scores of college graduates did decline in the early 1970s but not by as much as high school test scores. Consequently, the relative quality of recent college graduates hit bottom in 1975 and has been increasing ever since. Shifts toward more remunerative majors have also improved the relative wage of recent college graduates during the 1980's.**

4. Did the overall shortage of well educated workers during the 1980s cause increases in the wage payoff to academic achievements not signaled by school credentials? **Apparently, no. For workers under the age of 30, the payoff to years of college and to work experience increased substantially during the 1980s but the payoff to higher test scores did not.**

Each of these questions is taken up in turn.

I. The Impact of the Payoff to College on Effort and Achievement in High School

Probably the most important connection between relative wage trends and test score trends is the impact of the payoff to college on the incentive to study in high school. Academic achievement in high school has important effects on the probability of attending college, the quality of college attended and the probability of completing college but, as we will see shortly in section 4 of this paper, achievement in science, mathematical reasoning, reading and vocabulary has almost no effect during the decade following graduation on the wage rates and earnings of those not going to college.[3] Consequently, the payoff to the

college degree is a primary determinant of the economic payoff to studying in high school. This suggests that the magnitude of the payoff to college may influence course taking and effort in high school. This issue can be examined in both time series and cross section data. Let us begin by reviewing how test scores of high school students have changed over time.

Test Score Trends: For the post-WWII era, the best data on trends in the general intellectual achievement of students nearing completion of compulsory schooling comes from the Iowa Test of Educational Development (ITED). This data set is extremely valuable because it provides equated data extending back to 1942 and annual data from 1960 to the present. Because about 95 percent of the public and private schools in the state of Iowa regularly participated in the testing program, the analyses of trends in ITED data for Iowa is not plagued by changing selectivity of the population taking the test. This feature of the data makes ITED trends for Iowa a better representation of national trends prior to 1970 than the ACT, the SAT, and the American Council on Education Psychological Exam. Since these other tests were taken at first by a highly selected group of students and only more recently by more representative samples of college bound students so trends in scores on these tests are biased by the decreasing selectivity of those who took the test.

Figure 1 plots the trends of ITED composite scores for Iowa 11th and 12th graders. Through 1965 the trend was up: at first moderately so, and then dramatically after Sputnik.[4] The gains for 12th graders between 1942 and 1966 are all the more remarkable for they coincide with an increase in the high school graduation rate in Iowa from 65 percent in 1941 to 88 percent in 1968.

In 1966 the educational achievement of high school students stopped rising and began a decline that lasted about 13 years. On the ITED the composite scores of Iowa 9th graders dropped .283 SDs and the scores of seniors dropped .35 SDs or about 1.25 grade level equivalents. Comparable declines occurred throughout the country and for upper elementary and junior high school students as well.[5]

It appears that recent efforts to improve the quality and rigor of the curriculum have had an effect, as test scores are rising again. By 1988 Iowa 12th graders had recouped about three-quarters of their previous decline and ninth graders had surpassed their 1965 record by almost two-fifths of a grade level equivalent. SAT and ACT scores have risen as well though at a slower rate because of increases during the 1980s in the proportion of high school graduates taking these tests.

College Payoff Trends: The wage premium received by those with a college education has also varied a great deal over the course of the last 60 years. The ratio of the weekly earnings of five high level professional occupations to the weekly earnings of manufacturing production workers fell substantially during the depression and World War II from 3.3 in 1929, to 2.88 in 1939 and 2.46 in 1950.[6] Professional wages then rebounded and the ratio rose to 2.9 in 1964. Decennial census data on the payoff to college for men with limited amounts of post school work experience exhibit a similar pattern. The ratio of the incomes of 25 to 35 year old white males with four or more years of college to the incomes of 20 to 29 year old high school graduates was 1.99 in 1939, 1.45 in 1949, 1.68 in 1959 and 1.76 in 1969 (see figure 1).[7] Figure 1 also presents Katz and Murphy's estimates of college/high school weekly earnings ratio for workers with less than 5 years of post-school work experience. Their carefully constructed series indicates that the wage premium for college degree holders with under 5 years of work experience fell from 51 percent in 1963-64 to 44 percent in 1979-80 and then rose to 84 percent in 1988.[8] Marvin Kosters' data on trends in the payoff to college tell the same story. He calculated that the college-high school hourly wage differential for workers of all experience levels fell from 49 percent in 1973 to 40-41 percent in 1979 for both men and women and then grew rapidly in the 1980s, reaching 82 percent for men and 52 percent for women by 1988 (see Chapter 1).

