Next Steps: Preparing a Quality Workforce

by Stephen Coelen
Sevinç Rende
Doug Fulton

Department of Economics
and
Connecticut Center for Economic Analysis
University of Connecticut

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Prepared By:

Stephen Coelen, Research Professor, Department of Economics University of Connecticut
Managing Partner, *WISERTrade* LLP, Holyoke Community College
Professor Emeritus, University of Massachusetts Amherst
Senior Research Fellow, Connecticut Center for Economic Analysis

Sevinç Rende, Assistant Research Professor, Economics University of Connecticut

Doug Fulton, Consultant, University of Connecticut

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Acknowledgments

It is not news to any potential reader that individuals and communities face increasingly complex choices and constraints in financing the education they hope will secure good jobs and a high quality of life. This is as true in Connecticut as it is in many other US States. The long list of institutions supporting the current study, **Connecticut Next Steps: Preparing a Quality Workforce**, however demonstrates that Connecticut holds more promise than perhaps many other US states in finding a solution. Connecticut has amassed the interagency collaboration necessary to prepare a better future for its residents. Further in supporting that this work be done by an outside, independent research team—obliged to tell the story as it appears, Connecticut showed that there is a way past the stumbling block on which other states have tripped trying to accomplish such daunting work. Sharing data only among agencies—without the outside contractor, falls prey to the killing objection that there are too few checks and balances to understanding the subject matter objectively and to handle the associated data properly. As done in Connecticut, each contributing agency secured contractual commitments that the use of the integrated database not exceed the circumscribed purposes under which it was initially created. As that independent, small *and* carefully monitored research contracting team, we—the authors of this report, nonetheless accumulated debts close to the length of Connecticut River on this remarkable project.

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Roberta Hyland and Richard Reeves of the National Student Clearinghouse were very helpful in explaining the work of their database works, in getting our data orders filled promptly and in giving encouragement to our work. It is an important objective that school districts, as well as higher educational institutions, participate in NSC activities, very especially the degree verification programs of NSC.

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Next Steps: Preparing a Quality Workforce

I. Executive Summary

This study tracked five cohorts of Connecticut 10th grade students taking the Connecticut Academic Performance Test (CAPT) between 1996 and 2000 over as many as 8 ½ years beyond high school. It followed these students through their college experiences and/or into the labor force to study and document the many elements of their success critical to preparation for entry into a skillful workforce:

1. students' success in moving through college:
    a. their choosing to go to college in the first place;
    b. the wait-time elapsing before their start in college;
    c. eliminating their individual remedial skills deficiencies;
    d. their passing of courses; and
    e. their staying on time in targeting their degree completion,
2. the students' record of more permanent educational qualifications , and relevant to future workforce participation
    a. credits earned;
    b. degrees earned; and
    c. overall collegiate grade point average, GPA, at end of their study (whether completed with degree, or not, and
3. students' (once done with schooling) early achievements upon entering the workforce:
    a. number of spells of employment and non-employment
    b. average earnings per quarter
    c. earnings growth from first stable employment to last
    d. most frequent industry worked

Such information admittedly focuses only on the relative talents of the State's public high school student population and on its role in creating part of the State's future workforce. Such a focus is limited, but warranted. This population is unique and represents the sons and daughters of Connecticut taxpayers. It is an important population because, without migration, it would be the potential logistical future of the existing workforce and represents employer concerns about perpetuating production and consumption capacities in the State. Lastly but not least, in its youth, this population is the concern and embodiment of the hope and dreams of the parents of the State. Because of the wealth and scope of its data, the study differs from all prior and current studies. With the information at hand, Connecticut now has more knowledge of its current position with regard to high school graduates than does any other State in the country. Measures developed here create a dynamic policy platform for debate and discussion on appropriate steps for maximizing the quality of the potential workforce—a discussion which should engage in equal measure the State's business, education and governmental sectors. If any of these do not come to the policy table, Connecticut will be much the worse for the loss, Each of the 170,064 persons taking CAPT exams between 1996 and 2000 was followed (with care for privacy and confidentiality) by appropriate administrative records, determining students' post-secondary education attainment and their participation in Connecticut's work force. We find that of 170,064 students, 27.3% did not pursue any educational institution beyond high school. Another 8.2% attended a higher education institution, but with uncertainty about which one and when enrollment started and stopped. Records on the first post-secondary institutional choice of the remaining 64.6% of students show, within this college bound population, 32% attended the Connecticut Community and Technical College System—CTC; 16% attended the Connecticut State University System—CSU; and 12% , the University of Connecticut—UConn. Within the remaining college bound population, 35% left Connecticut to attend their first higher education institution, leaving only 5 % of the Connecticut public high school students pursuing higher education going on to Connecticut private higher education institutions.

The Next Steps study concludes that students scoring higher in CAPT LIT and CAPT MATH exams in 10^{th} grade in the State's public high schools were more likely to take SAT exams and attend college—as might have been expected; but gender, ethno-racial background and family income status further accentuate this effect. Male students are less likely to attend college than female students at equivalent test score levels; students in supported school lunch programs, a proxy measure of low income status, during high school are less likely to pursue higher education than their counterparts from better-off families. In particular, Hispanic male and Asian-American female students appear to be less likely to attend college than other group of students. Following high school, students attend a higher education institute, on average 3.2 semesters, or equivalently 8.9 months, after graduation. This average was a bit higher for students enrolling in the CTC system and somewhat lower for students enrolling in CSU or UConn systems. Ethnicity and race and family income status of students also appear to be more important in delaying college enrollment than do test scores.

We also linked institutional transcript information of students attending public segments of higher education in Connecticut to their 10^{th} grade test scores, showing that students who perform well in 10^{th} grade CAPT LIT and CAPT MATH exams are less likely than others to take remedial courses during their college career. But those who pass their remedial course work are likely to attain GPAs at the end of their college course work on a par with students who did not need remedial coursework. Students who fail remedial courses, regardless of their high school test performance, finish their college career with significantly lower GPAs than do their counterparts who passed remedial coursework.

Although we find strong associations between 10^{th} grade high school exams and students' subsequent higher education and labor market success outcomes in our analyses, we emphasize that many other factors, not available in the database, may also affect success. These omitted variables include the degree of parental involvement during students' school careers, parental earnings and/or education or the variations in available school funds across the districts in which students attended high school. Partly as a result, the degree of explanatory power of CAPT exams on subsequent success outcome measures varies from minimal levels 4% to 43% at high levels, even after incorporating other factors. Self-reported high school curricula work, in addition to CAPT exams, appears to have statistically significant influence on higher education outcomes, signaling the importance to college success of continuous effort during high school. Finally, because CAPT exams likely absorb unobserved student abilities in addition to observed 10^{th} grade achievement, any singular assessment of the contribution of high school tests to student achievement during later stages requires an empirical strategy beyond the inquiry this report aims to achieve.

With these disclaimers, however, we hope that an overall assessment of our results will show that CAPT exams can be used to determine the areas for further help during students' high school work. Students from disadvantaged groups need guidance in their decisions to attend college—we show, for example, that 10^{th} grade high achieving students in supported lunch program are less likely to attend college than are equally achieving students from better-off families. In this context, providing more accessible information on the varieties of college and financial aid options available to high achieving students from disadvantaged backgrounds becomes critical. We also show that among college attending students, those with lower CAPT exam scores are more likely to take remedial coursework in college, delaying their likely graduation for many reasons including taking time for "extra" remediation courses not needed for degrees. Getting more CAPT-predictable remediation while the student is still in high school has the potential to greatly improve the success of students who with high school work will not fall behind in college.

Of non college bound student population, 60% were found to be working in Connecticut, according to the Connecticut's Unemployment Insurance (UI) database post their expected high school graduation. This database, however, excludes the self-employed, military personnel, federal personnel, and persons working out-of-State. We therefore can conclude only that 60% of non-continuing students worked for wage remuneration in Connecticut. The remaining 40% might have possibly:

- joined the military,
- become self- or federally-employed,
- been placed in custodial care institutions
- been unemployed,
- been out of the workforce
- been employed in other states, or
- not have been traced in the dataset because of name changes or incomplete tracking information.

Our data analysis confirms the national trend showing that earnings of students attending post-secondary education start higher and rise faster than earnings of students not pursuing higher education. The relative divergence of salaries over time is a likely sign that the earnings in Connecticut's labor market have turned against workers with low educational attainment, while increasingly rewarding skilled labor. Degree-holding seems to offer the potential of leveling the earnings gap between minority and white populations as well as the earnings gap of a second comparison group, poor and affluent students, but this result warrants further analysis. The one persistent gap not attenuated by degree holding appears to be the gender-wage gap, women with or without degree start their early work career with earnings lower than their male counterparts.

While our study describes a broad view of Connecticut's work force, there are still many points which the study can't explain. We do not know for example whether higher-education graduates coming from other states sufficiently replace the graduates of the State's own public high schools who leave the State. The UI database does not collect information on the states of unemployment , therefore our results are silent on employment probability, a very important measure of success for students and their parents who strive to secure a good job in Connecticut's labor market. Lack of hours worked in the UI database significantly impeded measuring earnings on a common scale, preventing comparable readings among individual workers. Nonetheless, we did our best to control the bias stemming from such possible hourly differences. As well, because of the large lack of occupational data, we can't systematically assess whether the demand for skills in the Connecticut's labor market matches the supply of skills, provided by the graduates. For instance, the explained variation in early work career earnings of Connecticut's former 10th public high school students increase from 16% to 30% after incorporating information on the industry of employment, pointing out other factors in labor market, such as occupation, are as important as 10th grade high school exam scores. This last point is especially important for policy purposes. Considering that Connecticut jobs, as those in many other U.S. states, face international competition from jobs migrated abroad, a policy discussion on the jobs that will stay, and the demand and the supply of skills for such jobs would enrich the discussion. All such work is made impossible without occupation detail in employment records.

Our analysis, however, shows that there are four important, independent channels through which Connecticut "brain-drains" siphon the future productivity of many of the best and brightest (meeting the highest standard of achieving CAPT goal) of the public high school 10th grade cohorts from Connecticut's future labor market:

1. The first brain-drain occurs in high achieving students who, beyond high school, do not pursue college. The small decline in this educational discontinuity from 1996 to 2000—non-continuance rates falling from approximately 10% to 8%—is insufficient to assuage the problem. The amount of CAPT goal-achieving students in Connecticut failing to pursue higher education is still too high a percentage to satisfy future workforce needs (Sections V and VIII.B,2);

2. The second brain drain occurs when Connecticut high school graduates make initial choices of going to out-of-state rather than staying in in-state colleges. We concluded that 48% of the best and brightest 10th graders in 2002 and as many as 67% in 1998 opted to begin their higher education in institutions out-of-Connecticut. From out-of-Connecticut college locations, the presumption has always been that it is much harder to lure such students back to work in the State and that many students starting out-of-State will be lost to the State. This study verifies that only 20% of the highest achieving CAPT takers starting out-of-Connecticut come back to the Connecticut labor market following the completion of their studies (Section VIII.B.3);

3. Intra-state transfers during college lead to a systemic third form of brain-drain, loses through net out-transfer of greater volumes of already enrolled students going out-of-Connecticut than entering it.[1] Observed transfer losses involve the "best and brightest," modal CAPT test scores

[1] Net migration is more out- than in- when those starting in-State transfer out-of-State during college in greater numbers than their counterparts, starting out-of-State and transferring into-State.

of out-transfers being higher than for in-transfers. In the high school classes of 1998 through 2002, intra-state transfer accounted for additional losses of 4.6% of Connecticut's best and brightest students (Section VIII.B.4), and

4. The fourth form of brain drain occurs as workers, who started in the Connecticut employment following completion of their education—whether or not staying in Connecticut for college, subsequently leave Connecticut employment. Nearly 70% of the highest achieving students of CAPT who finished their higher education continue as wage workers in Connecticut, but this means that their complement, 30%, become an additional brain drain to the Connecticut workforce (section X.D).

We discuss the implications and repercussions of the different channels of brain-drain on the various stakeholders in Connecticut's future, students, parents, higher education institutions, the State, local school districts, and the business community in the policy conclusions section. Connecticut Next Steps also makes a few inferences, but falls short of making a full case, about the extent to which education attenuates earnings inequality in the State. We believe the strength and dynamism of the Connecticut economy, moving more and more toward a service economy, depends on the strong development of new, high-income earners from among students who grew up in low income households. New infusions of high-income earners are necessary to replace those of current high-income who will soon or have already entered retirement. Unfortunately, our indicator variable failed to capture the association between parental income and early work-life earnings of their children because we did not have an adequate income variable. A better measurement of family income would highlight the role education plays in improving the earning opportunities of Connecticut's public high school children**.** We find that, on average, early work earnings of college-educated degree-holding students from impoverished families appear to be higher than their counterparts from more affluent families. Although our analysis requires further sensitivity analysis which the available data were unable to yield, this result nonetheless encourages that Connecticut is spawning an empowerment for such growth.

II. Introduction

This study, **Next Steps: Preparing a Quality Workforce**, is a follow-up of two studies published under the Nellie Mae Education Foundation, New England 2020: A Forecast of Educational Attainment and Its Implications for the Workforce of New England and Connecticut First Steps: Success Beyond High School. The results of the first of these studies showed how divergent Connecticut's demographic population forecast is from its recent history. [2]The study then followed with a bridge between population and educational attainment to trace likely shifts that would occur in the educational attainment if there were no changes in key rates of educational participation, progression and graduation by race and ethnicity. The second study showed significant losses in Connecticut's workforce might most

[2] For an independent confirmation of the results reported therein, the readers can refer to Prescott et al (2008) "Knocking at College Door: Projections of High School Graduates by State and Race/Ethnicity, 1992 to 2022, by *Western Interstate Commission for Higher Education.*

significantly develop from those of an age about to join into Connecticut's future, focusing on sons and daughters growing up in Connecticut. This group often showed itself either to fail to go to College despite indicators showing promise of significant individual opportunity or to go out-of-State for College raising questions of loss of potential. Bright students left undereducated waste important prospective resources; bright students choosing out-of-State colleges raise possibilities that they will not return to Connecticut for labor market productivity after college.

By contrast, in the current study we expand the coverage presented in **Connecticut First Steps** in two important ways. While **Connecticut First Steps** followed only one cohort of public high school students, the current study *broadened* the sample frame, including five cohorts of public high school students. All participated in their common thread, the Connecticut Academic Performance (CAPT) tests. CAPT tests were taken between 1996 and 2000 by those included in the current study. Furthermore, the current study *broadened* coverage of the cohorts' activities following them through both their post-secondary educational endeavors and their participation in Connecticut's labor market.

The construction of the dataset used in this study, linking five cohorts of Connecticut public high-school students to the State's public post-secondary institutions and the State labor market, could not have occurred without the contribution and contractual participation of many different organizations, most Connecticut State agencies:

1. The Connecticut Department of Education provided important initial information on the CAPT-taking population. This identified the basic population frame underlying the study's cohorts.

2. Facilitated by the Connecticut Department of Higher Education, Connecticut's public, post-secondary educational institutions provided data both on college courses taken and students' success therein for the large subset of students choosing to go to the different public segments. These segments include: the Connecticut Community and Technical College segment—CTC; the Connecticut State University segment—CSU; and the University of Connecticut—UConn. Used in the current study, these data reflect only a segmental (in-State public college students, only) sample of the full database on public high school students; throughout this report, we make every effort to identify that such results pertain only to that sample.

3. The National Student Clearinghouse provided attendance dates and other degree related information for nearly the entire cohort of Connecticut students graduating between 1998 and 2002—such data applied, whether or not students went beyond Connecticut's public sector colleges. The limitations that apply to NSC data reflect primarily on the extent of participation of institutions in the NSC, but institutions enrolling well over 90% of the national total of students do participate. This data identified where students gravitated, post-high school.

4. College Board contributed pivotal information on student SAT test score results, demographic profiles and self-reported high school course work. And finally,

5. The Connecticut Department of Labor provided data enabling us to link the student information to wage record data for persons in the original CAPT cohort samples employed in Connecticut, spanning a time period from 1994 to 2006.

At all stages of data analysis, confidentiality of the students was protected from loss and inadvertent disclosure. This was done on one level by assigning unique pseudo id numbers to each person in the study, these supplanting any personally identifiable information in analytical files tied to personal outcomes data. The file containing the linkage information between personal- and pseudo-ids was stored in a single secure central location; this was restricted to computers with no network access. At a higher level, access to student outcomes derived from contributing agency oversight was then strictly limited—on the research team's side to elements for which the case was made that they were important for purposes of the study; on each contributing agency's side to just that material provided by the agency and aggregated summary statistics for linked data reflecting the appropriate population sample for any specific analysis. At the third and final level, each component of data thought important for public release, was reviewed by the oversight members of the agencies to determine that the manner and detail of release did not propose any material which might indirectly identify persons by their inclusion in small-sized analytical research cells.

III. Literature Review

There is a vast literature on the importance of educational outcomes on long and short-run economic growth in developed countries (Hanushek and Wössman 2007). Why is this relationship important for public policy purposes? We believe, firstly, that policy measures should take into account the efficient use of always scarce public resources. Secondly, education is the major means through which people can improve their positions on the earnings spectrum—educational policies having direct effects on wages earned and thereby implications for economic equality. Thirdly, education provides social returns to civic participation and to public policy areas as diverse as the health, fertility, even potential criminal activity of a population beyond its private returns realized through individual earnings in the labor market (see for instance, Dee 2004). Although it is quite difficult to measure the "product" and "quality" of education, the relationship between standardized tests and the college segments from which individuals graduate can be associated with earnings, leading to inferences on economic growth and the competitiveness of the U.S. economy (Murnane et al. 1995) Evidence shows that earnings of persons with post-secondary education have increased over the years and one explanation offered in the literature is the transformation of the U.S. industry as a reflection of increasing international competition in high-skilled industries (Taber 2001; Bishop 1989).

Although the relationship between test scores and accountability has produced much discussion (Jacob 2005, Hanushek and Raymond 2004; Pennington 2003; Kane and Staiger 2002; Roderick and Engel 2001), there is a lacuna in the available data tracking the relationship between measured cognitive skills and schooling and labor market outcomes (Hanushek and Wössman 2007). This study aims to fill this gap by following post secondary schooling and Connecticut labor market outcomes for five Connecticut Academic Performance Test (CAPT) cohorts taking CAPT exams in Mathematics (CAPT MATH) and Literature (CAPT LIT) between 1996 and 2000. By tracking the relationship between observed ability, schooling, and earnings, this study highlights the role of state administered tests in predicting student outcomes, allowing the work to contribute to the discussions on the value of highstakes testing administered by the states (see for instance Rose 2006). Throughout the report, the contribution of the public higher education in sustaining the State's labor force is highlighted. And finally, this study explores the role in Connecticut higher education of the community college system, which enrolls more than one-third of college bound students who attended public high school between 1996 and 2002 and whose education decisions are affected by state and federal aid policies (Alfonso 2006, Gonzales and Hilmer 2006; Ehrenberg and Smith 2004; Leigh and Gill 2004; Kane and Rouse 1995). For instance the data show that the majority of students attending community college participate in Connecticut's labor force, following completion of their higher education studies, becoming a major source of labor supply for Connecticut's employers.

IV. Data Matching Process

The population of public school 10th grade CAPT-takers over the period from 1996 through 2000, likely graduating from high school between 1998 and 2002, represents the basic sampling frame for work associated with **Connecticut Next Steps: The Role of Education in Preparing a Quality Workforce**. This group represents a wide swath of students who, in several ways, captured the hopes and dreams of Connecticut taxpayers of the time. Arrayed by test score, these students present a succinct statement of the State's possible future. Linked to other data bases such as college enrollment , transcript data from the public colleges (to which more than half of Connecticut's high school cohort goes when continuing on beyond high school) we obtain detailed records on how students proceed in their advanced studies—which students were successful in their early careers, and which were not. Beyond detailed public institution transcript data, these data bases included:

a. the potential earlier assessment exam, CMT—the Connecticut Mastery Test, taken in the eighth grade of students' work,
b. student PSAT, SAT and AP assessment exams along with students' demographic and high school career characteristics recorded during students' registration with College Board,
c. enrollment records of students registered in public and private colleges across the nation, compiled by the National Student Clearinghouse, and
d. Connecticut labor market information on job activity before, during and after their secondary and post-secondary educational experiences.

A. Description of the Population Included in the Next Steps Study

Each CAPT cohort represents approximately 20% of the total population. The slight inequalities in percentages of total CAPT data by year are consistent with slow growth of enrollment over the years 1996 - 2000. Match rates of CAPT to CMT takers, except for the very low rate for 1996,[3] reflect shifts in enrollment and migration between 8th and 10th grade across the years. We found more than half (58%) of the CAPT population in the College Board dataset. The National Student Clearinghouse, reporting on current and historical enrollment of students in institutions storing data at NSC for graduation and/or enrollment verification purposes, matched against 64.5% of the CAPT population. There was also an 83% match between CAPT and labor market data. This is a reflection of work over the period, but probably is as high as it is because of the high degree of wage work among students while still in high school, before entering college—our ability to match with the UI database going back as far as 1994, a time when all in the combined set of cohorts would have still been in high school.

Table 1: Matching Data across Databases

	CAPT	CMT Record		College Board Record		NSC Record		Labor Market Record	
	Cohort	Not in CMT	in CMT	No SAT	SAT	Not in NSC	NSC	No Record	With Record
1996	32,278	32,257	21	14,222	18,056	12,172	20,106	5,604	26,674
		99.9	0.1	44.1	55.9	37.7	62.3	17.4	82.6
	19.0	48.0	0.0	19.8	18.4	20.2	18.3	19.8	18.8
1997	32,715	9,759	22,956	14,011	18,704	11,535	21,180	5,533	27,182
		29.8	70.2	42.8	57.2	35.3	64.7	16.9	83.1
	19.2	14.5	22.3	19.5	19.1	19.1	19.3	19.6	19.2
1998	33,984	8,505	25,479	14,037	19,947	11,941	22,043	5,634	28,350
		25.0	75.0	41.3	58.7	35.1	64.9	16.6	83.4
	20.0	12.7	24.8	19.5	20.3	19.8	20.1	19.9	20.0
1999	34,669	8,036	26,633	14,182	20,487	12,063	22,606	5,682	28,987
		23.2	76.8	40.9	59.1	34.8	65.2	16.4	83.6
	20.4	12.0	25.9	19.7	20.9	20.0	20.6	20.1	20.5
2000	36,418	8,642	27,776	15,475	20,943	12,700	23,718	5,842	30,576
		23.7	76.3	42.5	57.5	34.9	65.1	16.0	84.0
	21.4	12.9	27.0	21.5	21.3	21.0	21.6	20.7	21.6
Total	170,064	67,199	102,865	71,927	98,137	60,411	109,653	28,295	141,769
	100.0	39.5	60.5	42.3	57.7	35.5	64.5	16.6	83.4

Key demographic and socio-economic indicators available from the CAPT data base are summarized for the population in Table 2. Female students constitute nearly half; minority students, one third of the CAPT taking student population (for equivalency of the matching process on ethno-racial profile of the

[3]The low rate of match for 1996 CAPT takers results from our not receiving CMT data pertinent to 1994. This was a period, just post-implementation of 2nd generation CMT testing in 8th grade in 1993. The utility of matching data so soon beyond the massive change in CMT undertaken in 1993 seemed small and we chose not to pursue 1994 CMT data.

students across the data bases, see Appendix. A.1). While we do not have data on reduced and/or free lunch status for 19% of the sample due to the lack of data for the 1996 cohort, data on the other cohorts indicates that nearly 16% of the students were enrolled in free or reduced lunch programs. Less than 10% of the students were enrolled in special education, and a negligible percent, 1.1% of the total population, were enrolled in "English as Second Language" courses.

Table 2: Descriptive Statistics from CAPT datasets

Year	Cohort	% Female	% Minority	% R/F Lunch*	% Special Ed	% Limited English
1996	32,278	16,034	10,017	No data	3,209	342
		49.7	31.0		9.9	1.1
1997	32,715	16,214	9,619	4,982	3,105	332
		49.6	29.4	15.2	9.5	1.0
1998	33,984	16,980	10,333	5,247	3,353	428
		50.0	30.4	15.4	9.9	1.3
1999	34,669	17,064	10,409	5,908	3,266	403
		49.2	30.0	17.0	9.4	1.2
2000	36,418	17,753	11,020	5,718	3,248	429
		48.8	30.3	15.7	8.9	1.2
Total	170,064	84,045	51,398	21,855	16,181	1,934
		49.4	30.2	15.9	9.5	1.1

Although much of the study follows students participating successfully (i.e., receiving a valid grade) in CAPT tests, it is useful as we begin to note the size of the missing component caused by invalid CAPT scores, Table 3. This shows that approximately 11% of test scores of students taking CAPT LIT and 13%,

Table 3: Distribution of Valid CAPT Test Scores over Time, 1996 – 2000

	CAPT LIT		CAPT MATH		Total
CAPT Coh	Invalid Test Score	Valid Test Score	Invalid Test Score	Valid Test Score	
1996	3,292	28,986	4,004	28,274	32,278
	10.2	89.8	12.4	87.6	
1997	3,478	29,237	4,269	28,446	32,715
	10.6	89.4	13.1	87.0	
1998	3,738	30,246	4,469	29,515	33,984
	11.0	89.0	13.2	86.9	
1999	3,641	31,028	4,329	30,340	34,669
	10.5	89.5	12.5	87.5	
2000	3,898	32,520	4,788	31,630	36,418
	10.7	89.3	13.2	86.9	
Total	18,047	152,017	21,859	148,205	170,064
	10.6	89.4	12.9	87.2	

taking CAPT MATH exams between 1996 and 2000 were recorded either as missing or invalid. We hereafter limit our discussion only to students with valid exam scores, but note the exceptions.

Furthermore we would like to remind that our matching procedures were carried out for all students including for those with missing test scores.

B. Student Destinations post-CAPT, via Administrative Records

The Venn diagram in Figure 1, compiled from records in the respective datasets utilized in this project, presents a picture of the distribution of students' ongoing or recently completed educational attainment. The first dominant thread of our work was to categorize the record of CAPT cohorts by their records in College Board data—describing whether or not these students took any of PSAT, SAT, or AP exams or whether they filled out the College Board's Student Demographic Questionnaire. A second thread was to categorize students by their records in the National Student Clearinghouse (NSC) database. The NSC records described whether or not the student attended (nearly any of the) post-secondary institutions in the U.S.