Comparing Trends: The time-series data for the postwar period appear to suggest that changes in the economic payoff to college for young and inexperienced workers ~~appear to~~ influence the academic achievement of students in high school. Both the college payoff and test scores rose during the 1950s and peaked during the 1960s. The two series then decline together and starting in 1979-80 they start up together. When the average 11th and 12th grade ITED test score is regressed on the logarithmn of the current college graduate/high school graduate weekly earnings ratio and a trend, one obtains the following results:

ITEDAV =	22.07	+ 1.41*log(CollegeWage/HSWage)	-.0114*YEAR	R^2 = .78	
	(5.56)	(7.92)	(3.70)	1969-1987	

The results suggest that the decline in the payoff to college between 1969 and 1979 lowered test scores by 15 percent of a standard deviation (about half the total decline in academic achievement at the end of high school) and the rise between 1979 and 1987 raised test scores by 29 percent of a standard deviation.

Further support for the hypothesis comes from the fact that categories of students who have higher than average probabilities of attending college--white students, suburban students and college going students--experienced larger than average test score declines between 1966 and 1979.[9] On the other hand, test scores and the payoff to college moved in opposite directions during the 1930s and 1940s and there are other plausible explanations of the post 1966 test score decline and rebound. There was, for example, in the late 1960s and early 1970s, a series of EEOC and court decisions which forced most companies to drop the use of basic skills tests assessing verbal and mathematical competence as selection devices.[10] This probably lowered the rewards for studying for the non-college bound and this might have in turn influenced their effort in high school. In addition, graduation requirements and teacher expectations appear to have followed the same kind of cycle. Consequently, this examination of aggregate time series data provides only suggestive evidence regarding the link between rates of return to college and academic performance in high school.

Cross Section Evidence: Cross section data provide a second opportunity to examine how the college payoff influences the behavior of high school students. There is spatial variation in the future payoffs to college education so, if most young people intend to remain in the local labor market after school, one would expect geographic differentials in the payoff to effect (a) the number of college prep courses taken in high school, (b) the time spent studying and (c) the probability of attending college. In previous work I have found that a rather crude measure of the college payoff--the average differential between accountant's, teacher's and engineer's wages and operative wages--had significant positive effects on the college attendance rates of ~~most students~~ young men in the top 75 percent of the ability distribution.[11]

Table 1 presents linear regression estimates of the effect of college payoff, academic orientation of courses and study time on the subsequent college attendance of 27,046 high school juniors at Project Talent high schools in 1960. Separate models were estimated for students categorized by family income. The control variables included in the regression are listed at the bottom of the table. Academic orientation of courses has substantial positive effects on college attendance and hours of study has modest positive effects. The college payoff variable has significant direct effects on college attendance rates of students from low and moderate income families even when hours spent studying, the academic orientation of courses and aptitude are controlled.[12] Since students probably base judgments about the reward

to college on both local and national data, these results are probably a lower bound estimate of the aggregate effect of a nation wide change in the payoff to college.