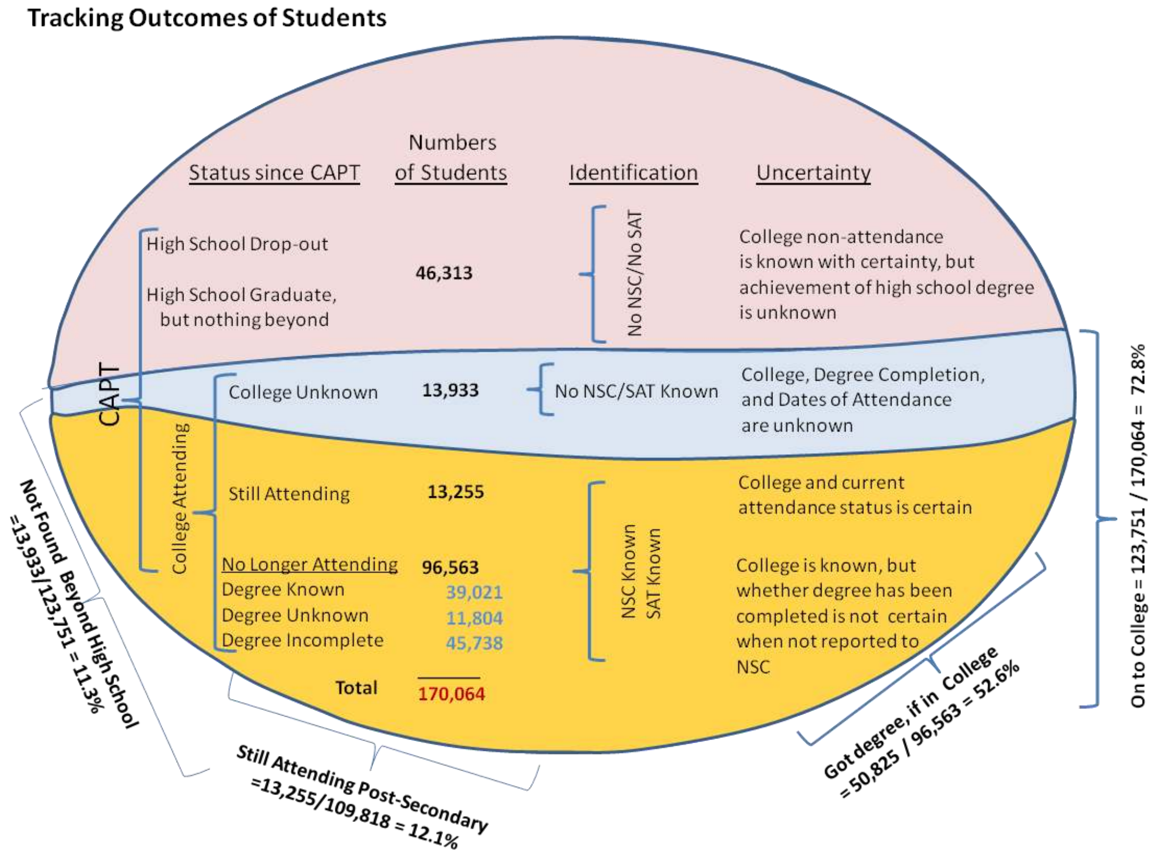
For tracking purposes, we need both databases—NSC and SAT—because in some cases, students attending post-secondary colleges are not required to take SAT, these more typically involving Community and Technical College (CTC) program students than four-year institutional students. But in Connecticut, all the CTCs, for example, register their students with NSC and therefore community college students show up in one or the other of the two databases, SAT or NSC. So long as the CTC institutions participate in NSC, for the few cases when colleges do not participate in NSC, we can rely on tracing students by the students' registration with College Board since so many students take SATs—typically an application requirement for at least one of the multiplicity of colleges to which they may apply. Similarly, for the relatively few students who opt that their records be not disclosed by NSC, most will have records with College Board and student college participation can be picked up from College Board data. As such, most students pursuing higher education —even those leaving Connecticut before progressing on to College, would have been picked up by the NSC data base as long as a name change did not otherwise intervene. Others not picked up in the NSC data base, are most likely to have been found in the SAT data base.

Of Connecticut public school SAT test takers in the five CAPT cohorts under study, only 27.2% lacked both a college-anticipating registration with College Board and enrollment records in the National Student Clearinghouse (the NSC). This is the group, including students without valid CAPT scores, by our argument above, that precisely identifies students who for a variety of reasons did not pursue post-secondary education. Others, enrolling in four year colleges, where the college does *not* participate in NSC *but* when the student takes SAT exams to satisfy application requirements to alternative-choices, 4-year institutions, belong to a group identifiable as consisting primarily of college enrolled students. We only do not know to which institution such students have committed their enrollments[4] and in what

[4] The largest local institution not participating in NSC is likely to be the University of Massachusetts at Amherst, but there are other institutions, in Connecticut not participating: (by order of size—as universities: Sacred Heart, Bridgeport, and Post Universities; as colleges: Trinity, Albertus Magnus, and Charter Oak State Colleges; and as a school: Katharine Gibbs School of Norwalk.

time periods student might have been enrolled and when their enrollment might have ended. This group contains 8.2% of students, a number very consistent with NSC's sense that their data reflect on more than 91% of enrolled students, everywhere. Data bases combined and used carefully then gives us a great deal about everyone, even those for whom we cannot find administrative records.

Figure 1: The Connecticut Student Sampling Frame and the Trace of Their Outcomes



Numerically, with the help of Figure 1, we can then state that out of 60,246 students who were not recorded by in NSC files, 13,933 were traceable through SAT records. We conclude that this group of 13,933, as stated above, has pursued higher education, leaving only the 46,313 students—those without any record of college enrollment (No NSC) or SAT exam records (No SAT) —to comprise the group not attending post-secondary institutions in the years following CAPT.

Since the CAPT 2000 cohort was largely expected to graduate from high school in 2002 and others only shortly earlier, some students would likely still be attending college. These students were given special attention; but, their degrees and early (post educational completion) labor market experiences are not available for research. Any student, determined to be still attending college in the Spring term of 2007 was assigned "still attending" status—referent to the fourth calendar quarter of 2006[5]/Fall term 2006-

[5] We also call the fourth quarter of 2006 as 2006.4, for short.

07. There were 13,255 students in this still-attending category at the end period of our tracking of student outcomes in higher education and labor market.

We focus much of our study attention on two groups of students. One is that for whom (by NSC records) college attendance is completed. The other is the special group of CAPT students not continuing on to post-secondary study, consistent with the representation in the Venn Diagram of Figure 1—those having neither SAT exam scores nor NSC enrollment records. We label the first group of students as the “no longer attending college” population; the second group, high school drop-out or high school graduate pursuing no more education beyond high school as “non college bound” students.

A simple calculation from the available data shows that 73% of Connecticut 10th grade high school students attend post-secondary education. This statistic itself is the product of two oft-cited statistics, neither available here because we lacked administrative records on high school graduation. But, for example, the 73% statistic can be roughly consistent with the product of a 90% continuation rate from 10th grade to high school graduation (an unknown graduation rate from our study, but consistent with a high performing high school system) and an 80% rate of continuance from high school graduation into college; also unknown precisely, but considerably higher than that reported by the Manhattan Institute for the Gates Foundation, for example.[6]

52% of the 1998-2002 public school cohorts which attended college and completed with current enrollments were conferred a degree. This is a statistic cutting across all types of schools. It is, we also point out, a lower-bound on the college graduation rate— NSC has sketchy degree data for some students for whom they report. This results from degree verification activities at NSC being relatively new. Some colleges, in the newness of the activity simply fail to report degree data to NSC on time. None of the public colleges in Connecticut seemed to have significant problems with such reporting; we cross-checked degrees from Connecticut public institutions’ data with NSC data and report this in detail in Section IX. But non-Connecticut institutions may not be as current as we determined Connecticut’s are.

One might give thought to one critical question, applicable to this current work: how secure are we in suggesting that those who are (or appear to be) unknown to NSC but who have had valid SAT data are enrolled, albeit in “unknown” institutions? This, after all, is a critical part of an important story and individual readers are wiser to pay attention to such premises. We raise this question, however, feeling quite confident in our handling of the issue. We proceed by pointing out that there were seven higher

[6] These rates are not available for Connecticut from data on individuals, but they are estimated for states by several organizations using several different methodologies. Part of our difficulty in being precise about comparisons to existing calculations of these rates is that the rate we need for high school graduation is a late-tenth grade to graduation rate, not the standard beginning of ninth to graduation rate. And for, college continuation, we need numbers starting college relative to graduates, also—before the current study, not previously not available for individuals. Education Week’s EPE Research Center, without reporting the individual components of their calculations, reports a 79.8% graduation rate for beginning ninth to graduation. The Manhattan Institute, for the Gates Foundation, reported a 79.3% graduation rate for beginning ninth to graduation. The 90% graduation rate mentioned in the text is quite consistent with those cited here, in this footnote. The college continuance rate, however, is quite different,

educational institutions (three universities,[7] three colleges,[8] and a school[9] absorbing somewhere between 14,613 and 18,367 students)[10] who chose not to participate in the NSC program over the five years relevant to this study's sample frame. To the number of students involved in associated non-reports, there are another 2,676 students whose records were blocked by the school and another 1,223 students who blocked their own records (a total NSC non-reports ranging between 18,512 and 22,266). We account for 13,933 who were determined to have SAT but not NSC. Therefore, our margin of error is between 4,579 and 8,331, approximately 2.7% - 4.9% of the sample frame. We think this provides reasonable approximations to concepts developed in the remainder of the report.

A further comparison of the two groups by their CAPT scores achievement—one without any NSC enrollment records but with SAT registration; the other with both NSC enrollment records *and* SAT registration—is given in Appendix A.3. This shows that indeed there are little differences in CAPT performance between the two groups, providing further (circumstantial) evidence that students without NSC but with SAT records do go to college.

In **Table 4**, we separate students generally into 4 groups—including students with administrative records of the following types:

1. without NSC *and* SAT records. These are the students whom we believe go on to *no college*.
2. without NSC but with SAT records. These are students who did go to college, but for whom we know little about the time profile of their attendance since the real data on the student is missing. Hence, these students are known as students with *unknown colleges*. We can infer the least with this group of students.
3. with NSC and with or without SAT records. These students are listed as *attended* (noting the past tense form of attended) if the student is no longer reported to be actively enrolled in any institution.
4. with NSC and with or without SAT records. These students are listed as *still attending* if they are reported to be currently enrolled by NSC.

Table 4 furthermore shows the share of "Still Attending" Students, depicted in the Venn diagram of Figure 1, gets larger as the CAPT cohort gets younger. Within the 1996 cohort of public high school 10th graders, only 4% of them are recorded as "still attending." This compares favorably to the 15% of the 2000 cohort of 10th graders still attending. The increasing share of the "still attending" population reflects on the CAPT 2000 cohort's "attended" population, as this cohort has lower percentage of students who completed their higher education.

[7] These are Sacred Heart, Bridgeport and Post.
[8] These are Trinity, Albertus Magnus and Charter Oak State.
[9] This is Katharine Gibbs School in Norwalk, Connecticut.
[10] The variation here depends primarily on what percentage of students in these institutions come from Connecticut households. We allowed this to vary from 80% to 100%, obtaining 18,367 if 100% of articulated enrollments originated from Connecticut resident children and 14,693 if 80% originated in Connecticut.

Table 4: Percentage of Cohort Found in Defining NSC and SAT Record Databases

	Non College Bound	College Bound		
	No College	Unknown College	Known College	
			Attended	Still Attending
CAPT Cohort	No NSC - No SAT	No NSC/SAT Known	Prior, but no current NSC	Current NSC records
1996	22.6	9.0	64.0	4.4
1997	21.1	8.4	65.5	5.0
1998	20.6	8.9	64.0	6.5
1999	20.6	8.7	62.7	8.0
2000	20.9	8.4	55.9	14.9
Total	21.1	8.7	62.3	7.9

V. Non College Bound Students, with no enrollment and SAT record

The data analysis also showed that the share of non-college bound students among all CAPT takers at *all* CAPT achievement levels in 10th grade fell from over 23% to nearly 21% between 1998 and 2002, a two percentage point improvement. This makes the two percentage point improvement in non-college going among the goal achieving students seem not so dramatic. Had we included the outcomes for the students with *invalid CAPT scores* to our analysis, the share of non college bound students within the population would increase to 27.3%, as depicted in Figure 1 (see also Appendix A.3 for a complete database comparison). This discrepancy indicates that students failing to take CAPT exam or attain invalid scores at 10th grade are more likely to be in non-college bound student population. In order to highlight the demographic and socioeconomic background of non college bound students , we present below the profile of students including those who failed to attain a valid CAPT exam score.

The profile of the non-college bound students shows significant ethno-racial and income disparities. The highest proportion of non-college bound students fall among the Hispanic students, 46.8% of Hispanic students had neither SAT test nor NSC record information, therefore not attending college. Of non-college attending Hispanic students, less than half (41.8%) are female; however, almost half of them (47.1%) were in the reduced and free (RF) lunch program during their high school (for similar results from Texas Schools Microdata Panel, see Lofstrom 2007). Similarly, for white non-college bound students, poverty seems to play an important role—the share of students in RF lunch programs within the non-college bound group (at 11.2%) is higher than for 10th grade public high school students who pursued higher education (far less than 5%). Asian-American students have the lowest percentage of non-college bound students (18.5%), however, in this group, the share of female students who are not college bound is highest (42.2%) compared to other ethno-racial groups. The comparatively lower percentage of RF lunch program students in the non- college bound Asian-American student population compared to other minority students suggests that income constraints may play a less important role within the Asian-American community than the gender of the student.

Table 5: Representation of Students in Alternative Databases by Race and Ethnicity, Gender and Family Income

	(%) Population	(%) Female	(%) RF Lunch	(%) Population	(%) Female	(%) RF Lunch
	Black			Asian		
No NSC No SAT	37.7	40.3	36.8	18.5	42.2	20.9
No NSC/SAT Known	9.5	54.7	37.5	9.8	47.4	13.4
Attended	45.1	54.8	30.6	62.6	49.8	11.8
Still Attending	7.8	57.1	32.5	9.2	43.6	17.8
Total	100	49.5	33.7	100	47.6	14.2
	Hispanic			White		
No NSC No SAT	46.8	41.8	47.1	21.9	35.4	11.2
No NSC/SAT Known	9.4	56.0	48.4	7.9	49.2	4.4
Attended	37.6	55.5	38.5	62.1	54.4	3.0
Still Attending	6.2	61.5	43.7	8.0	51.8	3.9
Total	100	49.5	43.8	100	49.6	5.0
	Other					
No NSC No SAT	41.3	40.0	23.6			
No NSC/SAT Known	6.8	50.0	20.5			
Attended	44.5	54.1	15.4			
Still Attending	7.4	55.3	21.0			
Total	100	48.1	19.5			

Almost four out of 10 Black high school students also appeared in non-college bound group, and the share of RF lunch program students in this group is quite high, more than one-third of non-college bound Black students were enrolled in RF Lunch program.

The Connecticut First Steps study reported that approximately 10% of high achieving[11] students in 1996 CAPT LIT and MATH exams did not pursue higher education. This was the first study to point out so explicitly that, for a State whose primary economic resource is human capital, there is such "brain-drain"—a critical concept with which Connecticut must deal. The research team was asked to especially follow-up on this group, re-evaluating whether continuing study confirmed the earlier reported results. By following the five cohorts of 10th grade public high school students, in this study we can now not only report that we do in fact confirm the previous finding but also update the non-college bound student profile for the subsequent cohorts. While the table above provides statistics relevant for all CAPT takers, Figure 2 compares the high achieving CAPT students, i.e., attaining "Goal Achieving" assessment, with all CAPT takers within the non-college-bound group. The percentage of the best and brightest declined slightly from 10% to levels still above 8%, remaining at unacceptably high levels, remarkably close to those of students at all CAPT Score band levels (~21%).

[11] "High achieving" used here and throughout this report implies students with CAPT "goal achieved" score ranges. Occasionally in this report, just to vary text language, we also refer to this group also as the "best and brightest"

Figure 2: Percentage of Total and Goal Achieving Persons Not Going on to College

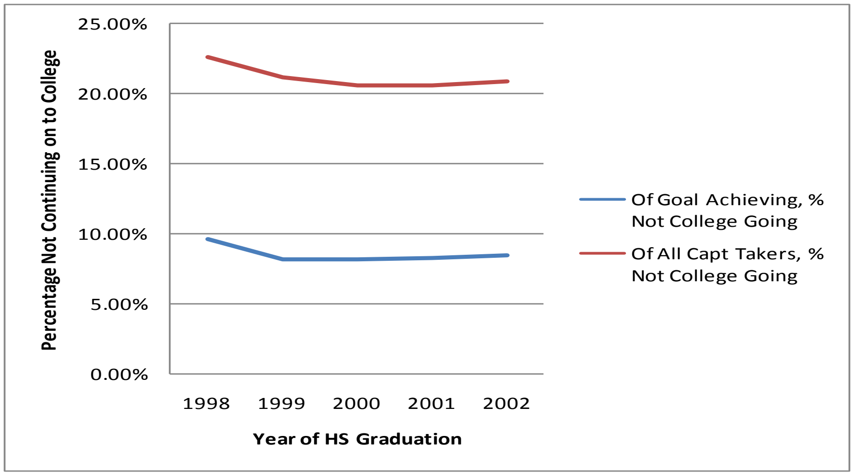
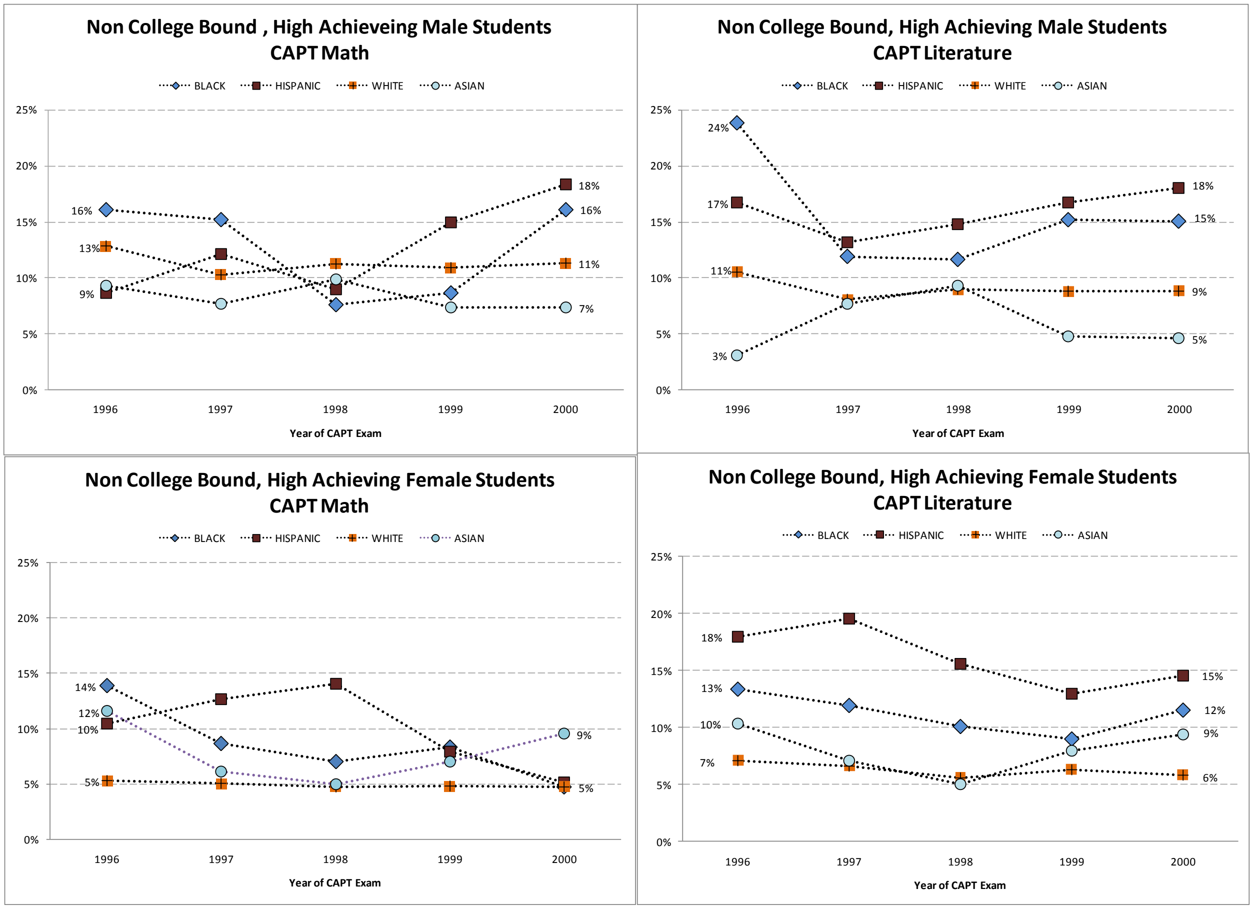


Figure 2 shows non-college going rates for the full population; Figure 3 presents detail on who these high achieving yet non-college bound 10th grade students are, paying attention to the ethno-racial and gender profiles of students involved. We see first that results by race and ethnicity vary very significantly over time and between the exams used for measurement. Consider, for example, high achieving Black males. From the time that the 1998 graduation cohort was ready for college—when, disastrously, almost a quarter of Black males achieving the top category in CAPT LIT did not pursue higher education—to the time of graduation of the last cohort of 2002, a precipitous drop occurred in the proportion of non-college bound to 15%--improving the non-going rate for those who should have gone by 40%. If we measure this same situation however by looking at the “high-achieving” through a CAPT MATH rather than a CAPT LIT criterion, we see that the share of non-college bound Black males dropped far less sharp, from 16% in 1998 to approximately 15% in 2002. But for Black male students, the data reveal that the percentage non-college going has also raised over time whether the rise began in 1999 or 2000 depends only on which exam measure one wishes to use. For Black female students, on the other hand, nearly the opposite has occurred, declines in the non-going rate are nearly persistent over the full range of years.

Hispanic students have had outcomes quite like Blacks. For Hispanic males, there have been quite persistent increases in non-going rates; Hispanic females have seen the reverse—increases in college enrollment rates over time. By gender, only Asian-American, high performing, successful girls have a higher non-college bound rate than all the implied gender comparisons. Basically, the divergence of these conclusions thus argues that there are no simple answers of who slides off the slope at any given time. We argue for constant, due diligence, monitoring outcomes to see the latest trends and issues needing attention.

Figure 3: Percentage non-College Bound of High Achieving CAPT Students, by Race and Ethnicity and by Gender



VI. College Bound Students: CAPT and SAT

The previous section focused on a critical channel of brain-drain out of CT's workforce, namely, the untapped human capital of the high achieving students not pursuing higher education following their 10th grade CAPT exams. We will discuss their post secondary schooling predicaments in the section on labor market outcomes. The next question that follows, of course, is what factors are effective in predicting college attendance; whether the 10th grade CAPT exams can be predictive of college attendance, thereby signifying brain-drain of those who do not follow through to college. These are the questions on opposite sides of the same coin.

A. Similarities in SAT and CAPT Test Results

The previous study, Connecticut First Steps, suggested that CAPT scores predict well the probability of students taking SAT exams. This is an important part of the study findings, about which we will speak here as well. Ultimately the first study's conclusions suggest that the tests are similar; both are relatively good; but the tests have sufficient dissimilarities that one would never suggest giving up one of the tests in favor of the other. This very important conclusion derives not only from specific technical relationship between the tests but also from the tests being offered at different times and serving different purposes. It would be impossible for students, for example to take a State-specific high school exam as an entrance exam for college because there would be no standardization in exams of different students from different States applying to the same college. Further, it is impossible to homogenize State exams to the curriculum of one given State yet apply the exam to multiple States when different States have different curricula. Of course it is also quite intractable to offer an exam to students in line with the high school curriculum if the exam is not offered until students junior and senior years as SAT is; and similarly, it is impossible to offer a college admissions exam as early as the high school exams when they are to determine how much knowledge a student has accumulated coming into college.

We mention the difficulties that would be associated with contemplating the substitution of one exam for another because of timing of the two exams here first, because it is logistically crucial, but we jump into the technical relationship issues because one wants to know the similarities and differences of the two test results. We can say up front that indeed, over the five cohorts included in this current study, the two exams relate pretty well, but this is when we look at student average scores on CAPT for average values on SAT, and vice versa. These results are shown here in Table 6 and Figure 4. We show the dissimilarities between CAPT and SAT in the following section.