Do, however, prospective payoffs to college influence behavior of students while they are in high school? To explore this issue, our measure of the college payoff was included in models predicting the number of college prep courses taken through the junior year of high school and the weekly number of hours spent studying including in-school study periods. The standardized regression coefficients (representing the effect of a 20 percent change in the payoff to college) are presented in Table 2. The findings are that students living in labor markets with a large college payoff take additional academic courses but they do not spend more time studying. The absence of the expected positive effect of payoff on hours studying may be due to the inclusion in the study time variable of in school study periods, for college bound students typically take heavier course loads and consequently schedule fewer study periods.

We view this evidence as suggesting that the decline in the payoff to college for young workers during the late 1960s and 1970s probably contributed to the test score decline. A reliable estimate of the magnitude of this response does not appear feasible at this time, however. We will now turn to the effects of the test score decline on wage profiles. The next section of the paper examines the impact of recent slow downs in the improvement in the quality and the quantity of educated workers on trends in the overall payoff to college?

II. The Effect of the Test Score Decline on the Aggregate Supply and Relative Wage of Well Educated Workers

During the past century a rapidly expanding supply of college graduates has raced a fast growing demand for the skills developed at colleges and universities. When supply grows faster than demand, the payoff to college falls. That is what was happening during the 1970s when the payoff to college for males was declining at a yearly rate of .46 to .93 percent per year (see bottom panel of Table 3). When demand grows more rapidly than supply, the payoff to college rises. That is what happened during the 1980s when the college payoff for males rose at an unprecedented rate of 2.08 to 2.83 percent per year.[13] What caused this change? Was there a deceleration in the growth of relative supply of college graduates or was there an acceleration in the growth of the relative demand for college graduates?

Elsewhere in this volume Murphy and Welch suggest that the recent trade deficit and the resulting decline of US manufacturing may have contributed significantly to the large real wage declines suffered by high school graduates and the relative gains of college graduates. Bound and Johnson point out, however, that some of the industries which are heavy employers of college graduates--education and government--also experienced declines in their employment share and that the net effect of all shifts in the industrial composition of employment on the relative demand for college graduates was essentially zero. Consequently, if the outward shift in relative demand for college graduates, indeed, accelerated after 1979, its cause must be sought within industries. The two most likely causes of an acceleration of historical up-skilling trends are the micro-computer revolution and the transfer to Mexico and overseas of production activities which do not require a great deal of skill.

The other possible source of a pervasive increase in the payoff to college is the sudden deceleration during the late 1970s of the increase in the relative supply of college graduates and of skilled workers generally. An examination of Figure 2's data on bachelors degrees awarded reveals that there was indeed a significant deceleration in the growth of the college educated work force during the late 1970s and 1980s. Bachelors degrees awarded rose rapidly in the first three decades of the postwar period. However, the peak was reached in 1974 for men and numbers of degrees awarded to men is still nearly 50,000 below that peak. Bachelors degrees awarded to women has grown sluggishly since 1974. The deceleration in

the growth of the college share for all men and women 18 to 65 years old is rather modest--from 3.7 percent per year for 1973 to 1979 to 2.7 percent per year for 1979 to 1987--but it is larger for men and for younger workers, the groups which experienced the largest increases in the payoff to college.[14] Rates of growth of workers with 12 or fewer years of schooling also changed. The ratio of employed college graduates in the labor force to workers with 12 or fewer years of schooling, which rose by 5.27 percent per year between 1972 and 1980, grew at the slower rate of 3.92 percent per year between 1980 and 1988.[15]

In fact, however, the aggregate number of degrees granted by American colleges and universities during 1980s was significantly smaller than the growth in the numbers of people reporting 16 or more years of schooling to CPS interviewers so the deceleration in the true growth of college graduate supply appears to be larger still. Adkins has compared estimates of the stock of people who have completed 16 or more years of schooling in Census and CPS data to estimates of the number of college graduates based on cumulating degrees awarded and reconciled the differences for 1959, 1966 and 1970. He concludes that after appropriate adjustments are made, the two data sources yield remarkably similar estimates. When Adkins' reconciliation methodology is applied to the growth of college degrees after 1970 similar results are obtained for the 1970s. During the 1970s colleges awarded 8,523,000 bachelors degrees and the number of individuals born after 1925 claiming 16+ years of schooling increased by 10,675,000. Immigration probably accounts for about 809,000 of this discrepancy and individuals with 16 years of schooling but no degree for the rest.[16]