Table 6: Average CAPT MATH and LIT Scores by SAT Scoreband

	CAPT	
SAT Band	MATH	LIT
(200,240)	194.0	60.9
(250,290)	202.4	64.2
(300,340)	214.3	68.2
(350,390)	229.4	72.3
(400,440)	244.7	76.5
(450,490)	259.1	79.9
(500,540)	272.6	82.9
(550,590)	285.9	85.5
(600,640)	298.5	87.9
(650,690)	310.3	90.0
(700,740)	320.5	92.1
(750,800)	330.3	93.8

Figure 4: Near Perfect Relationship between CAPT and SAT

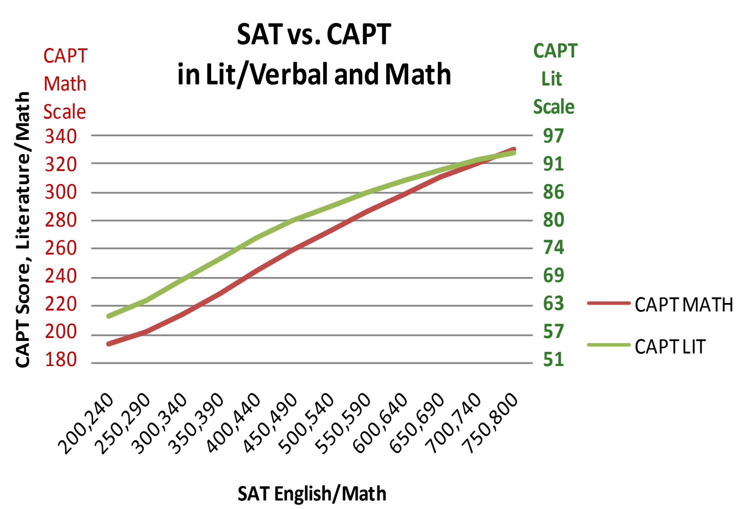
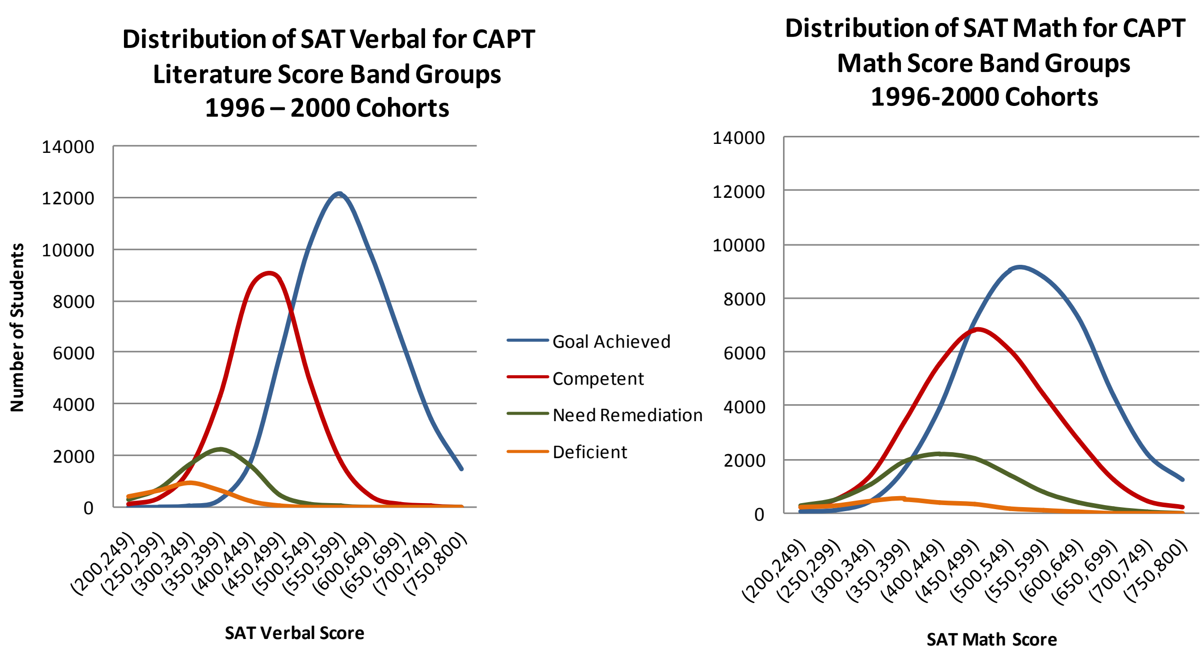


Table 6 and Figure 4 show lock-step relationships between student scores on the two exams, as we look at the average values reported. That is, from the first row of Table 6, we see that the average CAPT MATH scaled score for students who went on to obtain a SAT Math score between 200 and 240 was 194.0; we see for Literature that the average CAPT LIT scaled score was 60.9 for students scoring between 200 and 240 on SAT verbal. That there is not a single average CAPT LIT or CAPT MATH score out of the lock step of getting larger from lowest to highest SAT score is the “lock step” to which we refer a very strong feat. In Figure 4, the smoothness of the lines representing the relationship between CAPT and SAT, Math in red on the red scale and Literature in green on the green scale attests to the same feat. Most would say on the basis of these results and the work showing how strong CAPT is as a predictor, to be presented in the balance of this report, that we then might want to think about simply using CAPT—that exam without a cost to the student for many other purposes; but, read on.

B. Dissimilarities in SAT and CAPT Test Results

There are indeed great dissimilarities between CAPT and SAT so that a wide variety of students scoring at any given level in SAT may come from one CAPT scoreband and nearly equal numbers at that same level of SAT may come from another CAPT scoreband (or even from two or three alternative CAPT scorebands). This is shown in Figure 5, below, which relates frequency plots for SAT for given CAPT

Figure 5: Overlaps and Dissimilarities Between CAPT and SAT in MATH and LIT



scorebands. There we see quite clearly that some students with SAT Verbal scores between 350 and 399 fell on their CAPT exam into all of the various CAPT scorebands: "goal achieved," "competent," "needs remediation," and "deficient." The same is true in the relationship between SAT and CAPT Math, but with even higher likelihoods since the various CAPT MATH frequencies are more spread than are the CAPT LIT frequencies. In Math, in fact, there are such divergences in the distributions of CAPT MATH scorebands that one scoreband seems virtually subsumed within another when plotted against the SAT scores students subsequently obtain from their SAT exams. Except for the peaks of the curves in the right-hand diagram in Figure 5 (otherwise called the measures of central tendency, or the main determinant of medians and means of the respective scorebands), there are no ways of distinguishing one distribution from the other. This is exactly from where our statement, at the beginning of the prior section came: “the two exams relate pretty well, but (only) when we look at student average scores on CAPT for average values on SAT, and vice versa.” [12]

C. Correlation of SAT and CAPT

The correlations between components, i.e., math and verbal, of the SAT and CAPT exams show similar results if we think seriously about how high a correlation coefficient must be to be generally considered “high.” We see the correlations, in Table 7, computed for as large a set of samples as possible for each component comparison. CAPT MATH to SAT Math is the highest at .81. CAPT LIT is only correlated with SAT Verbal at .46 (surprisingly CAPT MATH is correlated with SAT Verbal at .69 and SAT Verbal with CAPT SAT Math at .76). Indeed the much lower than expected correlation of CAPT LIT and SAT Verbal suggests that the tests—despite both focusing on Literature and Verbal subjects—likely measure different facets of students’ abilities. How low this probability is stems from the interpretation of the correlation coefficient of .46 as implying that students’ CAPT LIT scores “explaining” only 21% of their SAT Verbal scores. The Math correlation of .81 implies one exam score explains 66% of the other exam’s scores. While it is true that the tests are applied at different times in a student’s high school career, these relationships are just too low to substitute one exam for the other. Certainly, if one considers substituting one exam for the other, a student who has the ability to score well on the subjects emphasized in one exam might perform poorly on the subjects of the other. Quite possibly, one student will score well on one exam and be rewarded with the rewards that come from that exam; but another student will do just the reverse. This severely limits opportunities for students to show that they have the adequate academic abilities. It is much better to give students two test, two opportunities and for individual counselors to determine what disparate scores on different exams mean.

Table 7: Correlations of SAT and CAPT Exam Math and Verbal-Literature Components

	CAPTLIT	CAPT Math	SAT Verbal	SAT Math
CAPT LIT		0.41	0.46	0.40
CAPT Math			0.69	0.81
SAT Verbal				0.76

D. Stability of the SAT and CAPT Tests over Time

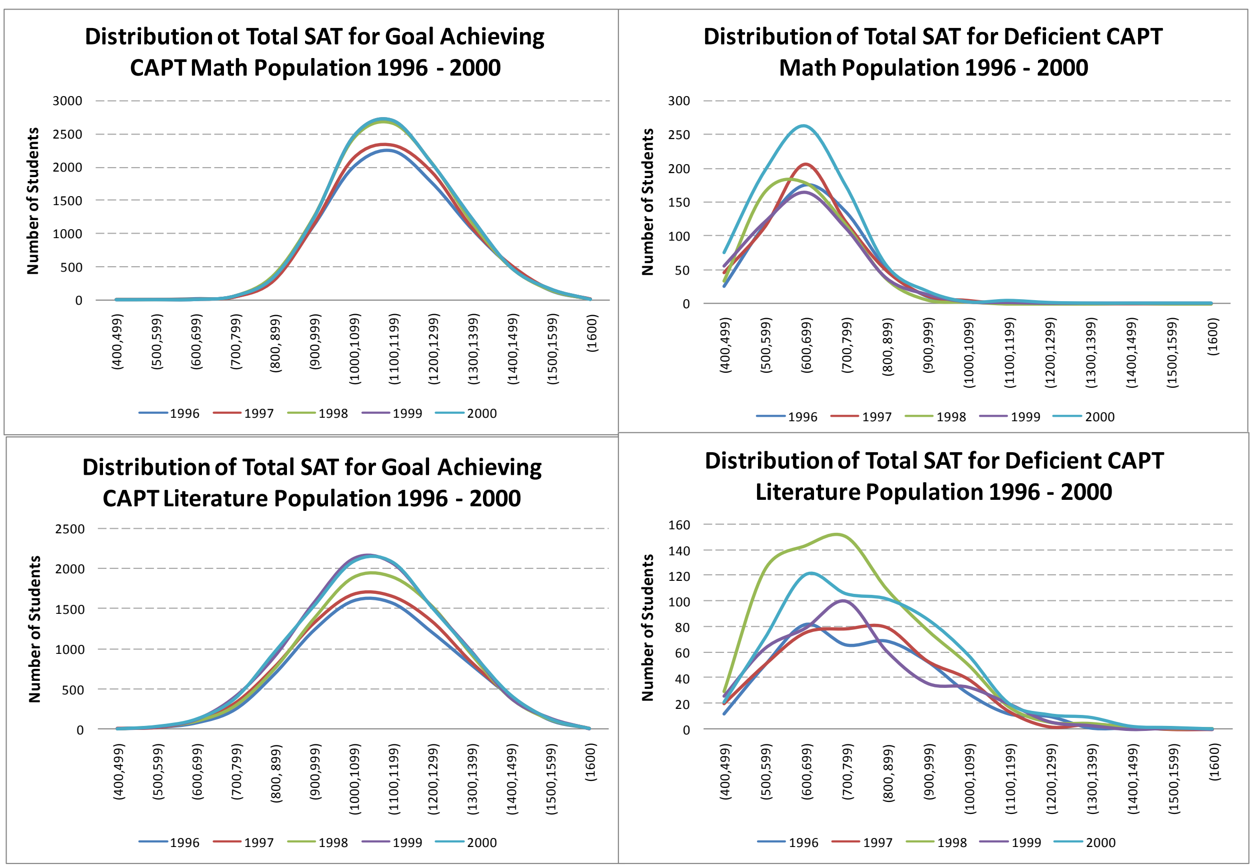
Figure 6 represents several elements simultaneously, thus allowing us to look at the stability of several facets between CAPT and SAT over time. We see, first—in the left panels, that CAPT MATH and LIT have precisely the same form (shape and curvature) over the years of CAPT taking relevant to this study, 1996 to 2000. As the Figure title indicates, these apply only to goal achieving students in the respective study

[12] See also Appendix A.4 for a comparison of 1996 and 2000 CAPT Cohorts.

years, but similar results would occur if we were to report the plots for all CAPT takers, not just the Goal Achieving; We would see nearly identical curves, mirroring one another, differing only (since these are frequency plots not probability distributions) in how many students took each test (as those shown differ only in the number of students Achieving Goal). This is a reflection, like other material in this section of the report, of the similarities between CAPT and SAT.

In the right panels, however, we see a different story, more so for CAPT LIT than for CAPT MATH, where the distribution of SAT scores of the CAPT "Deficient" level students are depicted. In CAPT MATH at the top, we see a visual depiction of a narrowing of the SAT variance for CAPT "Deficient" category in 1997 and a widening of the variance in 1998, each compared to other years. In CAPT LIT at the bottom, the distributions are simply more diverse, shifting in smoothness and evenness as well as in variance consistently from year, to year, to year. This is likely to be more of a reflection of uncertainty of how and where to draw the CAPT scorebands in these early years of Connecticut's CAPT-giving experience than it is of SAT shifts, the National exam having a much longer running experience than the State test.

Figure 6: Time Stability of the Relationship between SAT and CAPT Tests by CAPT Goal Achieving and Deficient Scorebands



VII. College and non-College Bound Predictions: CAPT, SAT and NSC

A. CAPT as a Predictor of SAT-taking

We refine our evaluation of the relationship between SAT and CAPT by looking at the predictive power of CAPT in forecasting future student activity. However, we divide such predictability into two prongs: A.) the power of the10th grade CAPT test to predict students' SAT-taking, distinguishing between those applying (and aspiring to go) to college; and B.) the predictive power of CAPT exams of college-going behavior.

We begin with our analysis of CAPT's predictability of SAT taking in this section and analyze the CAPT's predictability of college-going in the next section. These are important considerations despite the few institutions that have said they would drop the SAT test as an admissions requirement; the majority of public higher education institutions in the Northeast continue to employ SAT scores as an important criteria. We believe in the power of SAT as an admission measure and that its use as such not be dropped , for various reasons; this is a major conclusion of this study. We begin by exploring the degree to which the CAPT exam performance predicts whether or not the student will take SAT exam.

Figure 7 below evaluates the probability of taking the SAT exam given a student's prior CAPT LIT or CAPT MATH score levels, using probit regression analysis.[13] Figure 7 specifically shows the predicted probability of taking SAT for four different student groups, categorized by a student's participation in reduced and free lunch program (this relating to the student's family income) and race and ethnicity. Compared to CAPT LIT, CAPT MATH performance as seen in Figure 7 appears to:

- be more steeply sloped at mid-range CAPT scores,
- run more completely from probabilities nearer zero to probabilities nearer one, and hence
- produce a better predictor of SAT exam taking at high exam scores.

According to the evidence shown in Figure 7, white students performing at the high end of CAPT MATH exhibited a higher probability of taking SAT exam than those equally high achieving in CAPT LIT exams in the 10th grade. It is instructive to point out that for the predictive power of CAPT LIT, income also plays a role as does race and ethnicity. Namely, mid- and high-CAPT LIT achieving white students, if from sufficiently disadvantaged backgrounds that they participate in the RF Lunch program, have lower probabilities of taking SAT exams than do white students from better-off families. Interestingly also, the

[13] Probit regression analysis is the appropriate type of statistical estimation technique to use when the dependent variable is limited, i.e., 0—not taking SAT exams or 1—taking SAT exams subsequent to taking CAPT. We expect this to show a positive predictive power since it has been reported that students, when seeing that they have earned relatively high CAPT scores are encouraged to take SAT exams because the high CAPT result shows good evidence of the ability to do well on SATs. These results are very similar to logit analysis, with a difference in scaling of the coefficients.

divergence in the probability of SAT taking for student populations differing by race and ethnicity nearly collapses totally as CAPT MATH scores reach their absolute high and low levels.[14]

Figure 7: Variation in Student Probabilities of Taking SAT with Changes in CAPT LIT and CAPT MATH by Race and Ethnicity and Participation in Free or Reduced Lunch Programs

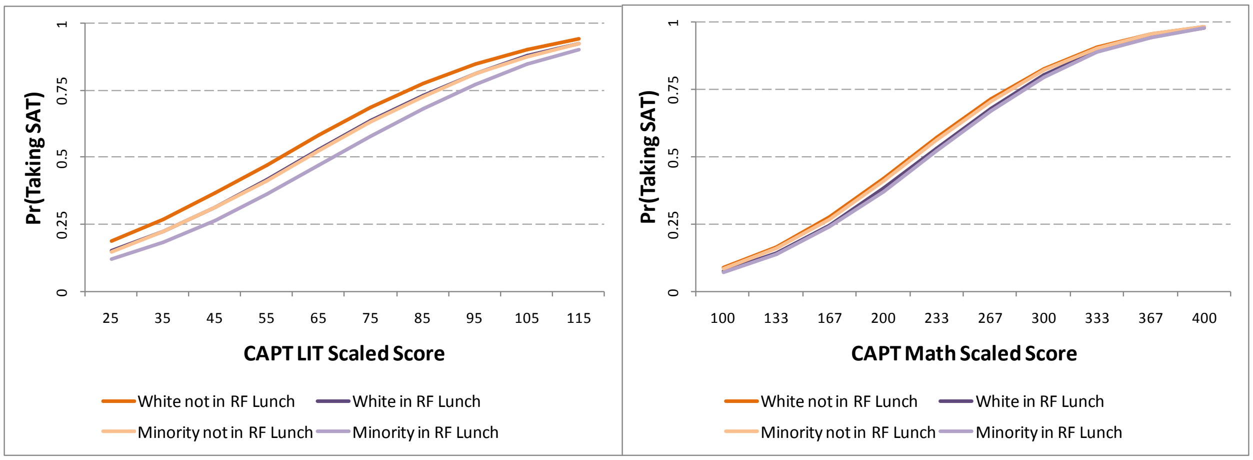


Table 8, below, presents a second way of looking at the differences in forecasts, but it does this for more variables than just race, ethnicity and income—the more limited set of variables plotted in Figure 7. Table 8 summarizes the mean predicted probabilities[15] of taking the SAT exam as several variables, the student's gender, race and ethnicity, family income, and CAPT performance all change, holding the non-changing variables at their overall means. To be clear, then, Table 8 shows for example that the mean probability that a female student with average levels of income, CAPT score, and race and ethnicity[16] have a 69% probability of taking SAT exams whereas males at the same average values for other variables have only a 64% probability of taking SAT exams. These differences suggest that female students, holding CAPT LIT and MATH score levels and other variables constant, are more likely to take SAT exam than their male counterparts. Table 8 summarizes the probability for minority students who, compared to white students, are less likely to take the SAT exam, as depicted in Figure 7. Students coming from affluent families are more likely to take SAT exams compared to students from less well-off families. A comparison of the differences in race and ethnicity and participation in reduced or free lunch programs between CAPT LIT and CAPT MATH shows that the difference between groups is higher when the CAPT LIT exam is used as the predictor than when CAPT MATH is used, a result already depicted in

[14] The latter fact is judged by the large convergence in probability predictions at the high and low end of CAPT scoring for CAPT MATH.

[15] The functional form of probit analysis is non-linear. To ease interpretation, we present in this and following tables throughout the report the probabilities in linear form. The actual presentation, including marginal effects, of the probit model is given in Appendix A.4. Analyses presented in this and following sections are performed in STATA 8.2. For detailed information see Long and Freese (2003).

[16] In this kind of analysis, race and ethnicity obviously cannot represent an individual. Race and ethnicity is taken as the average mix of races and ethnicities among observations on which the regression can be run—synthetically their statistical average—roughly 69.8% white and 30.2% minority (such numbers represented in Table 2, above

Figure 7. At a mean CAPT LIT exam score level, all else being equal, a minority student is 6 percentage points less likely than a white student to take SAT exam, a difference that falls to only 1 percentage point when standardizing by CAPT MATH exam scores. What do we take away from this, is that racial/ethnic differences in college-going interest sufficient to encourage student SAT-taking disappears as CAPT MATH scores equalize. This means that a key to improving racial and ethnic minority college-going rates is (in equalizing their abilities in high school) to ensure that minority students score as well as white students on CAPT MATH.

The columns showing the differences in probability of taking SAT exam by the minimum and maximum scores of CAPT LIT and Math reveals that at minimum score levels, the predicted probability of SAT exam-taking is higher for CAPT LIT than it is for CAPT MATH, 31% and 19%, respectively. From lowest to highest test scores, the probability increases however more for CAPT MATH than for CAPT LIT, respectively, 76% and 57%.

Table 8: Probability of SAT taking, by CAPT, Gender, Race and Ethnicity, and Participation in Reduced or Free Lunch Programs

	CAPT LIT			CAPT MATH			CAPT LIT & CAPT MATH		
	Probability	Difference	MargEfct	Probability	Difference	MargEfct	Probability	Difference	MargEfct
Female	0.687	-0.044	-0.044	0.738	-0.150	-0.151	0.714	-0.093	-0.093
Male	0.643			0.588			0.621		
White	0.679	-0.055	-0.054	0.670	-0.009	-0.009	0.671	-0.006	-0.006
Minority	0.623			0.660			0.666		
Not in RF Lunch	0.670	-0.051	-0.050	0.671	-0.035	-0.035	0.673	-0.028	-0.028
In RF Lunch	0.620			0.636			0.645		
CAPT LIT(min. score)	0.173	0.765	0.010				0.312	0.571	0.007
CAPT LIT(max. score)	0.937						0.883		
CAPT MATH(min. score)				0.085	0.897	0.004	0.191	0.759	0.003
CAPT MATH(max. score)				0.982			0.950		

B. CAPT and SAT as Predictors of College-going Behavior

Taking the SAT exam signals the intent of students to attend college. We bolster our analysis of CAPT in Section VII.A by using data from NSC's national enrollment data base to see whether students with higher CAPT scores show greater likelihoods of actually attending. In describing our use of the NSC data, it is useful again to mention that not all institutions in the State of Connecticut contribute to the database, and in some cases the data may not include all students at participating institutions even when the institutions participate (Appendix A.2. shows the percentage of students enrolled at Connecticut public higher educational institutions not reported in NSC data although all of the Connecticut public institutions participate). This may be because of student choice barring release of their records, institutional failure to report students, or definitional problems. Of these potential sources of mismatch, we suspect that most is due to the first mentioned rationale but the issue deserves further study.

The second prong of our exploration, then, is between CAPT exam score levels and students' decisions to pursue higher education combines the SAT information of the students with the national enrollment database. In this section, we will treat any student with an SAT exam record and/or a record in NSC's national enrollment database as students who attended college. The definition of college bound student population and the use of databases for which we identified the student's post high school destination has been discussed above in Section IV, Table 4.

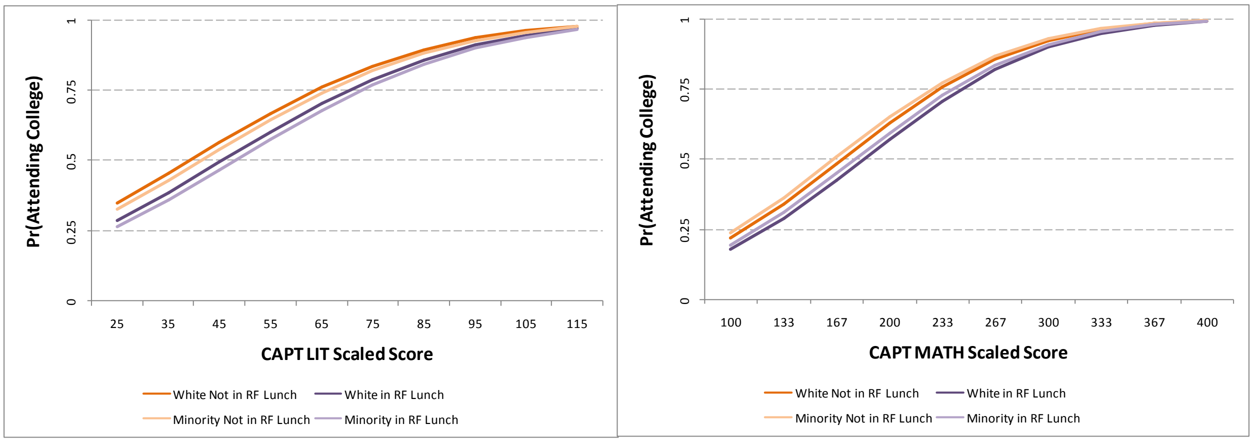
Figure 8 shows the results of the regressions[17] on the probability of college attendance. This probability increases with increases in the students' CAPT LIT and MATH scores. As is the case for the probability of taking the SAT exam, the student's racial/ethnic background exerts less effect on the probability of student's college attendance than does the family income of the student, proxied by student participation in high school supported lunch programs. We have to remind that Table 4, on non college bound students showed significant overlaps in reduced/free lunch status and race/ethnicity profile of the students. After accounting for student CAPT MATH scores (as compared to CAPT LIT), income (or school lunch participation), and other variables used in the model, minority students appear more likely to attend college than white students. These, however, are powerful forces to account for and much tougher to equalize in (non-theoretical) actuality. That they are not actually equalized accounts for observed lower rates of minority attendance. The result simply suggest colleges willingness to accept minority students with credentials, income and other factors equal to white students. [18]

On the other hand, the differentiation across family income status shown in these regressions may be a sign of many mediating factors. Beattie (2002), employing nationally representative High School and Beyond data argues the effect of income on college attendance varies systematically by race ethnicity and gender of the student. Charles et al (2007) similarly argue the importance of parental investments on college attendance decisions. The results we obtain for college attendance decisions of 1996 - 2000 CAPT cohorts seem to support the results argued in these studies. This shows graphically in Figure 8 in the greater difference between the red and blue lines than the darker and lighter versions of lines of the same color.

The model coefficients are presented succinctly in Table 9. These suggest that, female students are more likely to attend college than their male counterparts, controlling for CAPT scores. Cho (2007) shows a

[17] These regressions and relevant caveats are reported in Appendix A.5.
[18] The models presented in the Appendix pay closer attention to variations in college attendance across ethno-racial groups. The reader will note that the not all minority groups have similar probabilities in college attendance.

Figure 8: Probability of College Attendance by CAPT LIT and MATH Scores and by Race and Ethnicity and by Participation in Reduced or Free Lunch Programs



similar result using a nationally representative sample by highlighting the increases in women's performance in high school tests. This gender gap in college attendance is wider for CAPT MATH than for CAPT LIT, possibly reflecting stronger performance of males compared to females in math so that when the two groups are at the same CAPT score levels, females are more likely to attend college than males. Controlling for both exams, the results show that, everything else equal, an average male student is 6 percentage points less likely to attend college than an average female student. Interestingly, all else equal including CAPT scores on MATH, a minority student is 1 to 2 percentage point more likely than a white student to attend college, if we use CAPT LIT however, all else equal, a minority student has a 1.7% point less likely to attend college. Consider also the case where we control both for the effects of CAPT MATH and CAPT LIT exams; for a student who performed at the lowest CAPT MATH score, all else equal, the probability of attending college is 40% points, 11% points less than the predicted probability at the lowest CAPT LIT score. As discussed above on the probability of taking SAT exam, at the minimum and maximum score levels, CAPT MATH captures the predicted probability of college attendance more sharply than the CAPT LIT exam does.

Table 9: Model Estimates of the Probability of College Attendance by Explanatory Variables

	CAPT LIT			CAPT MATH			CAPT LIT & CAPT MATH		
	Probability	Difference	MargEfct	Probability	Difference	MargEfct	Probability	Difference	MargEfct
Female	0.844	-0.034	-0.034	0.877	-0.107	-0.107	0.865	-0.064	-0.064
Male	0.811			0.770			0.800		
White	0.832	-0.017	-0.017	0.826	0.015	0.014	0.831	0.017	0.017
Minority	0.815			0.841			0.848		
Not in RF Lunch	0.833	-0.049	-0.046	0.833	-0.040	-0.037	0.838	-0.034	-0.032
In RF Lunch	0.784			0.794			0.805		
CAPT LIT(min. score)	0.339	0.641	0.007				0.513	0.446	0.005
CAPT LIT(max.score)	0.980						0.959		
CAPT MATH(min.score)				0.219	0.776	0.003	0.402	0.579	0.002
CAPT MATH(max.score)				0.994			0.982		

VIII. College Bound students: NSC data—Sources of Connecticut's Brain-drain

Much of the success of students preparing to fill quality jobs comes from their success in college. This in turn is comprised of several steps, many of which are analyzed here. We consider: the time it takes before a student starts college; the institutional choices that students make—first and last institutions attended, and the transfers in between; remedial course taking; and credits earned. Along the way, we stop to inspect two very significant sources of "brain drain" in Connecticut which will certainly have an ultimate, large impact on the quality of the Connecticut workforce.

A. Time to Begin College

As much as college attendance is an outcome quintessential to success in today's business world, time to start college is equally important. Students who wait longer to start college are ultimately much less likely to ever go to college than those who start early. To analyze this, however, because high school graduation records were not centrally available to this study, we were forced to hypothesize that if CAPT-takers graduated from high school, they most likely graduated two years following their first take of CAPT, for most, a 10th grade exam. This assumption does not apply in all cases, but in most, we felt that the assumption would not be a source of bias with regard to evaluating time to begin college, especially any coefficients from regressions useful for our analyses.

In looking at time to graduate, we primarily wished to determine whether the 10th grade CAPT exam is as potentially important in predicting the time to start higher education as it was in predicting SAT-taking. We knew that many other factors also seemed likely to be important in this decision. Among these, consider for instance the availability of financial aid, work options before college, and other similar factors which might potentially affect the decision of when to begin the college.

Table 10 shows the average times taken to begin college in Connecticut public and private institutions and out-of-State public and private institutions. The table also shows how time-to-begin college varies by race and ethnicity, participation during secondary school in reduced and free lunch programs (our proxy for parental income) and gender. The numbers in the first column of Table 10 represent the average for all students; the other columns the wait-time for groups indicated in the column header. The wait-time, on average— for a cohort consisting only of young high school graduates—is largest for those going to Community and Technical Colleges, 14.2 months following expected high school

Table 10: Average Month Time-to-Begin College by First Institution Attended, Post Expected High School Graduation

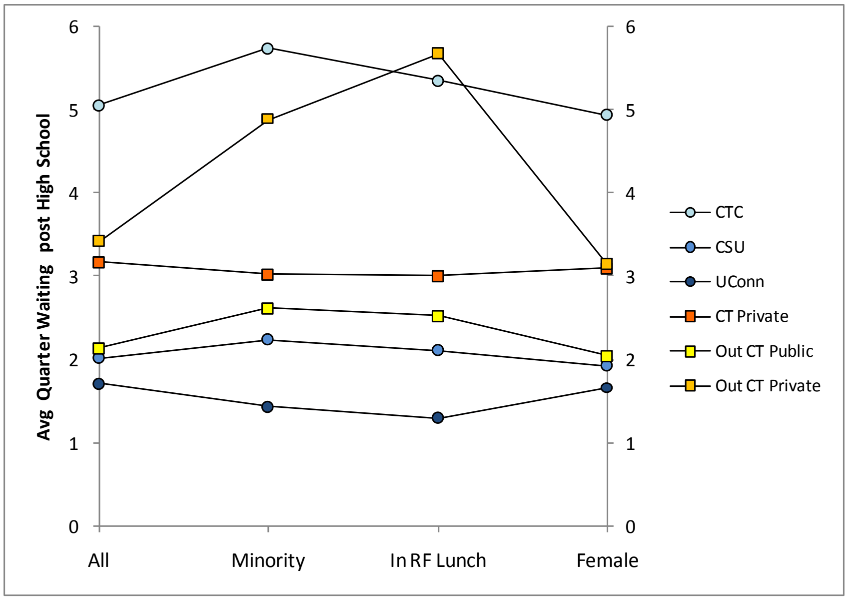
	All Students	Minority	In RF Lunch	Female
First Institute Attended	mean (std.dev)	mean (std.dev)	mean (std.dev)	mean (std.dev)
CTC	14.25	16.40	15.28	13.91
	(18.85)	(20.16)	(18.95)	(18.75)
CSU	5.07	5.72	5.34	4.76
	(9.77)	(10.74)	(10.06)	(9.34)
UConn	4.47	4.61	4.78	4.32
	(8.86)	(9.09)	(8.99)	(8.44)
CT Private	8.19	7.83	7.81	8.00
	(14.80)	(13.77)	(13.37)	(15.00)
Out CT Public	9.35	13.83	16.19	8.51
	(17.03)	(20.35)	(20.55)	(16.30)
Out CT Private	7.46	11.72	13.84	6.78
	(15.10)	(19.44)	(20.38)	(14.41)
Population Average	8.87	12.40	12.83	8.32
	(15.65)	(18.54)	(18.10)	(15.21)

graduation. This wait time to start college, 1.2 years beyond high school completion, undoubtedly reflects many things—students' financial resources, their immediate motivation and other factors that promote college attendance. What is important is that the wait-time is surely likely to affect student accomplishments while they are in college. Students' wait-times rise across various institutions for minority students, except for those choosing to go the Connecticut private institutions. Similar responses occur for students qualifying for reduced or free lunch while in secondary school. Only in the case of females is waiting time shorter than for the "all student" average.

These results are fully repeated for quarters[19], three month periods, and graphically in Figure 9, making it visually clear that the wait-time to enter college is higher for students enrolling in the Connecticut Community and Technical College system than in any of the other college segments, the single exception being students with disadvantaged backgrounds enrolled in out-of-Connecticut private colleges.

[19] In order to establish the compatibility between differences in timing of expected high school graduation and first enrollment date, we used "quarters" as unit of analysis.

Figure 9: Importance of Demographic and Income Factors



*The wait time represents 3 month periods.

While the wait-time is among the important indicators for subsequent college achievement, the variations in standard deviations summarized in Table 10 above shows that majority of students prefer to start college following their high school graduation. The figure below presents the timing trends in percentage of students beginning their college careers by higher education segments.

Figure 10: Percentage of Students Beginning College following High School Graduation

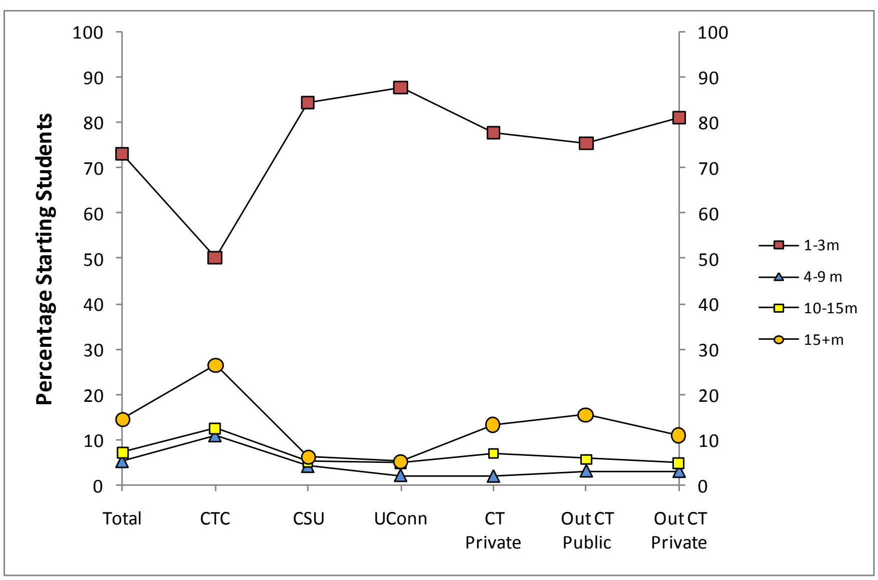


Table 11 shows that the wait-time to start gets larger with lower levels of performance on CAPT—a factor uniformly true whether measured against performance on CAPT LIT or CAPT MATH. Students whose test score in 10th grade placed them in the deficient scoreband tend to wait to start their college programs nearly a year more than Goal Achieving students.

Table 11: Avg. Semester Time to Start College, post expected High School graduation

CAPT BAND	CAPT LIT	CAPT MATH
	mean (std.dev)	mean (std.dev)
Goal Achieved	2.53	2.56
	(4.43)	(4.46)
Competent	3.10	3.24
	(4.96)	(5.08)
Need Remediation	4.23	4.20
	(5.96)	(5.98)
Deficient	5.52	4.73
	(6.71)	(6.20)

A model hypothesizing the relationship between time-to-start college and CAPT and SAT score levels is presented in Appendix A.6 with base model predictions summarized in Table 12. The model assumes the distribution of time-to-start college presents as a "count" distribution of the number of three-month quarters students delay entering college post expected high school graduation, and thus provides us the average of the first time students enrolled in a higher education institution, according to the National Student Clearinghouse data base, after expected high school graduation. In this model, both CAPT and SAT exam scores of the students are incorporated. Once again, seemingly with much we have already reviewed, higher test scores are associated with somewhat longer delays in entering college. Except for CAPT LIT test scores, higher scores in CAPT and SAT MATH and SAT Verbal tests, on the average, delay the timing of a student's first enrollment. The marginal effects of test scores, representing the effect of a unit change of each explanatory variable on the average time to start college, however, are relatively small compared to student background characteristics. Consider a 100 score increase in CAPT and SAT Math exams, for instance. For each increase of *100* points in CAPT and SAT Math exam scores, the time to start college is delayed by .02 and .01 quarters, respectively. Minority students show smaller effects of test scores in determining the time to start college than do non-minority students. Compared to other groups, all else equal, a minority student begins higher education with .19 quarters delay compared to a white student, and a student in reduced/free lunch program during high school has on average .11 quarter delay, compared to a student from a better-off family. The gender gap in time to start college shows that on average a female student enrolls .04 quarters earlier than a male student. Whether the first choice of college is a public higher education institution, or out of Connecticut also bears an influence on predicting the post-high school enrollment. Students whose choose to begin their higher educational career in Connecticut, on average, are more likely to begin earlier than students who leave the State for higher education. Finally, we note that on average, students selecting private institutions enroll earlier than their counterparts in public institutions.

Table 12: Model Estimates of the Time to Start College by Explanatory Variables

	CAPT LIT & SAT Verbal			CAPT Math & SAT Math		
	Avg. 3-month semester after HS graduation	Difference	Marginal Effect	Avg. 3-month semester after HS graduation	Difference	Marginal Effect
Female	2.275	-0.018	-0.018	2.288	-0.040	-0.040
Male	2.258			2.248		
White	2.234	0.192	0.187	2.236	0.198	0.193
Minority	2.425			2.434		
Not in RF Lunch	2.260	0.138	0.134	2.264	0.111	0.108
In RF Lunch	2.397			2.375		
First College -Out CT	2.396	-0.207	-0.205	2.404	-0.215	-0.213
First College - In CT	2.189			2.189		
First College - Private	2.247	0.032	0.032	2.257	0.021	0.021
First College - Public	2.278			2.278		
CAPT LIT(=min. score)	2.401	-0.215	-0.002			
CAPT LIT(=max. score)	2.186					
SAT Verbal(=min.score)	1.430	1.521	0.002			
SAT Verbal(=max.score)	2.950					
CAPT MATH(=min. score)				1.897	0.714	0.002
CAPT MATH(=max. score)				2.612		
SAT Math(=min.score)				1.901	0.614	0.001
SAT Math(=max.score)				2.515		

B. Choice of College Segments

The NSC database, by providing the enrollment information of well more than 90% of students enrolled in colleges across the US provides a comprehensive database with which to track Connecticut graduates and we put it to use in checking college choices of students. Such data are also revealed as: "interests in attending" particular colleges in College Board's student demographic questionnaire database, Student Demographic Questionnaire (SDQ); and as actual admission and "self-reported acceptances," in College Board's Admitted Student Questionnaire database, ASQ. The latter is done, however, only for a sample of applicants. We obtained the first of these, but not the second for the current project. Hence, we chose to use NSC as the database of choice in evaluating college choice, but checked answers from NSC against the SDQ responses of students about where they would like to go to college. Of students who revealed that they desired to attend a higher education institution out-of-Connecticut, 47% indeed did enroll in a higher education institution out-of-Connecticut. It is possible to read such cross checking, however, from another perspective. Out of 100 Connecticut public high school students who attend higher educational institutions outside-of-Connecticut, 77 remarked in response to College Board's SDQ at the time of their SAT exam, that they planned to pursue higher education out-of-Connecticut. Of 100 students who planned to attend a Connecticut higher education institution at the time they took SAT exam, 91 students enrolled in a Connecticut higher education institution as their first choice among institutions. We will come back to these issues later, but for now, it is clear that of the undecided, more choose to stay in-State than go out-of-State. Of students who preferred to go out-of-State at SAT-taking time, eventually 53% ultimately enrolled in Connecticut. The results are summarized in Table 13, holding important facets of student thinking on college choice as we try to influence more to stay in Connecticut for a good education.

Table 13: Choice of First Institution of Attendance by In- and Out-of State Status

		College Board SDQ			
		Undecided	In State	Out of State	Total
First Institute Attended -NSC	Out of CT	5,192	1,254	21,020	27,466
	Row(%)	*18.9*	*4.6*	*76.5*	*100*
	Column(%)	*41.1*	*8.8*	*46.7*	*38.3*
	In CT	7,436	12,933	23,958	44,327
	Row(%)	*16.8*	*29.2*	*54.1*	*100*
	Column(%)	*58.9*	*91.2*	*53.3*	*61.7*
	Total	12,628	14,187	44,978	71,793
	Row(%)	*17.6*	*19.8*	*62.7*	*100*
	Column(%)	*100*	*100*	*100*	*100*

We discovered in this project the mobility of students' choices and decisions about colleges. Understanding this, we needed a way to report both on students who made a choice of college and stuck with their choices and on other students who, having made a first decision, subsequently switch one or more times, but ultimately end their higher education at another institution. The result shows in an abbreviated "from/to" first and last segment of enrollment table,[20] Table 14—below, and a much larger Table in Appendix A.7.

There, of course, is nothing wrong with students' behavior in institutional switching. As long as institutions have different intellectual strengths tempting students to go to one as opposed to another and students refine or change their interests as they become wiser over their college programs, students will switch from one institution to another. Similarly, differential costs across institutions lead rational students to switch institutions if the latter is possible without harming the students' programmatic content. Without having good time series data, we suspect that student transfer mobility has gotten larger and that it will get larger with time. Such mobility makes it increasingly important for well functioning educational systems to capture new ways of reporting single student outcomes across different institutions. The focus of the current study facilitates this. Increased mobility also makes it important for the college experience to be more integrated, productive and synchronized. As important as this is, we do report our limitations, having the possibility to evaluate infinite numbers of transfers through college, we limit most of our study to focus only on the beginning and ending, first and last college choices, of students' academic lives.

[20] We should remark in discussing "last segment," that the last segment of enrollment does not imply that the student graduated from this segment. These tables are quiet on the issue of graduation. The tables literally report on "starting segment" as the institutional segment to which a student went first beyond high school (or beyond a non-reporting higher educational institution) and on "ending segment" as that in which, with or without receiving a degree, they stopped attending (reporting) colleges. In other words, the ending institution is the last for which active enrollments were found for each student. With no active enrollments in spring term, 2007 or earlier, and no subsequent enrollment, we assume that the student has stopped his or her college program. With active enrollment in spring term, 2007, we assume that the student was "still attending." Continuing follow-ups on the cohort under study will improve the precision of these assumptions.

There, then, is greater institutional interchange of students among the various segments of higher education than might have been anticipated. With such interchange, we must conclude that creation of a world class workforce will require placing a high focus on system-wide objectives. In this view, institutions still matter; they will always matter—they are the building blocks of a quality system. Yet, a global focus on the _**real**_ relative strength of individual institutions is critically important to workforce development. All components of the higher education system, public and private/prestigiously selective, open admissions, or something in-between, play a role in fueling the State's workforce development. Connecticut is likely not to get very far if it does not recognize the importance of all institutions that contribute to its workforce development.

Table 14 and its companion in Appendix A.7 show transfers among institutions from, at the leftmost column margin—the institution in which students started college; to, at the topmost row margin, the institution in which students end their college careers. A color legend is used in making the table more clearly understood:

1. pink cells at the right and bottom margins highlight whether the number of students starting (rightmost column, when colored pink) or ending (bottom row, when colored pink) at an institution is greater.
2. green cells highlight transfer flows in which the sending institution (in the left column) sends more to a receiving partner institution than it receives from the finishing institution (in the top row).
3. yellow cells along the diagonal show numbers of students who start and end in the same institutional segment.
4. For each institution first attended, the number in the top row of a cell group is the number of students starting in the institution indicated in the left margin and finishing in the institution at the top row. The second row is the proportion of starting students ending in specific institutions, all such numbers adding across a row to 100% and showing where all students starting in an institution end by the time they are no longer enrolled. The third row is the proportion of students in the ending institution originating from specific institutions, adding down each column to 100% and showing from where all students in the cohort ending in a specific institution come.
5. From Table 14 and its larger companion in Appendix A.7, we conclude the following:

    1.) Much of the role of educating Connecticut public high school graduates currently falls on public, in-State colleges. The public sector represents the beginning of college for 59.2%; 56.3% finish college there. Only, 5.3% of public high school graduates start in Connecticut private colleges; 6.2% finish there.

Table 14: College Choice by First and Last Segments of Student Attendance

First Institute Attended		Last Institute Attended									
		CT Public			CT Private			Outside CT		No Record	Total
		C&TC	CSU	UConn	2 Yr.	Selective	H Selective	Public	Private		
CT Public	C&TC	24,566	3,319	1,286	413	544	40	1,661	2,546	0	34,375
	Row(%)	71.5	9.7	3.7	1.2	1.6	0.1	4.8	7.4	0	100
	Column(%)	78.9	18.1	10.5	25.0	12.3	5.9	11.5	9.5	0	20.2
	CSU	2,874	11,646	641	143	258	21	796	1,011	0	17,390
	Row(%)	16.5	67.0	3.7	0.8	1.5	0.1	4.6	5.8	0	100
	Column(%)	9.2	63.6	5.2	8.7	5.8	3.1	5.5	3.8	0	10.2
	UConn	1,030	1,001	8,735	80	266	56	636	1,324	0	13,128
	Row(%)	7.9	7.6	66.5	0.6	2.0	0.4	4.8	10.1	0	100
	Column(%)	3.3	5.5	71.4	4.8	6.0	8.3	4.4	5.0	0	7.7
CT Private	2 Yr	292	112	30	867	35	3	40	68	0	1,447
	Row(%)	20.2	7.7	2.1	59.9	2.4	0.2	2.8	4.7	0	100
	Column(%)	0.9	0.6	0.3	52.5	0.8	0.5	0.3	0.3	0	0.9
	Selective	331	270	115	27	2,704	8	118	189	0	3,762
	Row(%)	8.8	7.2	3.1	0.7	71.9	0.2	3.1	5.0	0	100
	Column(%)	1.1	1.5	0.9	1.6	61.2	1.2	0.8	0.7	0	2.2
	H Selective	8	9	12	7	10	492	24	41	0	603
	Row(%)	1.3	1.5	2.0	1.2	1.7	81.6	4.0	6.8	0	100
	Column(%)	0.0	0.1	0.1	0.4	0.2	73.0	0.2	0.2	0	0.4
Outside CT	Public	849	808	524	33	173	11	9,673	1,094	0	13165
	Row(%)	6.4	6.1	4.0	0.3	1.3	0.1	73.5	8.3	0	100
	Column(%)	2.7	4.4	4.3	2.0	3.9	1.6	66.9	4.1	0	7.7
Outside CT	Private	1,204	1,144	894	82	428	43	1520	20,469	0	25,784
	Row(%)	4.7	4.4	3.5	0.3	1.7	0.2	5.9	79.4	0	100
	Column(%)	3.9	6.2	7.3	5.0	9.7	6.4	10.5	76.5	0	15.2
No Record	with SAT	0	0	0	0	0	0	0	0	13,933	13,933
	without SAT	0	0	0	0	0	0	0	0	46,477	46,477
	Row(%)	0	0	0	0	0	0	0	0	100	100
	Column(%)	0	0	0	0	0	0	0	0	100	35.5
Total		31,154	18,309	12,237	1,652	4,418	674	14,468	26,742	60,410	170,064
	Row(%)	18.3	10.8	7.2	1.0	2.6	0.4	8.5	15.7	35.5	100
	Column(%)	100	100	100	100	100	100	100	100	100	100

2.) Significant percentages of Connecticut high school graduates go out of State to college. Over the five cohorts of graduates leaving Connecticut public high schools between 1998 and 2002, 35.5% go out-of-State to college; 37.6% finish there.

3.) Generally, Table 14 and Appendix A.7 show that the highest percentages of students starting and finishing in the same segment attended private institutions and the Connecticut highly selective privates especially. 81.6% of Connecticut public high school students who start in the Connecticut private, highly selective system finish there—smaller than many might have thought, but nonetheless because of its signal leadership in this characteristic, a phenomenon that we describe as the "highly-selective" care of students. Connecticut private "selective" institutions rank not far behind at 71.9%.

4.) This high percentage retention of students "in segment" if not "in institution" at the private institutions is followed by public Connecticut higher education segments lagging but not far behind. These are surprisingly led, in order, by the Connecticut Community and Technical Colleges, CSU and UConn. 71.5% of Connecticut high school students who started in the community college system over our study's purview end there. This rate, higher that the public sector's more selective institutions deserves further evaluation, but it is likely the result of the community colleges' ability to meet some students' needs for a highly specialized, quick source of work force development training and other students' need for a low cost evaluation of their (i.e., the students' own) sense of post-secondary education's fit for their interests and capabilities. Indeed, Connecticut Community and Technical Colleges, like their many counterparts across the State, have institutions with multiple mission and multiple outputs (Ehrenberg and Smith 2004). This high rate of starting and stopping in the community college system is followed by 67.0% of CSU students starting and finishing at CSU and at 66.5% of UConn students doing the same.

5.) Within Connecticut public institutions, CSU follows most closely the example of Connecticut's highly selective private college segment by taking in more student-transfers from other segments than it loses (i.e., the highly selective private institutions and CSU are net gainers). This is traced by comparing the segments' row sums with their column sums.

B.1 The Choice of Students: Either I.) Not going to College; Or II.) Initially Enrolling out-of-State—Brain-drain Sources I and II

Material on students choosing to go out-of-State was first developed in the research team's Connecticut First Steps study of graduates of Connecticut public high schools in the graduating class of 1998. With availability of new data to support this current work, we repeated the earlier work to determine whether crucial findings of First Steps were reproducible. We show new findings in Figure 11 and these are nearly identical results to those determined earlier. The two results are of particular concern to Connecticut policy makers:

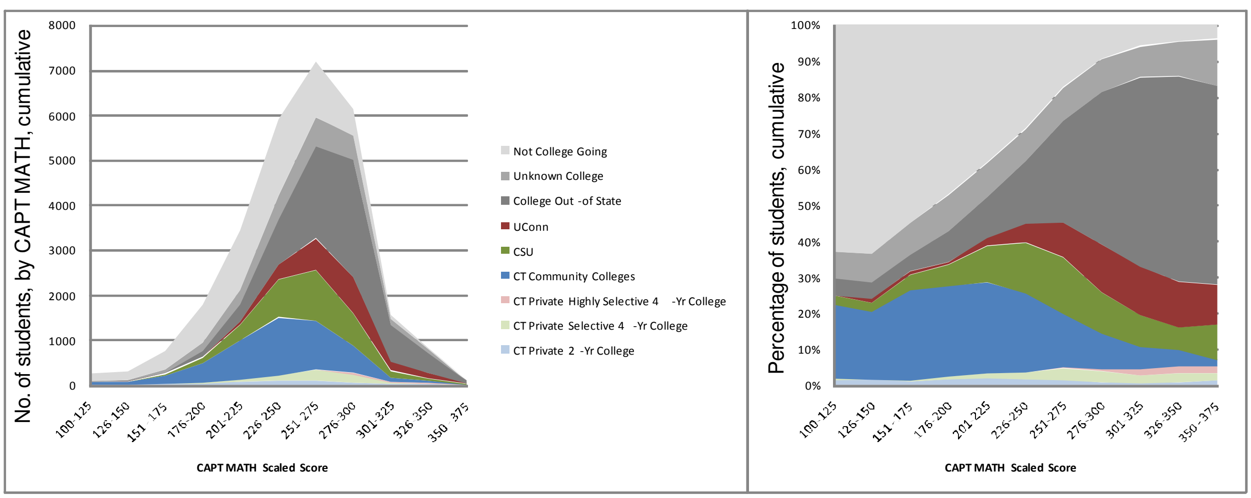
1. the high percentage of high scoring CAPT students not going to college shown in the top (most light-grey shaded areas in left frequency distribution of numbers of students by CAPT score attaining specific levels of educational attainment) and right (cumulative percentage of students at each CAPT score) panels of Figure 11, and
2. the low percentages of students choosing to go to college who made choices to stay in-Connecticut (the colored—non grey areas in the right panel of Figure 11).

The percentage of the very top scoring CAPT students not going to college from the public high school graduating cohort of 1998 can be visually inspected from Figure 11 as being approximately 8%, the area of the top, lightest grey band at the far right hand side of the right panel[21]. So as not to confuse readers, we point out that this calculation represents a higher standard than we described earlier in Figure 2. We had reported in Figure 2 that 10% of the goal achieving students in the class of 1998 did not continuing on to college. The difference between the 8% and 10% of Figures 2 and 11 lies in Figure 2's reference to Goal achieving category covering a wider group than Figure 11's calculation of CAPT takers with scaled Math scores between 350 – 375[22].

But whatever the percentage (8%, 10%, or somewhere in between), high achieving CAPT takers not continuing on to college represent Connecticut's first significant brain-drain loss. This loss, unlike most brain-drain concepts, does not stem from students leaving the State. Such non-continuers are a brain-drain loss because of the failure in heightening their capacity as they might have had they gone on to college. Hereafter, we call these non college bound highly achieving students as brain-drain I.