The growth in the number of bachelors degrees awarded decelerated dramatically in the late 1970s and 1980s (see Figure 2). Between 1980 and 1987, colleges awarded 6,543,000 bachelors degrees. In CPS data, however, the numbers claiming to have 16+ years of completed schooling rose by 9,181,000. Immigration can account for no more than 734,000 of this increase and individuals with 16 years of schooling but no degree for another 1,019,000. This leaves a remaining discrepancy of 885,000 that is probably increased misreporting of years of schooling. If so, the annual growth rate of the ratio of college to high school workers between 1980 and 1988 in Table 3 drops from 3.92 percent per year to 3.51 percent per year and the implied deceleration in the growth of relative supply grows to 1.76 percentage points.

The second reason why CPS data on college graduates understates the true deceleration in the supply of well educated workers is the post 1966 decline in the knowledge and skills

of the students graduating from high school. Bishop has shown that this caused a substantial deceleration in the growth of effective supply of well educated workers. His EQ index describing the schooling constant average test scores (measured in population standard deviation units) of workers weighted by their share of compensation grew much more slowly in the late 1970s and 1980s than in the 1950s and 1960s (see Table 3).[17]

The growth of mean years of schooling also decelerated during the 1980s. The annual growth rate of mean years of schooling, which was .0964 in the 1960s and .0915 in the 1970s, fell to .0588 in the 1980s (see bottom panel of Table 3). Since a population standard deviation on academic aptitude and broad spectrum achievement tests is approximately 5 grade level equivalents, we can translate the changes in the EQ index into a years of equivalent schooling metric by multiplying by 5. The yearly rates of gain of the EQ index multiplied by 5 are given directly below the rates of gain of mean years of schooling. This way of equating test score gains with years of schooling implies that during the 1960s the gain in average "quality" of workers at given levels of education was about 2/3rds of the gain in schooling quantity. The test score decline resulted in a reduction in the contribution of improvements in "educational quality" to the growth of worker quality during the 1970s and an even larger drop in the 1980s. The next line of the table 3 reports the rates of growth of an index which combines the two effects. Clearly the rate of growth of the quantity and quality of the schooling embodied in the work force declined substantially in the 1980s. The annual rate of gain, which had been .157 years of schooling equivalent in the 1960s and .137 years of schooling equivalents in the 1970s, fell to .084 years of schooling equivalent during the 1980s.

We conclude, therefore, that measured in efficiency units the growth of the supply of well educated workers slowed more substantially after 1980 than has previously been thought. Employers may have reacted to the declining quality of high school graduates by raising the minimum levels of schooling expected of new hires. Does the deceleration in the growth of relative supply fully account for the rapid rise in the return to college during the 1980s? That depends on the elasticity of substitution between college and non-college labor. If elasticities of substitution are no higher than one, the slowdown in the growth of the relative supply of college graduates can probably fully account for the growth of the college premium. If, however, elasticities of substitution are greater than one, the growth of the college premium

must have been occasioned by an acceleration in the growth of relative demand as well as a deceleration in the growth of relative supply.[18]

III. Did Shifts in the Relative Quality of College Graduates Occur during the 1960s, 70s and 80s ?

Bound and Johnson have suggested that shifts in the quality of college graduates relative to high school graduates might be responsible for some of the growth of the wage differential between college and high school graduates for young workers. The relative academic achievement of a cohort of college graduates will increase if college admission and completion becomes more contingent on initial levels of achievement or if colleges become better at promoting learning. It will also grow if college students shift from majors which offer little remuneration to majors which are well remunerated. All three possibilities will be explored. We will begin by examining the evidence of changes in the first of these mechanisms--the association between academic achievement in high school and college attendance.