A second brain-drain, however, is also implied in Figure 11. This flows from the high percentage of the public high school cohort that chose to go out of State for college. Going out-of-State for college is not unto itself the brain-drain. Only when out-of-State attendees' (post college attendance) subsequent participation in the Connecticut labor force is lower than their in-State counterparts, does college choice of out-of-State institutions transmute into a brain-drain loss for Connecticut. We can see that only about 27% or so of the very top CAPT scoring students of the 1996 CAPT cohort stayed in-State, the genesis of Connecticut's brain-drain II.

Figure 11: Brain-Drain I and II: Student Choice of Starting College and, if Starting, Staying in-State by CAPT Score, 1998 Connecticut Public High School Graduating Cohort

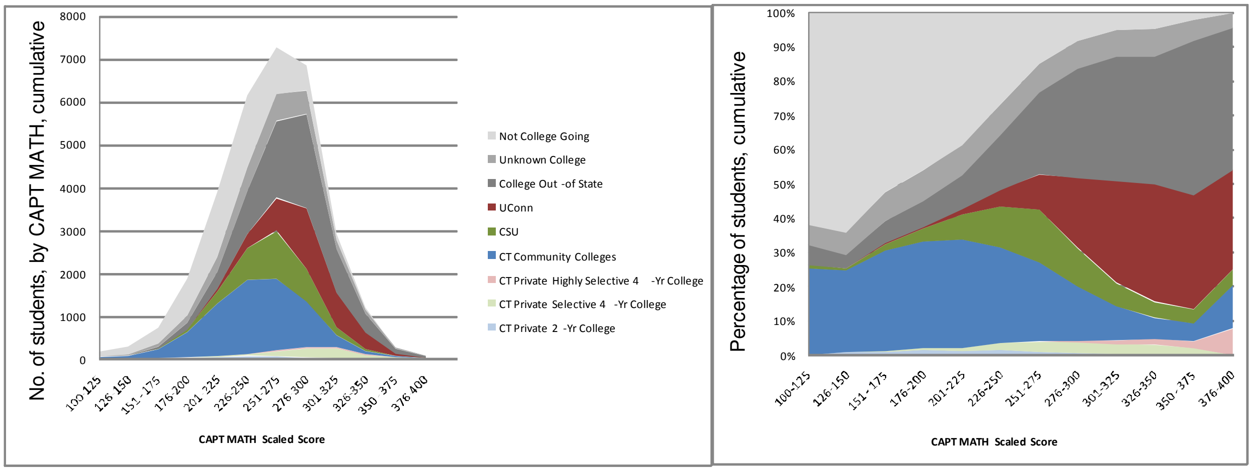


We return for further explorations of these two brain-drain concepts later in this section. First, however, it is useful to show the calculations for at least one more of the public high school cohorts, for

[21] This is actually calculated by subtracting the 92% representing all other categories from the 100% represented by these same categories plus the non-college going group of students.
[22] For the class of 1998, Goal achieved was given to students in the range of 266-400. No one in our study group scored above 386.

the last graduating cohort in Figure 12. A comparison of Figures 11 and 12 shows how dramatically the situation changed.

Figure 12: Brain-Drain I and II: Student Choice of Starting College and, if Starting, Staying in-State by CAPT Score, 2002 Connecticut Public High School Graduating Cohort



In as short a period of time as from 1998 to 2002, the far right tails of Figures 11 and 12 show the proportion of the very best CAPT students, scoring between 375-400, not going on to college fell from 8% to nearly 0%.[23] During this short time, the percentage of the highest CAPT scoring children going on to school out-of-State also fell dramatically—from approximately 64% in the 1998 cohort to 48% in the 2002 cohort. Most of this drop is accounted for by the in-State enrollment growth at UConn (denoted by the burgeoning maroon area in Figure 12). UConn increased its "take" of the brightest[24] in-State students from approximately 9% to 27% of the enrollments and accounts for most of this improvement in in-State attraction of students.

B.2. Details of High Achieving High School Students Choosing not to go on to College—Brain-drain I

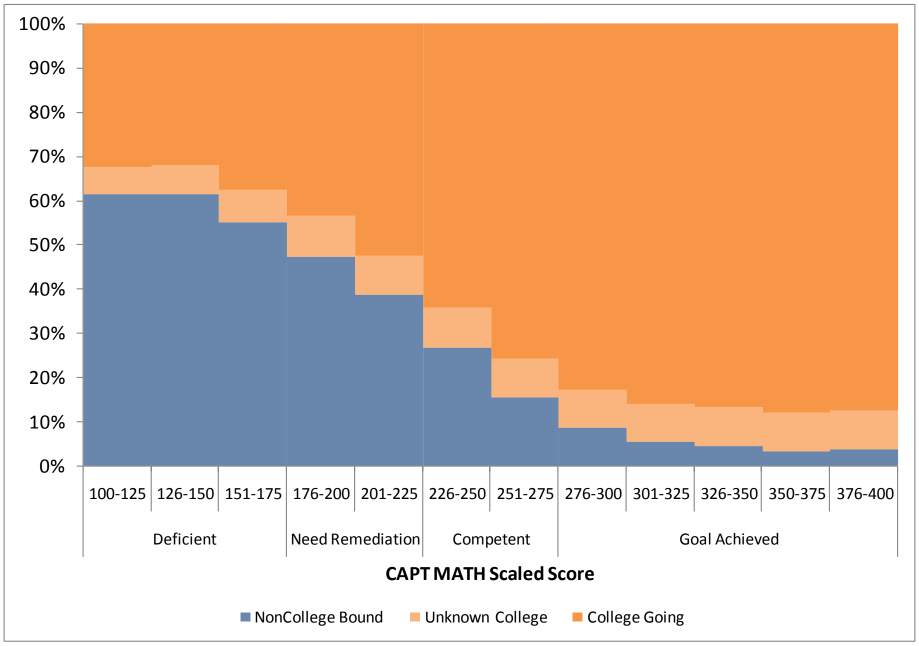
In order to homogenize our treatment of the various sources of brain-drains in this report, we add the CAPT score distribution of persons by their attendance or non-attendance in college after high school. The figure below shows the share of non-college bound students within each of the CAPT achievement levels over the years. The reader will remember that within the Goal Achieving category, the percentage of non-college bound students have dropped from 10% to 8% over the years, and the area shaded by

[23] Figure 2, earlier in this report, showed the fall in the best and brightest not attending college from 1998 through 2002 went from 10% to about 8%. These percentages were obtained, however, in using the CAPT goal-achieving scoreband as the definition of best and brightest. In Figure 11, we calculate the fall in the very best CAPT scorers from 8% to 0% using a much narrower standard of students whose scores ranged from 375 and 400—only the very top of the "goal achieving" scoreband. These seemingly different results are indeed compatible, however, measurement differences creating the semblance of difference.

[24] Here, again, such a statement can be made only if the CAPT Math test is taken as an indicator of student brightness.

blue shows how non-college bound students within the highest achieving category is distributed within each score bands.

Figure 13: College-going and non-going by CAPT Score and Scoreband

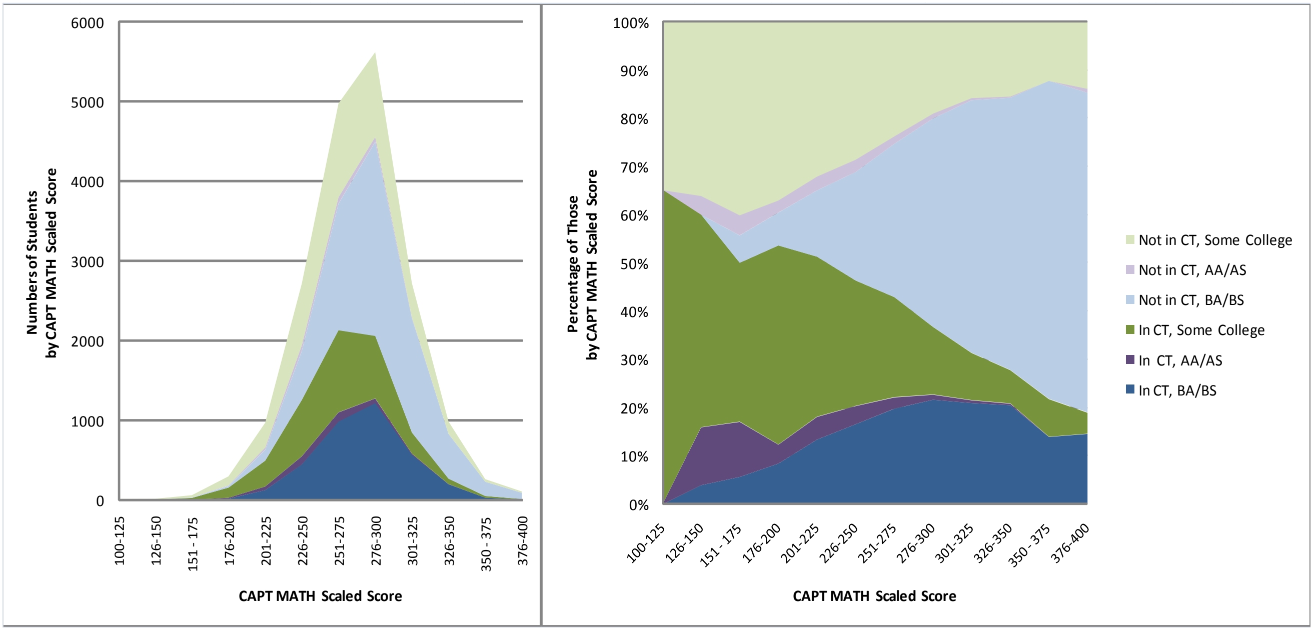


B.3. Rates of Participation in Connecticut for Students making an Initial Choice of going out-of-State—Brain-drain II

Figures 11 and 12 showed that the choice of out-of-State enrollment is a major precursor of Brain-drain II, but in order to determine that there really is a brain-drain here, we must document that students who begin college out-of-State have lower probabilities of returning to work in the Connecticut workforce beyond college completion. These probabilities were not calculated in our first study, but are given here in Figure 14.

Looking only at the population of students starting college out-of-State, Figure 14 those who, by level of educational attainment, work in Connecticut's jobs covered Unemployment Insurance database. Areas shown in solid color represent those with some college (green), associate degrees (blue), and baccalaureate degrees in arts and sciences. Areas shaded with black and white cross-hatched lines represent those not participating in Connecticut covered employment in 4th quarter, 2006. Of those students, who began their higher education studies out of Connecticut, only about 20% appear in Connecticut employment by the end of study period, proving that enrolling in out-of-State higher education institute is indeed an important precondition of a great brain-drain, brain-drain II.

Figure 14: Connecticut Employment in 4th Quarter 2006 by Educational Attainment--Connecticut Public High School Graduating Cohorts from 1998 to 2002 Starting College out-of-State

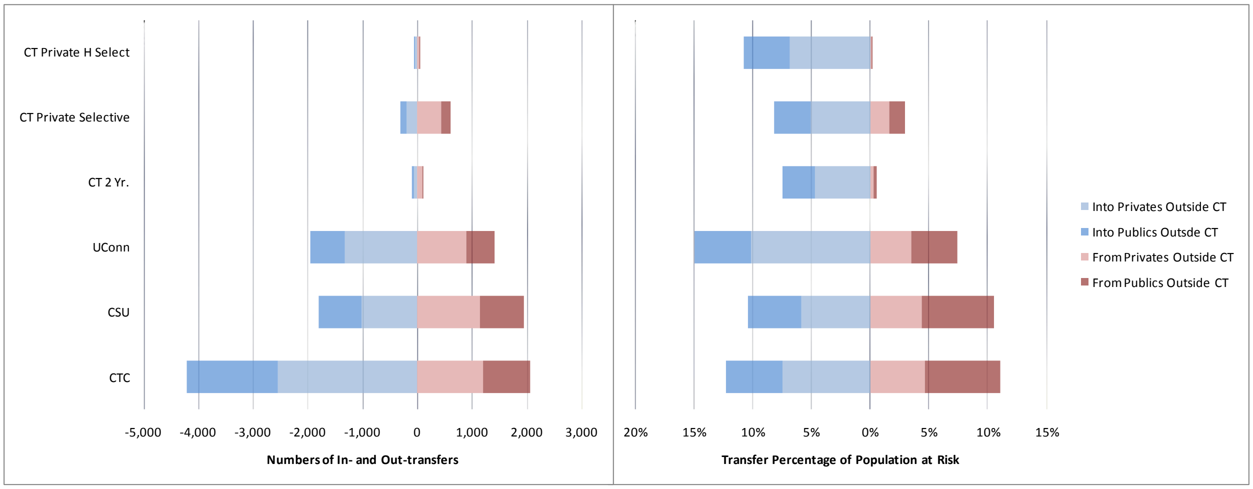


B.4. Net Flows of Transfers among Students by Initial Student Choice of College Attendance—Brain-drain III

We also saw in Table 14 that many students are not stationary during college. Great numbers of students change the college of their attendance one or more times throughout their college careers. This transfer activity, too, becomes a State brain-drain source whenever the numbers originally enrolling in-State who transfer out-of-State exceed the numbers of those initially enrolling out-of-State who transfer back in. We thus become focused on counting the numbers of transfer students into and out of each of the Connecticut higher education segments, determining the relative size of the flows in the two directions. Numbers for such calculations come directly from Table 14. We report in the left panel of Figure 15 transfers, into and out-of-State, calculating the number moving in each direction relative to the populations of Connecticut public high school students initially enrolled in each segment.

We report in the right panel of Figure 15 the rates of in- and out-migration relative to the relevant populations at risk. This population, for in-transfers, is that from which transfers come, generally, the total enrolled out-of-State public or private enrollments of Connecticut public high school students in focus in this study; for out-transfers, it is the original Connecticut public school enrollment attending the institution. The differences in the denominators distort the in- and out-percentages making the right panel of Figure 15 seem as though there is more out-transfer than in-transfer; by comparison, however, the left panel (making the denominators for both in- and out-migrants the same—the number of Connecticut public high school students originally enrolling in the institutional segment in Connecticut) shows that the Connecticut selective privates are net gainers of talent in Connecticut. In contrast, the right hand panel of Figure 15 shows that Connecticut's highly selective institutions lose a greater percentage of their original enrollments to out-of-State transfer than do the selective private institutions. It also shows that the public sector generally loses greater percentages of their original enrollments to out-transfer than do the private institutions. The public segments further bring in a higher percentage of those who begin their college careers out-of-State. At this point, it is crucial to remind our readers of the following: While for the sake of brevity, we grouped public higher education institutions under single campus names, the fact remains that each institution is comprised of distinct campuses serving a wide variety of needs for students pursuing higher education. Hence, variations within campuses with respect to our average results warrant further analysis.

Figure 15: Gross In- and Out-of State Transfers to and from Connecticut Higher Education Institutions



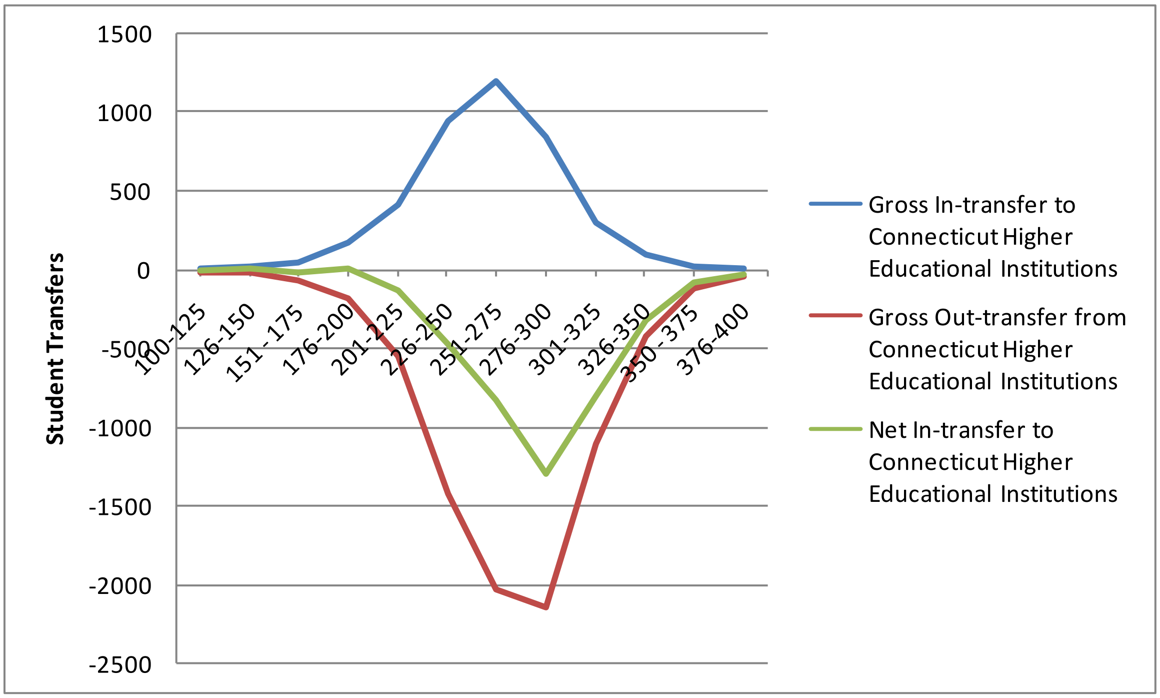
Overall, the data behind Figure 15 confirms that Connecticut loses more students than it gains from academic transfers during students' academic programs. For the private segment, gains—the red portion of each institutional bar in Figure 15, are much greater than losses. This must be properly interpreted—it does not suggest that there is a greater *total* flow of transfers out-of-State during student programs than transfers into-State. The analysis merely says that of the special cohort of Connecticut public high school students, more, additionally, leave Connecticut after starting college. Note that the population tracked in this study constitutes only a portion of total student population of each higher education institution. Of all the segments in Connecticut higher education, only the Connecticut State University system among the public institutions and selective and 2-year colleges among the private institutions hold their own, bringing in more transfers than they lose. These results are documented in Table 15.

Table 15: Rates of Gross Out- and In-Transfer of Students Relative to Connecticut Institutions

	Into Public Out-CT	Into Private Out-CT	From Public Out-CT	From Private Out-CT	Net of Starting Students
CTC	-4.8%	-7.4%	6.4%	4.7%	-6.3%
CSU	-4.6%	-5.8%	6.1%	4.4%	0.8%
UConn	-4.8%	-10.1%	4.0%	3.5%	-4.1%
CT 2 Yr.	-2.8%	-4.7%	0.3%	0.3%	0.5%
CT Private Selective	-3.1%	-5.0%	1.3%	1.7%	7.8%
CT Private H Select	-4.0%	-6.8%	0.1%	0.2%	-1.8%

The surplus of out-transfers over in-transfers, accumulated to a net basis, implies a brain-drain loss additional to that caused by first time students choosing to go out-of-Connecticut for school. We refer to this latter loss as brain-drain III. Further, we show this population distributed against CAPT MATH scores in Figure 16. Interestingly, this Figure shows the peak volume of the gross in-transfer flow (in blue line distribution) occurs at score range 251 – 275, a level lower than the peak of the gross out-transfer flow (the distribution shown in red), which occurs at 276 – 300. Figure 16 shows the net flow of transfers in green, with a distribution whose peak CAPT score also occurs at 276 – 300.

Figure 16: In- and Out- Cross State Transfers to Connecticut Higher Education



B.4. First and Last Institutions—by CAPT Score

CAPT MATH and CAPT LIT, and also SAT Math and SAT Verbal, change quite systematically for those enrolled in the segments of higher education under study. The changes in CAPT scores among higher education segments generally conform to our collective sense that more selective colleges and students with higher score levels in CAPT and SAT choose each other. Table 16 on CAPT MATH uses cell coloration to focus on Connecticut public high school graduates starting and/or ending in the Connecticut public higher education segment. Similarly, Table 17 on CAPT LIT uses coloration to focus on graduates starting and/or ending in the Connecticut private higher education segment. We save the material on SAT for Appendix A.8 since SAT results so fully mimic the CAPT results discussed here.

We color the main diagonal cells yellow (as we had also in Table 14 and Appendix A.7) indicating cases for which tabular material reflects students starting and stopping in the same segment—each yellow diagonal reflecting different segments of higher education. Looking at students' entering and ending segments yields an understanding of (some of) the dynamics played out in students' college choice. The main diagonal cells in Tables 16A and 16B perhaps provide the best reading of relative score levels for students "going to particular institutions." We see that average CAPT MATH scores, for example, rise from 236.0 at the Community College System to 258.7 at CSU to their highest point in the public system at 283.1 at UConn. Each level of CAPT MATH, looking at the next block on Connecticut private institutions, shows the privates to eclipse the public institutions (the highly selective private institutions over the flagship public, the selective private institutions over CSU, etc.) We also see that CAPT LIT scores rise from 76.8 for students starting and ending in the 2-year private institutions to 82.9 for those in the private selective 4-year institutions to their highest point of 92.1 for the highly selective Connecticut private colleges.

Yet, more telling about college choice dynamics is that institutional transfers, switching college of attendance midway through their college career, are among those whom we might call the "best and brightest." We saw that there were massive proportions of transfers in Table 14 and Appendix A.7. Now in Tables 16A and 16B and in Appendix A.8, (defining "best and brightest" as those with higher CAPT or SAT scores), we additionally see that transfers tend to have higher test scores than those choosing one institution and staying in it until completion. We see, for example, that all cells to the right of the main diagonal for the community college row in Table 15 (implying transference from community college to one of the segments named at the top row of the Table) are colored pink. This signifies the CAPT MATH score for each implied transfer cohort to *all* other segments is higher than for those who remain. All of the information, however, in Table 15 is not as simple and easily absorbed. There are out-transfers and in-transfers for some institutions with lower CAPT scores than those who remain throughout their college career at the institution. This occurs some for CSU, but even more for UConn. Connecticut public high school students attending UConn who transfer to Connecticut 2-year and selective 4-year institutions as well as to Massachusetts and Rhode Island public institutions have higher average CAPT scores than starter/stayers. This is both

Table 16A: Average CAPT MATH Scores by First and Last Institution of Student Attendance

Entering College Segment	Last Attending College Segment: Connecticut Public			Connecticut Private			MA & RI		Northern Tier		NY, NJ & PA		Rest of US	
	C&TC	CSU	UConn	2 Yr.	Selective	H Selective	Public	Private	Public	Private	Public	Private	Public	Private
Connecticut Public														
CTC	236.0	250.9	273.1	240.9	262.3	308.2	258.6	265.3	268.0	262.4	261.1	270.9	259.6	250.1
CSU	251.2	258.7	270.5	255.7	258.5	299.6	266.1	277.0	268.4	275.2	273.8	281.0	268.3	268.6
UConn	271.9	275.6	283.1	282.7	282.3	306.4	282.7	297.5	290.4	298.4	285.8	296.0	288.8	286.4
Connecticut Private														
2 Year	229.5	240.9	264.1	242.5	244.9	289.3	262.5	272.9	271.8	276.3	267.8	246.7	242.3	242.4
Selective	253.9	264.8	277.6	263.0	270.3	294.0	270.0	286.8	282.0	268.9	260.5	287.9	269.8	272.5
H Selective	296.4	265.3	305.8	298.9	295.2	309.5		298.1		319.0	283.8	309.3	313.5	302.8
MA & RI														
Public	259.5	269.4	281.9	256.2	274.7		268.1	262.6	275.9	250.6	263.7	278.2	269.7	264.8
Private	254.2	266.2	280.8	275.0	278.7	300.6	264.9	281.0	284.9	284.0	273.8	284.2	280.7	281.9
Northern Tier														
Public	263.6	265.7	275.5	271.9	265.6		271.2	264.9	271.4	266.9	263.2	274.7	275.4	278.2
Private	251.1	259.8	280.5	270.2	256.9	303.7	257.0	285.3	261.3	280.2	288.7	285.6	277.8	278.7
NY, NJ & PA														
Public	252.9	270.6	281.4	268.6	274.2	361.0	274.1	277.0	270.7	242.8	275.1	278.5	276.0	274.5
Private	263.2	272.7	285.9	271.8	274.6	302.8	276.6	285.5	288.3	267.1	275.8	285.5	283.6	283.6
Rest of the US														
Public	250.6	268.5	286.1	280.7	274.6	319.8	274.8	280.7	274.1	269.3	278.4	284.2	274.7	267.5
Private	254.7	266.0	287.0	266.1	274.9	274.0	270.5	284.2	262.3	270.7	272.2	287.6	269.0	277.6

score range: 100 - 400

Table 16B: Average CAPT LIT Scores by First and Last Segment of Attendance

Entering College Segment	Last Attending College Segment: Connecticut Public			Connecticut Private			MA & RI		Northern Tier		NY, NJ & PA		Rest of US	
	C&TC	CSU	UConn	2 Yr.	Selective	H Selective	Public	Private	Public	Private	Public	Private	Public	Private
Connecticut Public														
CTC	69.9	76.4	81.7	77.3	79.4	90.5	77.8	79.0	79.9	75.8	78.1	81.4	77.1	76.3
CSU	76.7	79.1	82.8	82.1	81.0	90.7	78.8	84.2	83.0	82.1	83.7	86.7	81.8	81.1
UConn	81.0	83.6	85.5	90.6	86.9	91.3	83.9	89.7	86.8	88.4	85.5	88.9	87.8	88.1
Connecticut Private														
2 Year	71.6	79.3	86.3	76.8	78.0	102.7	75.0	92.0	80.3	79.2	85.7	80.6	78.0	78.0
Selective	75.1	81.4	84.9	83.6	82.9	91.8	83.2	84.9	85.3	76.1	80.0	88.6	81.7	81.2
H Selective	82.8	83.8	91.5	93.9	88.5	92.1		91.2		92.0	88.5	93.2	97.3	97.9
MA & RI														
Public	76.3	81.7	84.8	88.4	86.3		81.0	79.4	84.4	79.4	79.1	84.4	81.3	77.8
Private	75.3	81.3	86.5	83.8	85.3	90.4	81.6	85.0	81.9	89.6	85.8	88.1	85.6	84.6
Northern Tier														
Public	79.8	80.9	87.2	87.9	82.4		79.5	85.7	82.4	82.9	86.1	84.7	82.8	85.2
Private	75.2	79.4	85.1	82.2	78.4	82.3	74.6	86.0	83.0	84.4	87.5	90.6	83.7	85.2
NY, NJ & PA														
Public	77.5	82.1	85.9	89.0	87.1	101.0	88.8	81.9	79.1	66.8	82.7	83.0	83.9	83.8
Private	78.2	82.5	86.6	88.5	86.2	89.7	84.2	87.8	86.5	72.9	84.7	86.6	86.0	86.9
Rest of the US														
Public	74.4	79.8	86.2	90.0	85.0	94.7	83.6	87.0	82.5	79.9	82.4	88.1	82.2	79.8
Private	75.6	81.0	87.3	81.0	83.9	91.0	80.6	87.3	81.7	79.6	83.6	87.9	81.2	83.0

score range: 20 - 120

a decrement to the overall, aggregate capacity of students ending at UConn *and* a significant brain-drain loss to the State when students transfer across the State's borders.

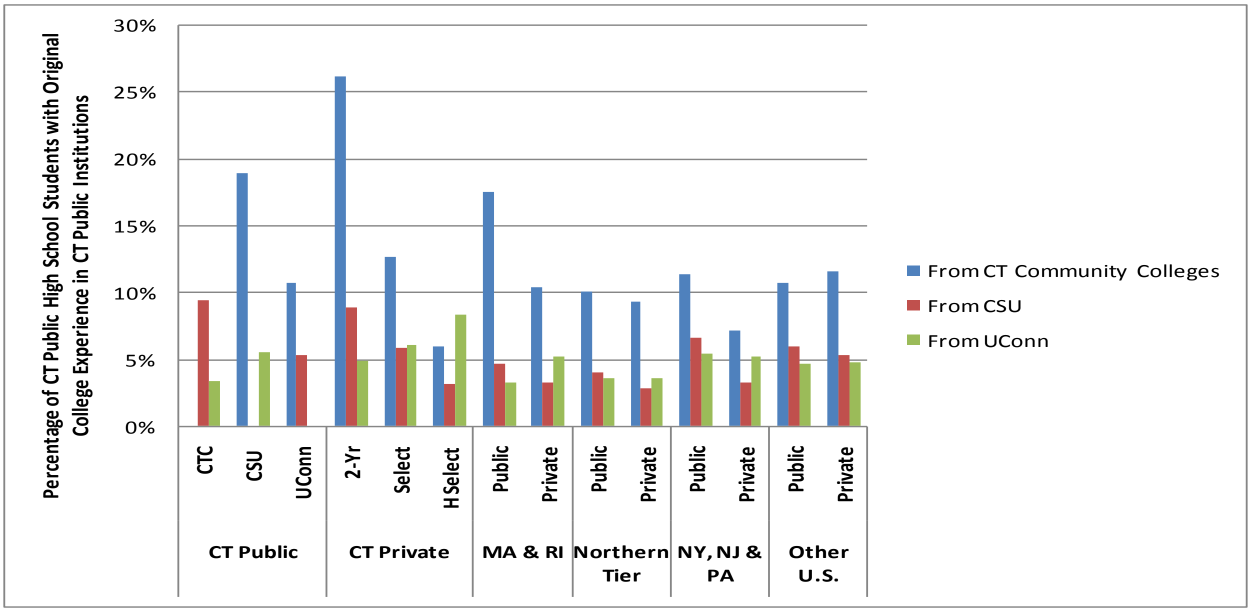
For the private institutions, we chose to look at CAPT Literature merely to present different data. The situation is similar for the 2-year private segment to what we described above for the public institutions. Only with regard to the Connecticut community college system did the 2-year privates have out-transfers with higher CAPT scores than their starter/stayers. In the selective private institutions, out-transfers are higher scoring than those who come and stay in transfer relations with 7 of 13 segments and in-transfers are higher scoring in 8 of 13 segmental transfer relationships. But, the highly selective private institutions tend to give and receive better students in the minority of their transfer relationships with other segments, 4 of 11 segments on out-transfer and 3 of 11, with in-transfer.

B.5. The Importance of Connecticut Public Institutions to Other Higher Education Sectors

An important side-effect worthy of being pointed out is that with such a large portion of Connecticut public high school students going initially into the State's public colleges, many institutions in- or out-of-State, public or private, become transfer recipients of large numbers of Connecticut public college students, especially from the community and technical college system. Recognizing that the early education of so many comes from the common public college training ground gives an opportunity to assess interactions among the transfer-receiving institutions and public college institutions sending students. Whatever the recipient institutions' view of quality among such transfers may be, they are admitting many such students and there is room for feedback. What preparation seems most helpful, what isn't being given that might be, what joint ventures might facilitate more transfer flows? Simply, transfer recipient institutions should consider how many transfers come from this single source. If sufficient, it might be well worth the effort to establish transfer pacts on what educational components are desirable among the transfer students.

With this in mind, Figure 17 shows the percentage of students ending at each of the segments who began in the three public institutional types, the community and technical college system, the CSU system and UConn. Of course, many Connecticut public high school students starting in the community college system feed into the four-year public institutions, CSU and UConn. Of those Connecticut public high school students ending their studies at CSU, 18 to 19% coming from the community college system is notable; so also are the 11%, ending at the University of Connecticut. Transfer compacts smoothing transitions of students between these public institutions could be important and should be facilitated by State policy. We also see in Figure 17, however, that CTC provides more than 10% of Connecticut public high school students completing their work at a wide variety of other institutions, these including: the CT 2-Yr privates, the CT selective privates, the MA and RI publics and privates, the Northern tier publics, the NY, NJ and PA publics, and all other state public and privates across the U.S.

Figure 17: Percentage of Connecticut Public High School Students Completing in Various Higher Education Segments Beginning in Connecticut Public Institutions



Lastly, we point out that the preparatory role of CSU and UConn in launching students into further higher education in other institutions should not be discounted. The percentages are a little smaller for the CSU system and UConn than for the Community College system, but the 8% and 3% of Connecticut public high school graduates starting at UConn and CSU who end at Connecticut's highly selective private institutions and the 6% contributed by both UConn and CSU to the Connecticut selective private institutions imply that overall, the Connecticut public colleges also play a role as a transfer or launching ground between Connecticut's public high schools and the student's last institution of higher education for 17% of those ending in the highly selective and for 25% the selective private institutions of Connecticut.

C. Remedial Coursework

At a time when students are taking increasing numbers of exams, including Connecticut's CAPT , that show student deficiencies in specific course-work, we must consider whether remediation can correct student deficiencies. If so, remediation is an important part of enabling students' collegiate work. In practice, however, recommendations for collegiate remediation are made to deficient students not on the basis of CAPT or other state-level exams, but an independent exam, College Board's Accuplacer exam. The independence between Accuplacer and CAPT, taken more than two years earlier, raises several important questions:

1. Is the earlier CAPT exam a reasonable predictor of the need and taking of remediation by students?,

2. Does CAPT as an exam have separate and independent effects from the SAT exam which students take later and closer to college remediation?,
3. If CAPT is a good predictor, can it be used to eliminate remedial gaps of students in high school, long before students move into collegiate work?, and
4. Once taken, and passed, does remediation improve student capability sufficiently to rectify the existing student deficiencies?

Our answers to these four questions are all affirmative. We will present evidence for these answers as we proceed through the balance of the report: the first three to be taken up in this section, VIII.C, and the fourth, in section VIII.F.

C.1 Remediation in the Connecticut Community and Technical College System

Among the public higher education segments in Connecticut, we had access to both English and Mathematics remedial courses only for the Community and Technical College system. The 10th grade CAPT LIT and MATH scores, by themselves, for students attending the C&TC system, are statistically significant predictors of whether the students will require and attend remedial course work or not. Our results indicate that, at the minimum CAPT LIT score level, the predicted probability that students will attend Remedial English course is .83. This drops to .25, a drop of 58 percentage points, for students with maximum CAPT LIT scores. The difference by SAT Verbal scores in predicting the probability of remedial English course work, on the other hand—compared to CAPT LIT, is much sharper. From lowest to highest SAT verbal scores, the probability of taking English remedial coursework drops by 79 percentage points. If statistically, we add SAT scores into the model, the predictive capacity of CAPT exams is reduced, but CAPT test scores in predicting the probability of remedial course work are still statistically significant.[25] Considering student background, participation in supported lunch programs during high school has a higher effect than student's gender or race and ethnicity on the probability of the student's taking English remedial course within the CTC system, as indicated by the differences in predicted probabilities.

Table 17 is not a formal statement of the form of the model used to explain remedial course-taking, but it depicts independent forecasts of the probability of taking English remediation when the student is female, holding other listed variables constant at their mean.[26] CAPT LIT and/or SAT Verbal, continuous

[25] For the full model used in explaining remedial course-taking, see Appendix A.9.

[26] Setting variables at their mean entails variable representing female would be set to the value, 1, and male to the value, 0; white and minority would be set to the average percentages of whites or of minorities in the data available for Table 18; similarly, not in RF Lunch and in RF Lunch would be set to the average probabilities of variable in the data.

Table 17: Model Estimates of the English Remediation Course Taking at CTC by Explanatory Variables

	CAPT LIT			SAT Verbal			CAPT LIT & SAT Verbal		
	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect
Female	0.542	0.009	0.009	0.436	0.089	0.089	0.444	0.050	0.050
Male	0.551			0.525			0.494		
White	0.536	0.038	0.038	0.472	0.003	0.003	0.468	-0.014	-0.014
Minority	0.575			0.475			0.454		
Not in RF Lunch	0.538	0.063	0.064	0.469	0.035	0.034	0.461	0.033	0.033
In RF Lunch	0.601			0.503			0.494		
CAPT LIT(=min. score)	0.837	-0.582	-0.007				0.735	-0.483	-0.006
CAPT LIT(=max. score)	0.255						0.251		
SAT Verbal(=min.score)				0.913	-0.791	-0.001	0.869	-0.710	-0.001
SAT Verbal(=max.score)				0.122			0.159		

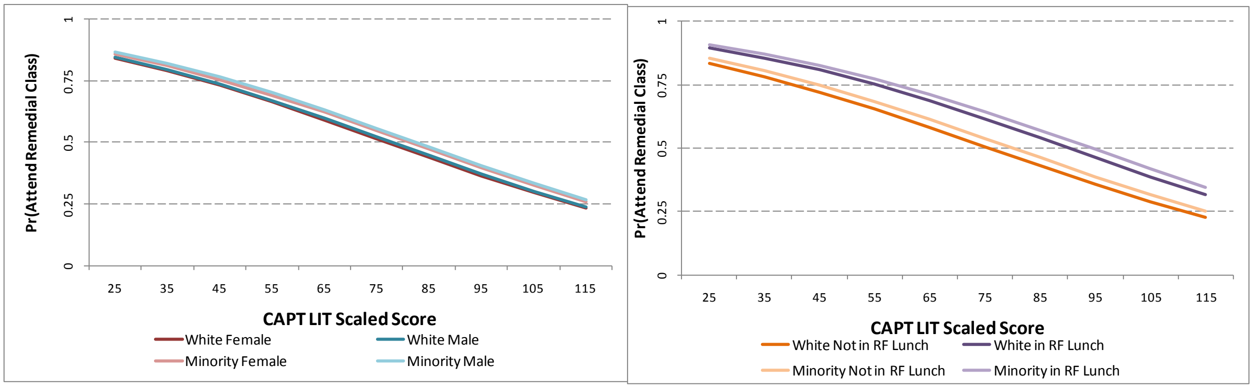
variables, would be set to the average values of CAPT LIT and SAT Verbal for the population included in the regression. The probability reported for Male in English remediation-taking is constructed exactly in an exact parallel manner except it would hold female =0 and male = 1.

All other variables reported in Table 17 are constructed in similar ways, holding "other" variables at their population means and the variable being reported upon at its values for the condition reported (i.e., white = 1 and minority = 0 for the white probability and white = 0 and minority = 1 for the minority probability, etc.). For the continuous variables, CAPT LIT and SAT Verbal, all dichotomous (dummy or 0/1) variables were treated at their regression population averages, but CAPT LIT or SAT Verbal were taken either at their maximum value or their minimum value.

Data in the "Diff." column represents the difference between the relevant extremes: male probability minus female probability; minority probability minus white probability; in RF Lunch minus not in RF Lunch; and at maximum exam score minus at the minimum exam score. Data in the "Marg. Effect" column represents the effect of a one-unit change in the variable of interest. For the dichotomous variables which change between 0 and 1, it is logical that what is reported in "Marg. Effect" is the same as that reported in "Diff.," since a one unit shift is the entire shift reflected in the "Diff." column. But, in the case of a continuous variable, it is the change for each unit of the continuous variable.

Figure 18, below, depicts the associations of gender, race-ethnicity and reduced or free lunch status of the student with remedial course taking probability. The difference in probability of taking remedial English courses, for example, for minority students in reduced/free lunch program compared to white students not in reduced/free lunch programs can be visually read off of Figure 18.

Figure 18: Model Prediction of Probabilities of English Remediation at the CTC System



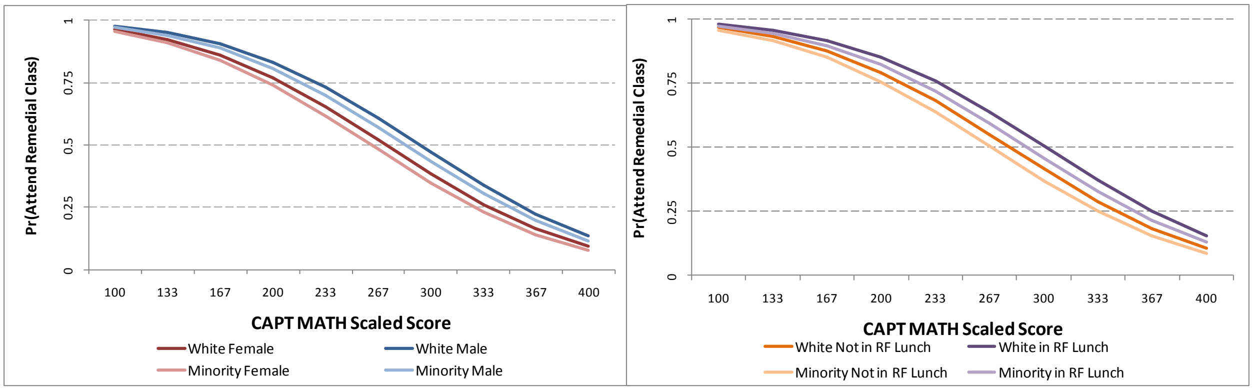
With respect to the power of the CAPT MATH exam to predict remedial Math course taking in C&TC system, we observe similar results to remedial English courses. The effective impact of CAPT MATH exam score (measured by the drop in size of its coefficient) in predicting the taking of at least one remedial course during the student's studies drops sharply when SAT Math is incorporated into the model, implying that the two exams overlap one another in noting missing skills needing development through remediation, the full effect of missing skills "coming out" in the additive effects of the two test results, CAPT and SAT. The overlap is not complete, however, each exam picking independent rationale for remedial work; if the overlap were complete, the two exams would lose significance because of the implicit multicollinearity between CAPT and SAT Math.

Table 18: Model Estimates of the Math Remediation Course Taking at CTC by Explanatory Variables

	CAPT MATH			SAT Math			CAPT MATH & SAT Math		
	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect
Female	0.593	0.081	0.082	0.515	0.120	0.121	0.501	0.129	0.130
Male	0.675			0.635			0.630		
White	0.638	-0.035	-0.035	0.574	-0.037	-0.037	0.568	-0.056	-0.056
Minority	0.603			0.537			0.512		
Not in RF Lunch	0.623	0.050	0.051	0.560	0.044	0.044	0.551	0.040	0.040
In RF Lunch	0.674			0.604			0.591		
CAPT MATH(=min. score)	0.966	-0.855	-0.004				0.762	-0.421	-0.002
CAPT MATH(=max. score)	0.111						0.341		
SAT Math(=min.score)				0.977	-0.876	-0.002	0.954	-0.807	-0.001
SAT Math(=max.score)				0.102			0.147		

The interaction effects of student's gender and race-ethnicity on predicting remedial math course work, however, is much more differentiated than in English remediation. White males, at given CAPT Math score levels, are more likely to attend Math remediation courses compared to a minority females. Furthermore, we observe that, while for given CAPT LIT score levels, minority students who were in reduced/free lunch programs are more likely to attend English remediation, for CAPT MATH score levels, we observe that white students from less affluent families are more likely than their minority counterparts to attend Math remediation classes in the C&TC system.

Figure 19: Model Prediction of Probabilities of Math Remediation in the CTC System



C.2 Remediation in the Connecticut State University System

The English remediation courses within the CSU system, at the time of our analysis, did not have a consistent set of coding across the various campuses of the CSU system. We, therefore, decided to leave CSU English remediation results out of our report. For Mathematics remediation in CSU system, our analysis reveals that, like remediation in the C&TC system, the predictive effect of CAPT MATH exam weakens once SAT Math exam scores are included into the model. Using only CAPT MATH as a predictor, at lowest score level, the probability of taking Math remediation course is .93; with SAT Math scores in the model, the probability drops to .58.[27] Similarly, at highest CAPT MATH score, all else equal, the probability of taking math remediation is .004, while with SAT math exam scores, at highest CAPT MATH score levels (taken from Table 19), the probability of taking math remediation class increases to .06. In addition to CAPT and SAT math exam scores, the student background characteristics also play an important role in predicting whether the student will take math remediation within the CSU system. All else equal, a female student has a lower probability of taking Math remediation compared to a male student, and a minority student's probability of attending a Math remediation course is lower than that of a white student.

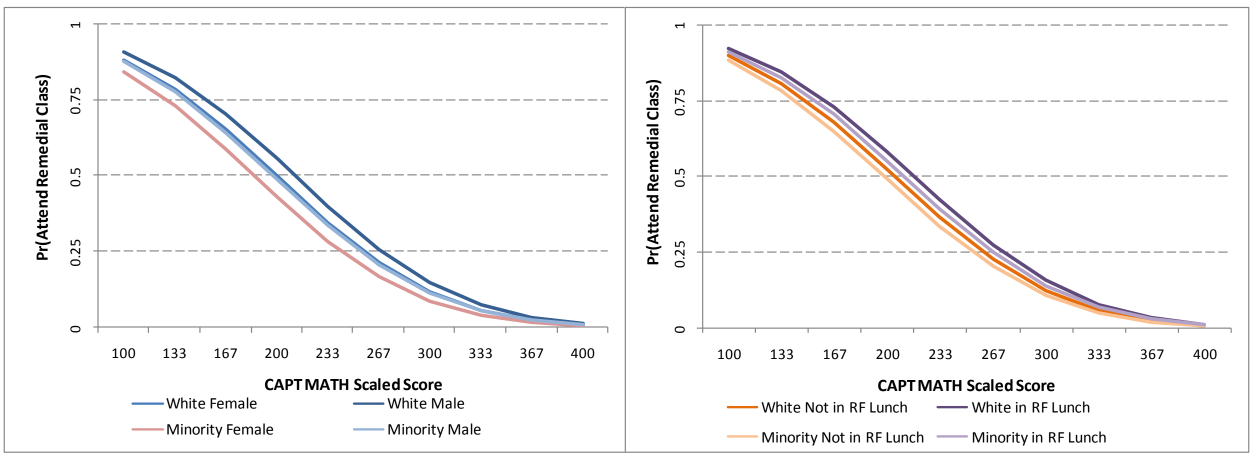
[27] This results, while the overall model math remediation prediction probability remains consistent with observed likelihood of remediation, because the balance of the model prediction is taken up, or "explained" by the effect of SAT's average.

Table 19: Model Estimates of the Math Remediation Course Taking at CSU by Explanatory Variables

	CAPT MATH			SAT Math			CAPT & SAT Math		
	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect
Female	0.237	0.014	0.014	0.219	0.032	0.032	0.211	0.039	0.039
Male	0.251			0.251			0.251		
White	0.246	-0.019	-0.020	0.235	-0.020	-0.021	0.233	-0.039	-0.041
Minority	0.226			0.215			0.194		
Not in RF Lunch	0.243	0.007	0.007	0.232	0.003	0.003	0.227	0.005	0.005
In RF Lunch	0.249			0.235			0.232		
CAPT MATH(=min. score)	0.933	-0.929	-0.004				0.576	-0.518	-0.002
CAPT MATH(=max. score)	0.004						0.058		
SAT Math(=min.score)				0.980	-0.976	-0.002	0.924	-0.911	-0.001
SAT Math(=max.score)				0.004			0.013		

The cross-effects of student socio-economic and demographic effects, depicted below, appear as important factors. All else equal, at the same CAPT MATH score level, white student who participated reduced/free lunch programs in high school have a higher probability of taking math remediation than a minority student who was not in supported lunch program.

Figure 20: Model Prediction of Probabilities of Math Remediation in the CSU System



C.3 Remediation at the University of Connecticut

Students attending the higher educational public flagship institution of Connecticut do not take English remediation courses. For this reason, our analysis is limited to math remediation. In comparison to math remediation in the CTC and CSU systems, the predictive effect of CAPT MATH score, when determined from an analysis that also includes SAT Math scores, is smallest for UConn students, perhaps indicating a difference in remediation tests or the utilization and focus among the systems of remediation[28]. Controlling for the SAT math score of the student, the analysis shows that at lowest CAPT MATH score levels, the independent contribution of CAPT MATH to the probability of taking a

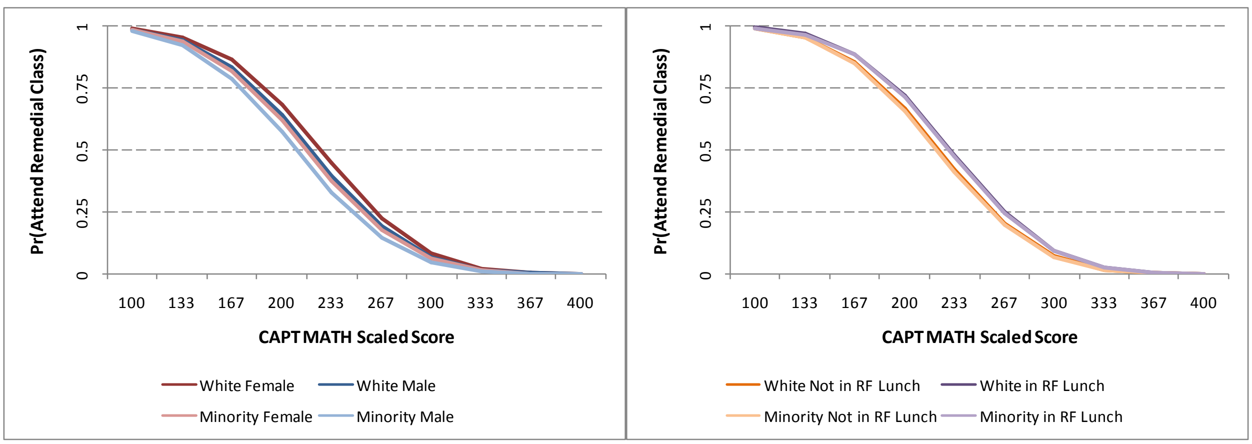
[28] We should also point out that few observations at the lower and upper ends of score distribution prevent robust inference in the neighborhood of extremum observations.

math remediation class is 34%. When the analysis is done with using SAT Math exam, at the same score level, the predictive effect of CAPT Math increases to 94%.

Table 20: Model Estimates of the Math Remediation Course Taking at UConn by Explanatory Variables

	CAPT MATH			SAT Math			CAPT & SAT Math		
	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect	Probability	Diff.	Marg. Effect
Female	0.148	-0.028	-0.028	0.122	-0.009	-0.009	0.118	-0.005	-0.005
Male	0.120			0.113			0.113		
White	0.135	-0.003	-0.003	0.119	-0.007	-0.008	0.118	-0.015	-0.016
Minority	0.132			0.112			0.103		
Not in RF Lunch	0.132	0.060	0.054	0.116	0.048	0.043	0.114	0.043	0.039
In RF Lunch	0.192			0.163			0.156		
CAPT MATH(=min. score)	0.944	-0.944	-0.004				0.337	-0.303	-0.001
CAPT MATH(=max. score)	0.001						0.034		
SAT Math(=min.score)				0.999	-0.998	-0.002	0.994	-0.992	-0.001
SAT Math(=max.score)				0.001			0.002		

Figure 21: Model Prediction of Probabilities of Math Remediation in the UConn System



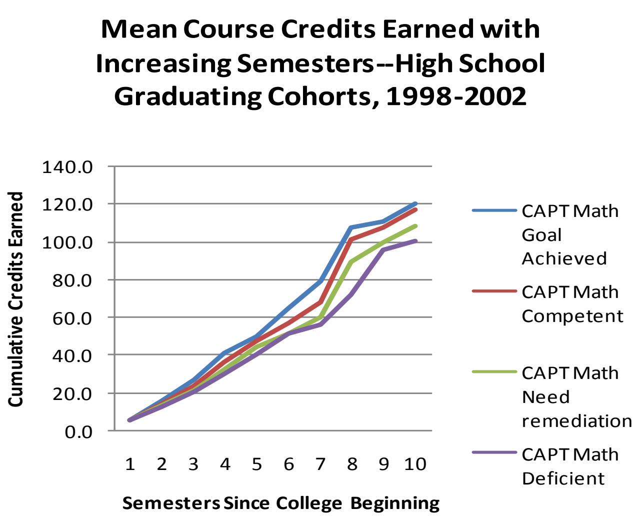
In contrast to the effects of student background variables observed for CTC and CSU system, the probability of Math remediation at UConn reacts differently to student background. Both in CSU and CTC system, white male students have the highest probability of attending math remediation courses at given CAPT MATH levels, compared to minority female students. At UConn, we observe that the probability of taking math remediation is nearly identical for both groups of students. Furthermore, while in the CTC and CSU systems, there is a distinct difference in probability of taking math remediation between white and minority students in- and not in-reduced/free lunch programs, at UConn the probability largely overlaps.