3.1 Trends in the Impact of Academic Achievement on College Entrance Rates

Taubman and Wales examination of trends in the impact of academic test scores on the probability of college entrance between 1924 and 1960 concluded that ability became an increasingly important determinant of the probability of high school graduates entering college during the period.[19] This trend might have reversed in the 1960s, however, for the 1960s and early 1970s were a period of rapid growth for colleges with open door admissions policies. Growing numbers of low ability students pursuing vocational curricula in 2 year institutions might have reduced the academic achievement differential between those entering college and those completing schooling with a high school degree.

To test this hypothesis the calculations made by Taubman and Wales were replicated in two more recent nationally representative longitudinal studies of high school seniors--National Longitudinal Survey Class of 72, and High School and Beyond (1980 graduates). Rates of college entrance for the year following graduation were calculated for each quartile of the ability distribution. The relationship between college entrance rates and a student's ability ranking was approximated by a series of linear segments and mean ability rankings

were calculated for college entrants and for non-college going high school graduates.[20] The results are presented in Table 4. The mean ability ranking of high school graduates not going to college was .47 in 1925, .43 in 1946, .42 in 1950, .40 in 1957, .35-.36 in 1960-61, .38 in 1972 and .364 in 1980. The class rank gap between those attending and those not attending college grew from .06 in 1925 to .20 in 1946 and then .28 in 1960. The gap then fell to .22 in 1972 and then returned to .25 in 1980. These calculations imply that the dependence of college entrance on ability did indeed fall between 1960 and 1972 but then rose again between 1972 and 1980.

Correlations between test scores and college entrance are an alternate way of characterizing the dependence of college entrance on ability. The correlation between test scores (high school grades) and a zero-one dummy for college attendance 18 months following high school graduation was .399 (.315) for 1972 high school graduates and .442 (.384) for 1980 high school graduates.[21] Clearly the dependence of college entrance on ability was rising during the 1970s. Evidence on changes between 1961 and 1972 can be obtained by comparing the .399 correlation obtained in NLS Class of 72 data to the average correlation (for 5 family income strata) between test scores and college attendance 18 months after graduation in Project Talent data on students who graduated in 1961. The Talent achievement composite's correlation with college attendance was .458 around 1961 indicating a large decline in academic selectivity by 1972 when the comparable figure was .399.[22]

Data on the characteristics of college freshman from the American Council on Education's (ACE) Cooperative Research Program provide another look at trends in the degree to which college entrance depends on prior achievement levels. The percentage of freshman who self reported themselves to be in the bottom half of their high school graduating class first rose from 22 percent in 1968-69 to 26.8 percent in 1970-71 and then dropped to 20.2 percent in 1978. At this point the wording of the question changed but the trend appears to have continued after 1978. The percentage of freshman who reported that they were in the bottom 60 percent of the high school graduating class dropped from 38.8 percent in 1979 to 36.0 percent in 1986.[23] When combined with the fact that college entrance rates were rising in the 1980's, these data suggest that the effect of high school achievement on the likelihood of entering college rose during the 1970s and 80s after falling during the 1960s.

For the period after 1980 the final source of data on trends is a 1985 survey of college admissions directors. The 2203 institutions who responded to the survey represented 74

percent of the institutions admitting freshman students into bachelors and/or associates degree programs. The admissions directors were asked retrospective questions about changes in admissions selectivity between 1980 and 1985. Only 2 percent of the institutions reported that they had become less selective during that period. The proportion reporting they had become more selective, on the other hand, was 42 percent at four-year private colleges, 49 percent at four-year public colleges and 30 percent at two-year private colleges and 8 percent at two-year public colleges.[24] All of these data sets tell a consistent story of first declining then rising effects of academic achievement on college entrance probabilities.[25]

3.2 Trends in the Relative Test Scores of College Graduates

The differential in academic achievement between high school graduates and college graduates will also increase if college graduation becomes more conditional on initial achievement levels and/or if colleges become more effective promoters of learning.