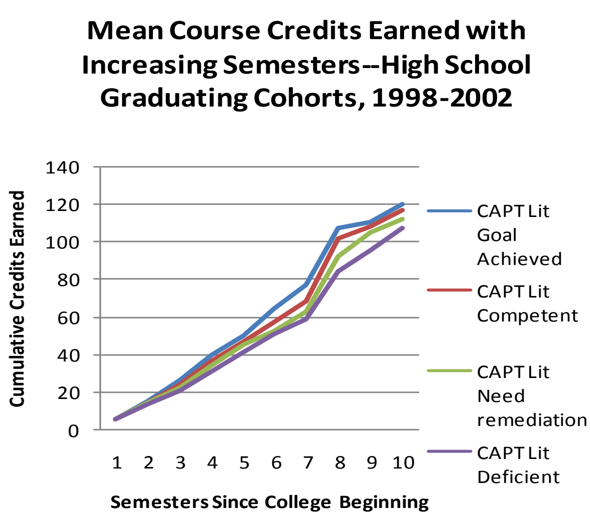
D. Credits Earned

The earlier First Steps study found that CAPT and SAT were good predictors of credits earned over semesters since students' start within higher education. We fully replicate these results here, proving that whatever deficiencies are implied by lower CAPT scores compared to higher CAPT scores, the results of CAPT, on average are important. This may be done preemptively, before students take CAPT, by equalizing the availability of those resources to students that demonstrably affect student CAPT score levels. Alternatively, strengthening students with lower CAPT scores can be done post hoc by remedial work. However, mixing strategy—giving a little of both: reallocation of resources among students and remediation seems sub-optimal, as does knowing that students will need remediation in high school, but waiting to start remediating until college. This certainly will be one of the foci prompted by results from this study.

Figure 22 shows, in the left (for CAPT MATH) and right (for CAPT LIT) panels, that students at higher score bands in CAPT, on average, earn higher amounts of credits per semester than those at lower CAPT score bands. Perhaps more significantly, by the end of 8 semesters into college—when very few of the students in a 4-year college curriculum have completed coursework, students at the highest LIT score band will have completed, on average, approximately 25 more credits than students in the lowest LIT score band. By comparison, students at the highest MATH score band will have completed, on average, approximately 35 more credits than students in the lowest MATH score band. These differences are significant, amounting to 1.17 years of full time course work for the differences shown in CAPT MATH and .83 for the differences in CAPT LIT. Such differences are enough to knock many, at their fourth year of college, out of an enthusiasm for completing college: they are falling behind their colleagues and classmates, their college costs and loan indebtedness are increasing, and they still have more than the equivalent of a year to go.

Figure 22: Mean Course Credits Earned by Semester and by CAPT Scoreband



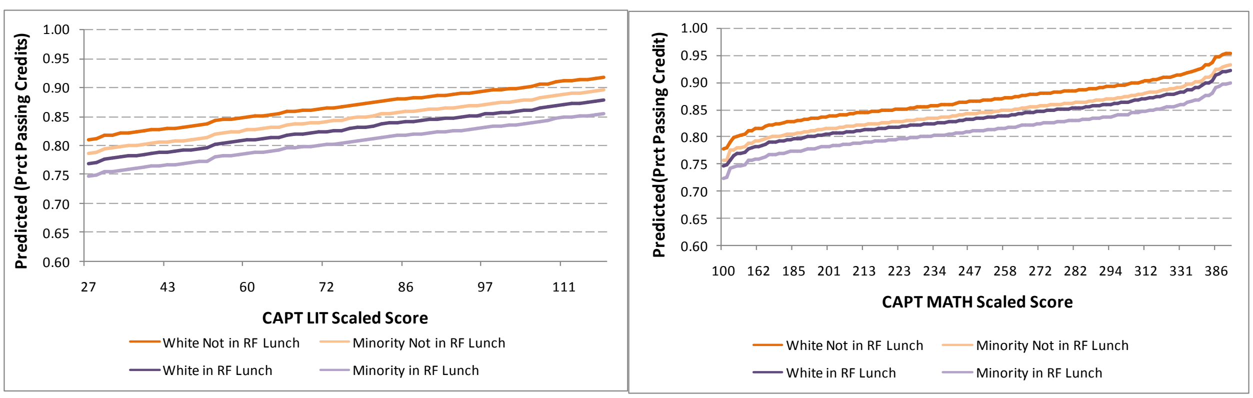


E. Percentage of Courses Passed

The numbers of credits earned by semester of effort obviously relates to the percentage of a student's courses attempts, passed. Hence, we built a model for the students who attended public high schools between 1996 and 2000 of percentage of courses attempted that were passed[29]. There are significant differences in percentage passed by CAPT MATH and CAPT LIT, high and low scoring CAPT MATH takers likely having the most different results in success in passing courses; high and low scorers in CAPT LIT having still large differences in pass rates, but less different from one extreme to the other than in CAPT MATH.

Student family income, however (leading to participation in reduced or free lunch programs), made nearly as big a contribution in explaining course pass rates as did race or ethnicity. As Figure 23 shows in both panels, students pass between 75% and 95% of courses attempted, with a faster downturn at extreme low and faster upturn at extreme high CAPT MATH scores. The effect of CAPT LIT scores seemed to be linear (i.e., constant) throughout. However, variation among the predictions show that non poor white and minority students pass more similar percentages of courses than do white students in or out of reduced or free lunch programs. Similarly, minority students in or out of reduced or free lunch programs are also more similar that are minority and white students in reduced or free lunch programs or minority and white students not in reduced or free lunch programs.

Figure 23: Model Predictions of Percentage of Credits Attempted, Passed, by CAPT Score, Race and Ethnicity and Participation in Reduced or Free Lunch Programs



We have to remind that in our analyses of credits earned and percentage of credits attempted, we did not control for many other factors that may affect the student outcomes; consider, for instance, the possibility that students who were in supported lunch programs may need to work for longer hours during their college careers. While we could measure labor force participation, data on the "hours" of paid work were not available in the dataset. To what extent hours of paid work, the availability of financial aid to student population in Connecticut's public segment higher education institutions affect timely finishing college need to be analyzed further. Furthermore, school-level support systems are also shown to have an effect on timely graduation. In a randomized experiment in a Canadian university,

[29] The full model of percentage of courses passed is provided in the Appendix, A.11.

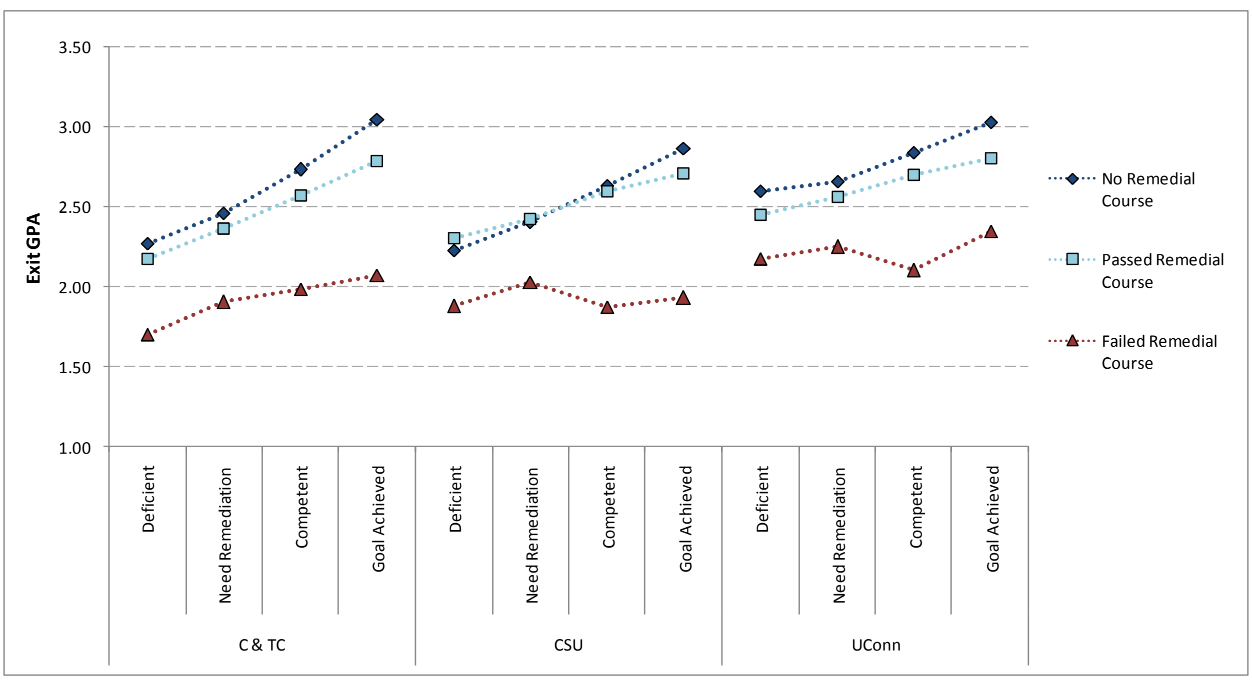
Angrist et al (2007) report that students who were offered peer-advising, organized in study groups and merit scholarship were likely to earn more credits at the end of second year than those students who were in control group, although support program was provided only during the first year. The authors of this study suggest that study skills acquired at the beginning of college career can have a lasting effect on student performance.

F. Exit GPA

The GPA of students at the end of their college career (especially when our analysis has focused on the "end of college" as student's last enrollment not insisting that graduation mark the end—thereby not losing anyone in our analysis) is one of the quintessential variables collected in this study. GPAs at the end of college, or "exit GPA" for short, can range from failure—i.e., below 2.0 to 4.0. This gives a wide range in GPAs to explain, helping make the analysis be stronger. Since GPA relates directly to earning a degree, as in being one of the prerequisites of a degree, the GPA is one of the most important qualities to measure in a student college performance.

Figure 24 shows for each of the institutional groups on which we had transcript information, the GPAs of students arranged by broad assessment of CAPT MATH score bands. The top dashed blue line with diamonds represents GPAs for students not taking college remediation at the Community College system (C&TC), CSU and UConn. It is clear that regardless of college of attendance, GPAs steadily rise

Figure 24: Exit GPA by CAPT Scoreband and Remediation



with CAPT score band. But it is also interesting that (of students who felt (or were told) they should take remediation), if they passed their remedial course work, even after several unsuccessful tries, their GPAs tower over the comparison group which failed all attempts at remediation. Further, GPAs of students successfully mastering the remedial work are very close to those of students not taking remediation; and at CSU, these rates are above their comparison groups rates.[30]

We would like to point out that taking remedial courses does not bias the remediation takers to have higher GPAs. For most, remedial course work does not count into cumulative GPA at the end of college. For all, assuming the remedial course pass was at a higher than average level for students, it is also true that there are simply not enough remedial courses to affect the cumulative GPA very much. Table 21 shows the number of remedial courses taken by individual students needing remediation in each of the Connecticut public higher education sectors.

Table 21: Student Remedial Course-taking in Math (UConn, CSU and CTC) and English (CTC, only)

(%) Student Population	UConn	CSU	CTC
No Remediation	0.82	0.75	0.48
One Remedial Class	0.16	0.21	0.26
>1 Remedial class	0.00	0.04	0.26

The full regression model of Exit GPA is presented in Appendix A.12.

IX. Students No Longer Attending—Graduating with a Degree

The decision to pursue higher education requires careful consideration of benefits and costs involved. Degree-holding, from this perspective, becomes all the more important. The gap between life-time earnings of those differing in educational attainment: completing high school, some-college and graduating from college has increased over the last two decades. In this section, we discuss the results of our analysis for 1996 – 2000 CAPT students who are no longer attending higher education institutions. The Venn diagram in Section IV.B depicted the distribution of college bound students by their degree-holding status. For instance, a considerable number of students were still in college, however, the cohort analysis presented in Table 4 reveals that majority of these students are in the CAPT 2000 cohort, the youngest of the cohorts included in our analysis.

For students not in the public segment of Connecticut's education, the only graduation data available to the project was provided by the NSC but it covered graduation dates and degree information for 90%$^+$ of the target student population of the study. Concerned about the potential quality of institutional data like NSC's (when they as an institution report what other institutions have reported to them), for

[30] At CSU, non-remediation taking students have GPAs at or above the GPAs for all except the CAPT-test "deficient" group. It is a small point, but seemingly worthwhile, to point out how natural it is for persons ***not taking*** remediation in college who were told on the high school CAPT exam that they had serious deficiencies in Math to attain lower GPAs than those at the same CAPT level ***and taking*** remediation level

students who attended the Connecticut public high education institutions, we cross-checked the graduation data of NSC with the transcript information of students. In some cases we found the exact degree title from NSC was unknown, although NSC reported that the student was awarded a degree. But the difficulty with the degree data does not stem from this source as much as from cases when the NSC degree data are not up-to-date with the records of individual institutions (lags possibly either inside the institutional processing or inside of NSC). We found varying degrees of under-reporting for the public higher educational segments of Connecticut, 1.9% for UConn, 10.3% for CSU, and 4.7% for CTC. Much of this variation may stem from differences in individual campus reporting time frames relative to NSC's. For all possible cases when we had transcript information superseding NSC information, we used the former in place of the latter. The implication of such discrepancies for our analysis in this section is that rates and probabilities of graduation with a degree serve as a *lower limit* for actual graduation statistics, since underreporting of graduation records are more likely than over-reporting. Another reminder is also in order. The student population tracked in this study, CT's public high school students attending 10th grade between 1996 and 2000, constitute only a subsample of the total student population attending these institutions. Needless to say, higher education institutions also educate talented students from out-of-State and abroad. The results reported herein, thus, are not representative of institution based graduation records.

A. Graduation rates, All Sample

We begin our discussion on graduation by paying attention to the first and the last higher educational institution attended. Table 22, below, summarizes the graduation rates of students in each entering college segment by the last institute attended. As such, our focal point is to highlight the variations in degree attainment by transfer patterns. Such focal point should not be interpreted as the oft-cited "6 year graduation" rates in the literature and in policy discussions. For instance, the graduation rate for students who began and ended their higher education at the CSU system is at 52%, suggesting that out of every 100 students

Table 22: Percent of Students Graduating with a Degree by First and Last Institution

First Attending Segment		Last Attending Segment														
		CT Public			CT Private			MA & RI		NT		NY, NJ, and PA		Rest of US		Total
		CTC	CSU	UConn	CT 2 Yr	CT Select	CT H Select	Public	Private	Public	Private	Public	Private	Public	Private	
CT Public	CTC	0.15	0.51	0.68	0.59	0.63	0.89	0.40	0.65	0.58	0.49	0.43	0.71	0.39	0.27	0.26
	CSU	0.19	0.52	0.76	0.62	0.67	0.84	0.47	0.68	0.61	0.61	0.56	0.74	0.55	0.41	0.49
	UConn	0.21	0.67	0.82	0.78	0.80	0.94	0.49	0.82	0.77	0.85	0.75	0.85	0.66	0.67	0.76
CT Private	CT 2 Yr	0.15	0.52	0.74	0.44	0.62	1.00	0.25	0.63		1.00	0.75	0.82	0.16	0.29	0.40
	CT Select	0.14	0.55	0.67	0.80	0.73	0.75	0.41	0.82	0.71	0.57	0.45	0.82	0.54	0.51	0.66
	CT H Select	0.20	0.60	0.80	1.00	0.88	0.97		1.00		1.00	0.83	0.90	0.93	0.77	0.95
MA & RI	Public	0.15	0.59	0.69	1.00	0.52		0.57	0.53	0.50	0.25	0.56	0.69	0.52	0.35	0.54
	Private	0.13	0.56	0.73	0.60	0.68	1.00	0.30	0.79	0.59	0.48	0.48	0.81	0.62	0.70	0.73
NT	Public	0.16	0.51	0.74	0.50	0.59		0.35	0.63	0.69	0.52	0.48	0.73	0.45	0.46	0.61
	Private	0.13	0.43	0.70	0.88	0.70	1.00	0.42	0.76	0.21	0.72	0.25	0.76	0.45	0.53	0.64
NY, NJ, and PA	Public	0.13	0.44	0.69	1.00	0.54		0.30	0.70	0.44	0.50	0.65	0.69	0.52	0.53	0.61
	Private	0.17	0.53	0.74	0.71	0.64	1.00	0.55	0.87	0.80	0.50	0.48	0.82	0.66	0.65	0.77
Rest of US	Public	0.16	0.51	0.77	0.56	0.68	1.00	0.61	0.79	0.72	0.70	0.64	0.74	0.64	0.47	0.62
	Private	0.18	0.44	0.63	0.64	0.53	1.00	0.30	0.75	0.65	0.27	0.44	0.73	0.45	0.64	0.61
	Total	0.16	0.53	0.79	0.52	0.71	0.95	0.52	0.78	0.67	0.69	0.60	0.81	0.60	0.58	0.53

entering the CSU system, 52% leave with a degree. The graduation rate of students who began at CSU system and transferred to UConn and Connecticut's highly selective colleges are recorded at 76% and 84%, respectively, higher than the graduation rates experienced by the students who started and remained in the CSU system. This may be due to selectivity of students leaving being more focused on earning a degree, better facilitation in the student's new institution, but certainly none would have graduated from where they did without the push from CSU. This is one of the very important reasons for looking more carefully at graduation rates in the way presented here.

Higher graduation rates of transferring students, compared to their counterparts who stayed in the first choice of college is not always true, however. Transferring students who began their post-secondary education at private selective institutions tend to have lower graduation rates, compared to students who stayed in these same private colleges throughout the history of their higher education studies. Students who transferred from public flagship university of Connecticut, UConn, to the other public higher education institutions have lower graduation rates compared to students who completed their studies at UConn. In other words, while group averages point to the trends, in which direction transferring affects the probability of graduation for a student, all else equal, becomes an empirical question, likely to be different for different pairs of institutions.

The analysis used to assess the probability of graduation considers in addition to student background characteristics, the public vs. private and in- and out-of-State characteristics of the last higher education institute the student attended as well as information on whether the student transferred during the course of studies before the completion of higher education studies. The full model and its discussions are presented in the Appendix A.13.A. with base model summary predictions given in Table 23.

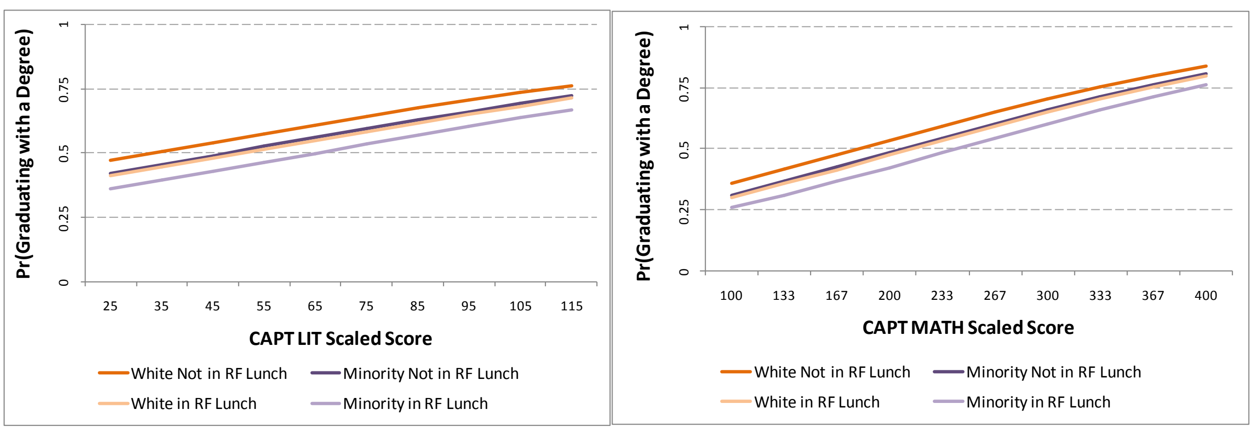
Table 23: Model Predictions of Higher Education Graduation by Explanatory Variables

	CAPT LIT & MATH			SAT Verbal & Math			CAPT & SAT		
	Probability	Diff.	MargEfct	Probability	Diff.	MargEfct	Probability	Diff.	MargEfct
Female	0.695	-0.073	-0.072	0.708	-0.103	-0.103	0.701	-0.085	-0.085
Male	0.622			0.605			0.616		
White	0.672	-0.055	-0.054	0.674	-0.060	-0.059	0.673	-0.055	-0.054
Minority	0.617			0.613			0.618		
Not in RF Lunch	0.668	-0.055	-0.053	0.668	-0.047	-0.046	0.668	-0.046	-0.045
In RF Lunch	0.613			0.621			0.622		
Private	0.710	-0.069	-0.070	0.709	-0.067	-0.068	0.708	-0.066	-0.067
Public	0.640			0.642			0.643		
Out CT	0.639	0.044	0.043	0.636	0.050	0.050	0.635	0.052	0.051
In CT	0.682			0.686			0.687		
Not Transfer	0.732	-0.247	-0.239	0.733	-0.248	-0.240	0.733	-0.248	-0.240
Transfer	0.485			0.485			0.485		
CAPT LIT (min.score)	0.474	0.293	0.003				0.502	0.253	0.003
CAPT LIT (max.score)	0.768						0.756		
CAPT MATH (min.score)	0.358	0.486	0.002				0.636	0.051	0.000
CAPT MATH(max.score)	0.844						0.687		
SAT Verbal (min.score)				0.543	0.184	0.000	0.597	0.104	0.000
SAT Verbal (max.score)				0.726			0.701		
SAT Math (min.score)				0.292	0.538	0.001	0.329	0.487	0.001
SAT Math(max.score)				0.830			0.815		

Of particular interest is how predictive 10^{th} grade CAPT exams remains years after its being taken and the comparison of this predictive capacity relative to the SAT exam. The results highlight that, as a predictor on its own, the probability that the student will graduate differs by 29 and 48 percentage points, between lowest and highest CAPT Lit and Math scores, respectively. Once SAT Verbal and Math scores are incorporated into the model, the predictive effect of CAPT weakens, and this weakening is especially prominent in CAPT Math scores. The probability of graduation for students at lowest SAT Verbal and MATH score levels are recorded as 54% and 29%, respectively, suggesting that at lower end of SAT Math scores, the graduation probability is weaker than that at lower end of SAT verbal scores.

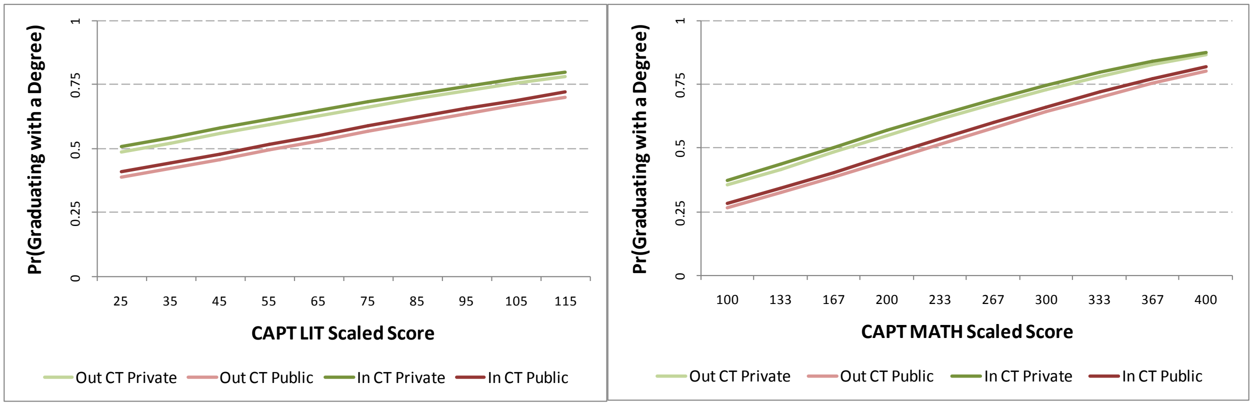
Male students, compared to female students, are less likely to graduate, and the probability of graduation with a degree is lower for students from disadvantaged backgrounds, compared to their counterparts from white and well-off families. To what extent the disadvantaged student backgrounds are multiplicative hindrances impeding the graduation success should be considered in detail in future (Alon 2008). An interesting comparison arises between in and out-of-State institutions at which the 1996 – 2000 CAPT cohort students attended. Students completing their higher-education at out-of State institutions had lower graduation probabilities than students whose degrees are awarded by the public higher education institutions of Connecticut. Whether the institution is public or private also matters in determining the graduation probability. At public institutions, the graduation probability is lower than the graduation probability at private institutions.

Figure 25: Model Predictions of Graduation by CAPT Score, Race and Ethnicity and Participation in Reduced or Free Lunch Programs



How do these factors affect graduation probability, if they are taken simultaneously into account? The probability plots in Figure 25, over the CAPT LIT and MATH score levels tell us how graduation probabilities differ depending on the student background. Minority students in reduced or free lunch programs during high school, at given CAPT test score levels, are less likely to graduate than white students also in supported lunch programs or than the students from better-off families. A comparison of the CAPT LIT and CAPT MATH probability plots further suggests that at the highest CAPT MATH score levels, the graduation probabilities are higher compared to the rates at high CAPT LIT score levels. On the other hand, at the lower end of scores, CAPT LIT predicts higher probabilities of graduation compared to CAPT MATH.

Figure 26: Model Predictions of Student Graduation by CAPT Score and Student Choice of Public and Private Institutional and in- and out-of State Attendance



A comparison of probability of graduation rates at public vs private institutions show that at the same CAPT Score levels students attending private institutions have a higher probability of graduation. Within the public segment of higher education across the US, CT's 1996 – 2000 10th grade public high school students who attend public higher education institutions in CT have a higher probability of graduation compared to their counterparts who attended public education instutitons out of Connecticut. While the results indicate a gap between public vs private, and in vs out of CT graduation probabilities, to what extent under-reporting of degrees cause these gaps warrants further analysis.

B. Graduation rates in the public higher education segment of Connecticut

While the above discussion on graduation probability has presented the results for all 10th grade students who are included in this study, there are many factors which we could not observe for this group. One factor is the remediation classes which prepare student for the college-level courses. In order to exploit the remediation data obtained from the transcript datasets, in this section, we limit our analysis only to students who attended the public segment of CT's higher education The full models for graduation of Connecticut public higher education students is presented in Appendix A.13.B.