A natural way to assess trends in the selectivity and value added of college is to compare the trends on tests taken by recent college graduates to the trends on tests taken at the end of high school. Such comparisons face difficulties, however, because the tests taken by college graduates--the Graduate Record Exam (GRE), the Law School Admissions Test (LSAT), the Graduate Management Admission Test (GMAT) and the Medical School Admissions Test (MCAT)--are not taken by representative samples of college graduates. These tests are primarily taken by students applying for admission to graduate and professional schools. The share of college graduates entering such programs and the selectivity of these programs have changed. In 1966, the first year for which data is available for all four graduate tests, the number of graduate exams taken (uncorrected for multiple test taking) was equal to 42 percent of the BAs awarded in that year (see column 5 of Table 5). By 1971 the ratio had risen to 62.7 percent. Since that date the ratio has fluctuated between 60.6 and 68 percent. An additional problem with the data arises from the fact that many test takers are returning to school many years after completing their BA.

Still another problem arises from the fact that foreign nationals are a large share of GMAT test takers (about 20 percent) and an increasing share of GRE test takers.[26] A time series of GRE scores for US citizens was, therefore, used for the period 1972/73 through 1988/89 and earlier data on average scores was spliced onto this. On the GMAT, foreign nationals obtain comparable scores on the quantitative section but substantially lower scores

on the verbal section. I was not able to obtain data on GMAT scores of foreign nationals prior to 1983, so it is not clear how GMAT trends would change if foreign nationals were not included. Because of these problems, comparisons of graduate test scores and high school test scores need to be done cautiously.

The time series constructed from these data is intended to measure trends in the general academic achievement of recent college graduates. Scores of the four different tests were deviated from their value in 1977, divided by their standard deviation and averaged.[27] The weights used in constructing the average were 0.253 for the GMAT, 0.182 for the LSAT, 0.077 for the MCAT and 0.488 for an average of GRE verbal and quantitative scores. The weighted average of the four graduate tests is presented in column 1 of Table 5-5. An index of these college graduate test scores (with a value of 1 in 1966) was generated by adding .8845 to this average and the result is plotted in Figure 3.

The academic achievement of graduate test takers apparently declined during the late 1960s. Between 1966 and 1972 there was a 0.20 SD decline on the quantitative Graduate Record Exam (GRE), a 0.28 SD decline on the verbal GRE and a 0.215 SD decline in the Graduate Management Admission Test (GMAT). There were small increases of 0.06 SD on the Medical School Admissions Test (MCAT) and of 0.09 SD on the Law School Admissions Test. The overall average declined by 0.13 SD. The decline of the Graduate Test Average during this period was probably in part a result of substantial increase during this period in the proportion of high school graduates completing college (see column 4 of Table 5-5 and figure 3). In addition, the proportion of BA recipients who took graduate exams rose substantially (see column 5). Consequently the average quality of all college graduates probably declined less than is indicated by the graduate test series.

As with high school graduates, there appears to have been a rebound in the test scores of college graduates planning to continue their schooling. The overall index remained essentially flat between 1972 and 1980 but has since risen 0.23 SD above the 1972 level. Trends have differed substantially across tests. Between 1977 and 1989 there were declines of 0.095 SD on the MCAT but increases of 0.146 SD on the verbal GRE, 0.24 SD on the quantitative GRE, 0.337 SD on the GMAT, and 0.179 SD on the LSAT.

The index of trends in the academic achievement of high school graduates to which the college graduate test score time series is compared is a weighted average of ITED test scores for the high school graduating classes of 4 to 9 years earlier.[28] Figure 3 plots high

school test scores on the same graph as the college graduation rate. Clearly there is a strong positive association, suggesting that the test score decline may have helped cause the fall of college graduation rates during the 1970s.

A rough summary statistic describing changes in the gap between college and high school test scores--constructed by adopting test score standard deviations as a common metric and then subtracting the high school index from the college graduate index--can be found in column 3 of table 5-5. Given that caution must be exercised in drawing inferences from this data series, what does a comparison of these two time series tell us about changes in the selectivity and value added of a four year college education during the past twenty-five years? The test scores of high school graduates rose rapidly during the early 1960s. Selectivity of college entrance fell and the proportions of high school graduates completing college rose (from 0.281 in 1966 to 0.327 in 1972). Value added appears to have declined possibly because of the disruptions associated with the Vietnam War period. As a result the improvements in the quality of students graduating from high school did not produce gains on the tests taken by college graduates four years later. In fact the test scores of these college graduates were declining during the late 1960s. The index of the gap between college graduate test scores and high school graduate test scores four years earlier fell by 0.37 standard deviations between 1966 and 1972. The trough of this series occurs three years after Woodstock (indicated by the vertical line on figure 3) and two years after four students demonstrating against the Vietnam War were killed at Kent State University. This figure exaggerates the magnitude of the true decline, however, since some of this measured decline in the relative quality of college graduates is a spurious result of the rise in the number of college graduates seeking admission to graduate school and taking the graduate tests.

At this point, we entered a decade of declining test scores for entering students and stable scores for college graduates. Value added probably underwent a recovery as the disruptions associated with the Vietnam War ended. In addition, the selectivity of college entry and graduation increased. Ratios of bachelors degrees awarded to high school graduates four to nine years earlier fell from 0.345 in 1972 to 0.301 in 1979. Thus the decline in the quality of the students entering college resulted in an increase in attrition, but no decline in standards for graduation.

Then starting about 1979 first graduate and then high school test scores began to rise. By 1984 the index of the gap between college graduate and high school graduate test scores

rose by 0.41 standard deviations from its low in 1972. Since then the gap has remained stable.

To sum up, the test score gap between college graduates and high school graduates has fluctuated violently. It fell by 38 percent of a standard deviation between 1966 and 1972 and has since risen 41 percent of a standard deviation. Test score fluctuations of this magnitude have probably had significant effects on the wage premium received by young college graduates. An estimate of their magnitude may be obtained by multiplying the changes in the test score gap by .1406, Bishop's estimate of the effect of a one high school standard deviation test score differential on the logarithmn of the weekly wage. This implies that changes in the test score gap lowered the college wage premium for young college graduates during the 1970s by about 5 percent and then raised it by a similar amount during the 1980s.[29] It would appear that growing academic achievement differentials between college and non-college youth have contributed significantly to the growing wage differential between the groups during the last decade.

3.3 Trends in the Distribution of College Majors

The wages received by college graduates depend on what the student studied while in school. The first four columns of Table 5-6 present data from periodic surveys of random samples of recent college graduates on the effects of field of study on salaries received one year after graduating from college.[30] The differences across field are sometimes as large as the wage gains accruing to those obtaining higher level degrees. During the 1980s engineers were receiving 64 to 78 percent higher starting salaries than humanities majors and business majors were receiving 29 to 34 percent higher starting salaries than humanities majors.

Data on the earnings of college graduates years after leaving college solidify the finding that majors in humanities, education, biological sciences and social sciences other than economics earn far less than business, physical science and engineering majors. The salaries of business majors tend to catch up with the engineers, but education and liberal arts majors remain far behind those with engineering and business degrees even when the quality of one's college is controlled. The seventh and eight columns of table 5-6 present data on the relationship between college major and yearly earnings of men aged 21 to 70 from the 1967 Survey of Economic Opportunity. With college rank constant, undergraduate business majors earned 32 percent more and engineers 51 percent more than humanities majors and education majors.[31] The ninth column of table 5-6 presents 1984 data on monthly earnings