Table 24: Model Estimates of Graduation from CT Public Higher Educational Institutions by Explanatory Variables

	CAPT LIT & Math			SAT Verbal and Math			CAPT & SAT		
	Probability	Diff.	MargEfct	Probability	Diff.	MargEfct	Probability	Diff.	MargEfct
Female	0.615	-0.105	-0.105	0.634	-0.125	-0.125	0.627	-0.109	-0.109
Male	0.510			0.509			0.518		
White	0.587	-0.095	-0.094	0.598	-0.100	-0.099	0.597	-0.095	-0.094
Minority	0.492			0.498			0.502		
Not in RF Lunch	0.573	-0.034	-0.034	0.584	-0.0323	-0.032	0.584	-0.032	-0.032
In RF Lunch	0.554			0.552			0.552		
Not in Public 2 Yr	0.626	-0.095	-0.095	0.638	-0.0948	-0.096	0.639	-0.097	-0.098
In Public 2 Yr	0.531			0.543			0.542		
CAPT LIT(min.score)	0.440	0.214	0.003				0.450	0.215	0.003
CAPT LIT(max.score)	0.654						0.665		
CAPT MATH(min.score)	0.481	0.164	0.001				0.546	0.065	0.000
CAPT MATH(max.score)	0.644						0.562		
SAT Verbal(min.score)				0.570	0.0186	0.000	0.562	0.049	0.000
SAT Verbal(max.score)				0.589			0.611		
SAT Math(min.score)				0.451	0.2109	0.000	0.482	0.161	0.000
SAT Math(max.score)				0.662			0.643		

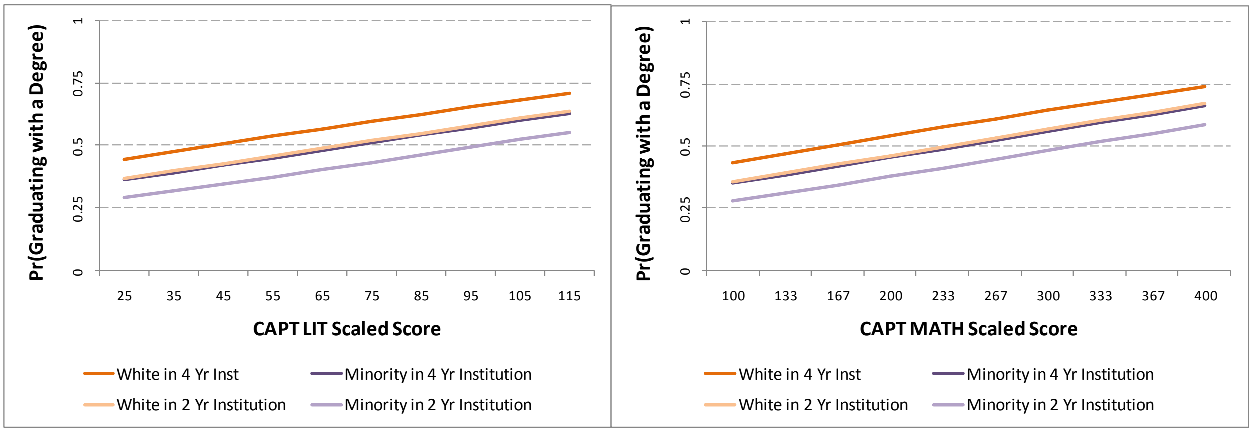
Two factors need be understood in order to correctly interpret our results. Public higher education institutions in CT are comprised of many campuses, each endowed with different missions in serving student needs. Secondly, the results reported pertain only to students who constituted the population frame of Next Steps, thus are by no means of representative of the graduation and degree holding records of the entire body of students attending these institutions.

Student characteristics appear as important factors in predicting the graduation probabilities of Connecticut public higher education students, much as they had for all students. Male students, compared to females, are less likely to graduate, a trend also observed for minority and reduced and free lunch program students in comparison to white students and students from better off families. All else equal, a student participating in CTC system has a lower probability of graduating with a degree, compared to students attending 4-year institutions. Certainly this occurs because of the greater variety of reasons and objectives that students come to community colleges; often these do not include obtaining a terminal degree.

The predictive power of CAPT and SAT exams for graduation probability is very close, consider the low end of CAPT MATH and SAT MATH scores. The model predicts that, all else equal, a student with a minimum CAPT MATH score, say of 100, will have a 48% chance of graduating, 3% percentage point higher than the value predicted by the minimum SAT MATH score of 200. In fact, when both SAT and CAPT exams are incorporated into the model together, low CAPT math scores predict a higher probability of graduation, 54%, compared to the prediction of the lowest SAT math score, 48%.

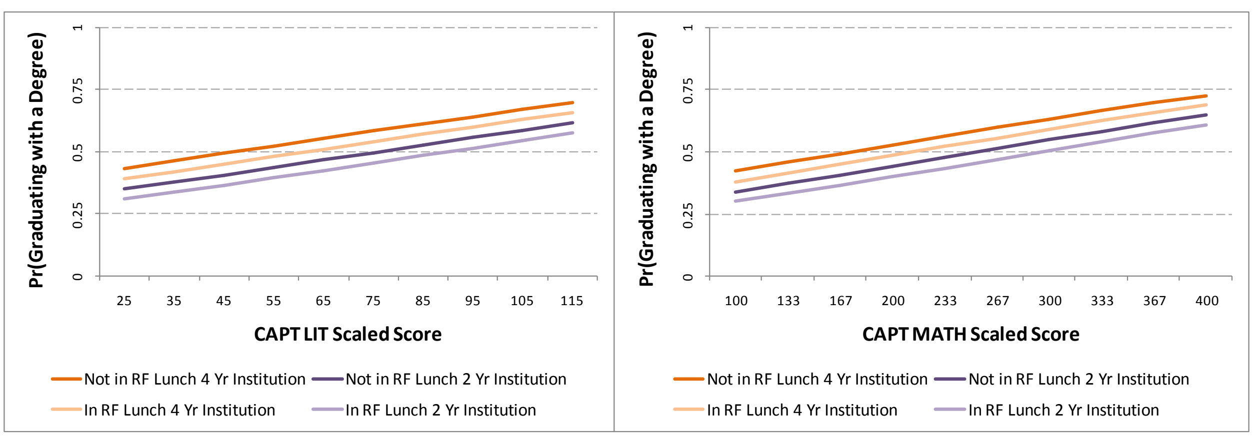
While the model predicts that minority students, students in public high school reduced or free lunch programs, and students attending 2 year institutions, at the same CAPT score levels, have a lower probability of graduation compared to their comparison groups, the cross-effects also illuminate how these factors, together, affect the predicted probability of graduation. The Figure 27, below, depicts these differences. At the low end of CAPT test score levels, minority students attending 2-year institutions are less likely to graduate than white students attending 4-year institutions. What is remarkable regarding the cross-effect of institution type and the student's background is the similar graduation probabilities for white students attending 2-year institutions and minority students attending 4-year institutions.

Figure 27: Model Predictions of Graduation by CAPT Score, Race and Ethnicity and Institutional Type



Compared to the cross effects we observe for the ethno-racial background of the students, the effects of family income and the type of institution, together, significantly affect graduation probabilities, these ranging from barely above 25% for students in low-income households attending 2-year institutions to nearly 75% for students coming from more affluent households in 4-year institutions.

Figure 28: Model Predictions of Graduation by CAPT Score, Participation in Reduced or Free Lunch Programs and Institutional Type



One possible policy discussion that can stem from our results here is a discussion on the short-term stop-out behavior of students with long-term drop out behavior and how graduation rates can be improved by increasing retention rates during the first critical semesters of students at Connecticut's public higher education institutions (Stratton et al 2005).

X. Labor Market Outcomes

The dataset used in this section is novel in allowing simultaneous analysis of three different success measures at different times of a person's life, (i) observed ability, CAPT LIT and MATH and SAT Verbal and math, during high school (ii) post-secondary education, and (iii) labor market earnings beyond college completion. These different measures can be analyzed together. In the previous sections we discussed the relationships between the first and second set of success measures, linking 10th grade CAPT exam scores to outcomes pertaining to higher education. The last success measure, the outcomes pertaining to the labor market earnings comes from the "Unemployment Insurance" (UI) dataset collected by the Connecticut Department of Labor. Specifically, the data allow us to answer the questions on whether 10th grade CAPT exam scores can be used as a predictor of successful outcomes in the labor market, whether there are any differences in labor market outcomes among students who attend post-secondary institutions, by their 10th grade exam scores. We ask this question not because we think that anyone evaluating a labor market candidate or participant utilizes a mid-high school test but because the CAPT tests to this point may provide a good idea of the person's raw talent.

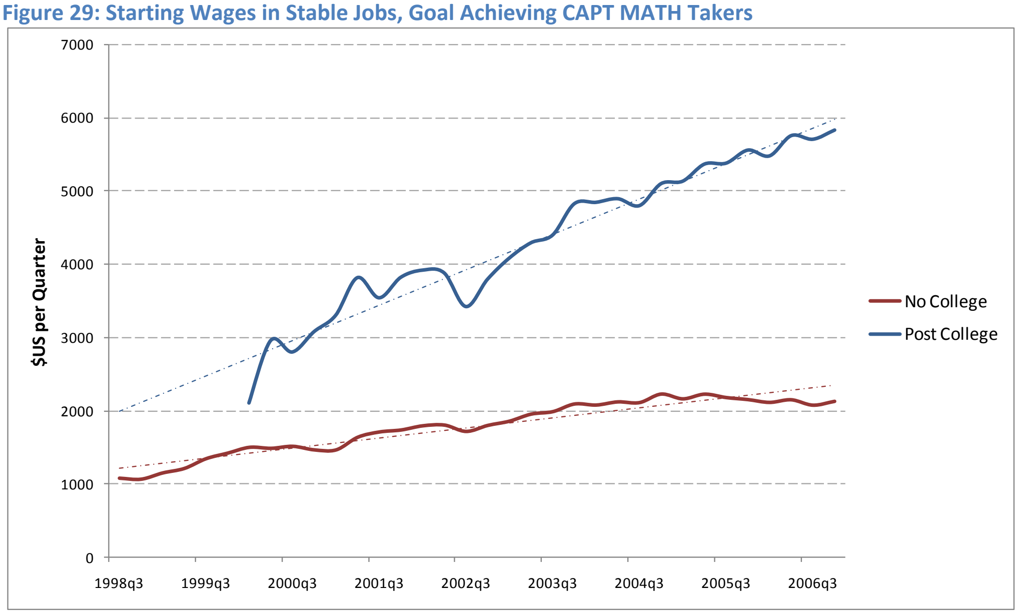
It is necessary, however, to highlight several drawbacks of the UI data. By its design, the UI data cover all except the self-employed, those in the military and working for the federal government, and some agricultural workers (Grubb 2002). Those working out of State are also not included in the data. This point is especially relevant for understanding labor market outcomes of individuals who continue to reside in CT but commute for work to neighboring states. We cannot make any assertions in relations to the groups excluded, such as the self-employed, or the labor market outcomes of graduates who left the State following the completion of their education. Since complete data on employment and unemployment states were not available, our analysis could not make predictions regarding the employment probability for the students who constitute the population in this study, conditioned on their educational outcomes. Our results are thus silent on a crucial economic success measure, securing a job in the first place, a concern much relevant for the students and their parents. There may be, understandably, many reasons for the "non-employment periods", such as maternal leave, illness, injury, participating in training programs, or taking time to pursue other activities, other than actively searching for a job.

Lack of hours worked further limits the depth and robustness of our analysis. Consider two individuals, earning similar levels, yet the first individual works far longer hours than the second one, depressing the former's hourly wages, the standard measure of productivity in the labor market. This drawback in the dataset prevents a rigorous understanding of the potential associations between schooling and labor market outcomes of the individuals. To the best of our ability, we tried to control such idiosyncratic differences but also will note when we suspect that our results may suffer from the inherent drawbacks of the UI data.

A particularly important missing component of the UI data is information on an individual's occupation. Having data on the occupation of the target population could be used in conjunction with the degree title and major information for the public segment of higher education, thereby facilitating the discussions on the demand for and supply of skills important in Connecticut's economy. Consider why such an analysis might be worthwhile; using 800 BLS occupational categories, Blinder (2007) predicts 22% to 29% of all US jobs will be potentially off-shored in a decade or two. Having data on occupations incorporated with degree major choices of the individuals in our study database would provide the opportunity to discuss the programs to support in the higher education institutions in relation to the jobs that will stay in the US and contribute to Connecticut's economy.

Despite these caveats, there are certain advantages in using the UI dataset for assessing the labor market outcomes of 10th grade 1996 to 2000 cohorts of public high school students in Connecticut. Stable job earnings data pertaining to the Connecticut labor market benefit students who may consider work options in the local labor market. Consider the following figure, Figure 29, which traces the starting wages of highest achieving CAPT students, some choosing some not choosing to pursue higher education. Although in this graph, we did not control for degree-holding status and years of education of individuals, the wedge in earnings between the college-educated and students with at most secondary-school is not specific to Connecticut (Katz and Murphy 1992, Blinder 2006). Despite its similarity to the national trend, the data generating the graph are obtained from early labor market experiences of the 1996 - 2000 10th grade public high school students working in Connecticut: the current young generation of tax payers. Administrators of higher education institutions and state level policy makers can assess the current conditions in the workforce and design policies to prepare the graduates for the conditions in the labor market accordingly. The analysis further opens the discussions about the pipeline from the public secondary schools and higher education to the workforce. We can assess for instance

Figure 29: Starting Wages in Stable Jobs, Goal Achieving CAPT MATH Takers



whether the students who were employed following graduation in Connecticut's work force were still employed by the end of study period, 2006.4. Tracing school success outcomes to the labor market therefore enriches the public policy discussion on the nexus of relations between secondary, higher education and the business community.

A. Participation in Connecticut Employment and Earnings

Keeping these caveats in mind, our discussion starts with the preliminary results on the broad categorization of secondary education choices and subsequent labor market outcomes of students who hold a CAPT score between 1996 and 2000 administered in Connecticut's public high school system.

Students traceable in the UI database by their CAPT achievement levels and their highest educational attainment are represented in Table 25, below. Among "Goal Achieved" students, the majority completed their education with a 4-year degree, and approximately half of these students began to participate in the labor market following the completion of their studies. By the end of study period, 2006.4, however, the percentage of highest achieving CAPT students who attained 4-year degrees, dropped to 45%, reflecting that over time, students in this group left Connecticut-based wage-employment. A comparison of the highest achieving CAPT cohort with a 4 year-degree with comparative groups of lower academic achievement levels but similarly with 4-year degrees indicates that the sharp drop following the completion of studies until the end of study does not apply to all students with 4 year degrees. For instance, of the students whose performance was "Competent" in 10th grade and who later pursued 4 year degrees, 64% of them remained employed, with only a 4% drop from their participation levels following the completion of their studies.

Among students who did not attend any college, even though they achieved the highest CAPT score level, 41% participated in the labor market, post their expected high school graduation. By the end of the study period, the last quarter of 2006, only 26% of these students continued to participate in CT's labor market as wage receiving workers. This group of workers are the least likely to stay in Connecticut's labor market, especially compared to other non college bound students whose CAPT score levels were lower. Within the group of students with "Need Remediation" CAPT levels, 65% worked following their expected high school graduation, although over time their share in the labor market dropped to 41%, but still higher than the participation levels of non-college bound students with highest CAPT achievement levels.

Table 25 also shows the percentage of quarters employed from the first to the last period during which we knew the person was employed[31] from the UI records. Students with higher education degrees tend to spend a greater proportion of their time employed, compared to non-college bound students. For instance, while non-college bound high CAPT achieving students spent 79% of their time employed, students with equivalent CAPT score levels, spent 89% of their time employed if they pursued a four-year degree post high school. Considering the fact that the duration of labor participation is shorter for college bound students, the differences in the percent of quarters employed point to the fact that non-college bound students are more likely to have fragile employment prospects compared to students with higher education degrees.

[31] We left out of these calculations any period of non-employment of 8 or more quarters which started prior to the last tracking date, 2006.4, and continued through 2006.4. This was done on the belief that most, if not all, so unengaged had either left the State or had at least minimally dropped out of wage work.

The last column in the Table shows the differences in average quarterly earnings for the group of students again by their CAPT achievement levels and higher-education outcomes. The group with the lowest quarterly earnings is the non-college bound students who attained “Deficient” evaluation in their 10th grade CAPT exams. Compare the quarterly earnings of these students with similarly non-

Table 25: Labor Market Outcomes by CAPT Scoreband and Educational Attainment

Sum of CAPT Scorebands, Math and Literature and Science*	Activity Post High School	No of Students	Worked in CT WF, following schooling	% Worked in CT WF, following school	Still in CT WF in 2006.4	% Still in CT WF in 2006.4	% Periods Participated in CT WF, following schooling	Average Earnings Per Quarter
Goal Achieved	No College**	6,795	2,790	0.41	1,741	0.26	0.79	3539
	Some College, incl. Certificates	19,180	14,126	0.74	10,139	0.53	0.86	5329
	Completed 2-Yr Degree	2,013	1,166	0.58	1,380	0.69	0.91	5840
	Completed 4-Yr Degree	25,141	13,071	0.52	11,348	0.45	0.87	6406
Competent	No College**	14,238	8,690	0.61	5,810	0.41	0.79	3542
	Some College, incl. Certificates	16,989	13,934	0.82	10,688	0.63	0.87	5093
	Completed 2-Yr Degree	2,087	1,304	0.62	1,504	0.72	0.91	5634
	Completed 4-Yr Degree	5,108	3,482	0.68	3,277	0.64	0.9	6274
Need Remediation	No College**	10,567	6,857	0.65	4,372	0.41	0.75	3078
	Some College, incl. Certificates	6,261	5,250	0.84	4,067	0.65	0.85	4464
	Completed 2-Yr Degree	466	314	0.67	356	0.76	0.89	5190
	Completed 4-Yr Degree	464	307	0.66	295	0.64	0.87	5829
Deficient	No College**	4,075	2,717	0.67	1,631	0.40	0.69	2648
	Some College, incl. Certificates	1,185	988	0.83	722	0.61	0.81	3982
	Completed 2-Yr Degree	38	19	0.50	28	0.74	0.92	5025
	Completed 4-Yr Degree	27	17	0.63	17	0.63	0.89	6217

college bound students whose CAPT performance was in “Goal-Achieved” category. Even though both group of students lack higher education credentials, students in “Goal Achieved” category command higher earnings than their counterparts with lower CAPT assessments. On average, a non-college bound student in the “Deficient” category earns 74% of the earnings of a “Goal Achieved” category student who also did not pursue higher education.

Indeed a comparison of changes in average stable wages[32] by highest educational attainment and CAPT achievement levels indicate that students with higher CAPT score levels begin their early work-careers with higher earnings than their lower scoring counterparts and their earnings tend to increase faster, controlling for their highest educational attainment. Compare for instance the earnings of the non

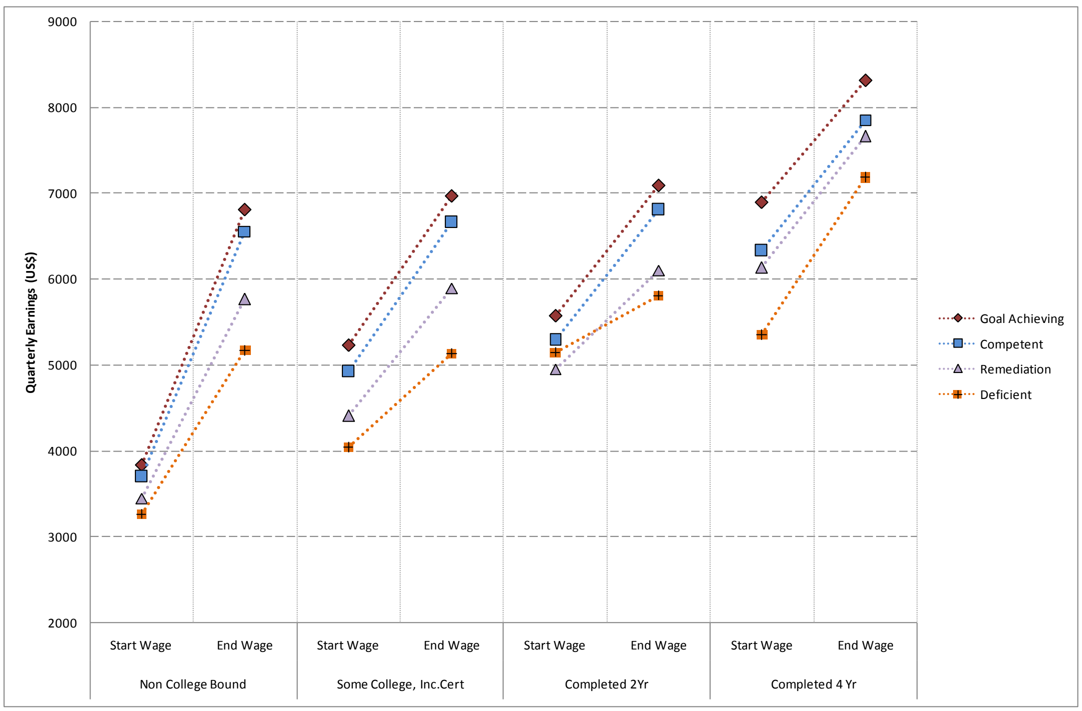
[32] We considered any period of employment a stable period of employment if a person did not change employer for at least three contiguous quarters. This definition of stable employment does not solve difficulties associated with:

1. not having the precise starting and stopping dates in the quarters of beginning and ending employment with a specific employer, and
2. not having hours of work per week through the entire employment period.

This definition potentially maximizes the probability that however much the individuals worked per week, they would, at least, have worked the full second quarter of a stable work period.

college bound students within “Goal Achieved” category with students in “Need Remediation” category, as depicted in Figure 30. In the first group, not only starting wages are higher, but also the increase in wages during the study period has been sharper compared to students within the latter category. Yet, there are undoubtedly returns to higher-education, especially to four-year degrees, as students in this group begin their work life with higher earnings than students with lower post-secondary attainment. For instance, by the end of study period, four-year degree holding students whose 10th grade CAPT exam category was “Deficient” had higher earnings than the non college bound students with “Goal achieved” assessment in 10th grade. We should also note that fragile labor market attachments of non-college bound students may play a role in the observed outcomes.

Figure 30: Starting and Ending Wages for Workers by College Attainment and CAPT Scoreband



While the Table and Figure above are useful in summarizing the labor market outcomes by CAPT and highest educational attainment levels, for high school students considering their higher education prospects and for policy makers considering the role of higher-education in preparing Connecticut’s workforce, an analysis of the higher education outcomes by the last institution attended, and by degree holding status will be equally informative.

We will begin with examining the distribution of 170,064 CAPT exam takers within Connecticut’s public high schools between 1996 and 2000, by their degree holding status. A remark should be made before explaining the outcomes. For the students with SAT exam record, but with no information in the NSC database, we can neither assess their last school attendance date nor their highest degree, so we will leave labor market outcomes of these students as “Not Available”, even though some of these student indeed were traced in the UI database.

Table 26: Labor Market Outcomes by Post-secondary Activity, including Last College of Attendance

		Population	Without Post-Secondary Degree					With a Post-Secondary Degree				
	Activity post high school	CAPT Students	Number of Students	Worked in CT WF following schooling	% Worked in CT WF, following schooling	Worked in CT WF in 2006.4	% Still in CT WF in 2006.4	Number of Students	Worked in CT WF following schooling	% Worked in CT WF, following school	Worked in CT WF in 2006.4	% Still in CT WF in 2006.4
		(1)	(2)	(3)	(4)=(3)/(2)	(5)	(6)=(5)/(2)	(7)	(8)	(9)=(8)/(7)	(10)	(11)=(10)/(7)
	No College without SAT	46,313	46,313	27,106	0.59	16,839	0.36	NA	NA	NA	NA	NA
	No College with SAT	13,933	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CT Colleges	CT Comm/Technical College System	26,777	22,578	20,624	0.91	15,617	0.69	4,199	2,685	0.64	3,248	0.77
CT Colleges	CT State Univ. System	15,019	7,129	6,434	0.90	4,900	0.69	7,890	6,295	0.80	6,197	0.79
CT Colleges	Univ of Connecticut	11,153	2,313	1,913	0.83	1,264	0.55	8,840	5,895	0.67	5,583	0.63
CT Colleges	CT 2 Year Priv	1,464	697	597	0.86	492	0.71	767	504	0.66	508	0.66
CT Colleges	CT Selective Private Colleges	3,963	1,169	1,005	0.86	777	0.66	2,794	2,036	0.73	1,952	0.70
CT Colleges	CT Highly Selective Private Colleges	644	29	19	0.66	6	0.21	615	285	0.46	194	0.32
CT Colleges	Still in College in CT	9,424	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Non-CT Colleges	MA & RI Public and Private	10,632	2,878	1,616	0.56	1,164	0.40	7,754	3,475	0.45	2,772	0.36
Non-CT Colleges	NT Public and Private	3,505	1,130	687	0.61	438	0.39	2,375	989	0.42	746	0.31
Non-CT Colleges	NY, NJ & PA Public and Private	10,195	2,445	1,243	0.51	786	0.32	7,750	3,097	0.40	2,185	0.28
Non-CT Colleges	Colleges Rest of Country	13,047	5,370	1,778	0.33	1,229	0.23	7,677	2,168	0.28	1,440	0.19
Non-CT Colleges	Still in College in Rest of Country	3,831	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Segment Unknown	164	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Total	170,064	92051	63022	0.68	43,512	0.47	50,661	27,429	0.54	24,825	0.49

The table groups students at several levels; by the last college attended, and whether NSC denoted these students as “degree holders”. For comparative purposes, we also add the outcomes for non-college bound students.

Students who attended C&TC system and completed their studies with a degree are more likely to be observed in Connecticut’s work force by the end of study period, compared to the students who completed their studies without a degree, 77% and 69%, respectively. The table also shows that the highest participation in Connecticut’s workforce comes from students who attended C&TC ad CSU systems, independent of their degree-holding status. For instance, 90% of students who finished their higher education in CSU without a degree participated in the labor force following the end of their schooling; by 2006.4, 69% of these students were still participating in the workforce. Among students who hold a degree from the CSU system, 79% continued to work in Connecticut’s workforce following the completion of their higher education until 2006.4. A comparison of students from CTC and CSU system with the students attending private higher education institutions indicates that public high school students of Connecticut, who attended the public segment of higher education, are more likely to participate in Connecticut’s workforce than public high school students who attended private segment of higher education. Among the public higher education institutions, public high school students attending UConn are the least likely to participate in the work force, independent of their degree holding status.

The students who were 10th grade public high school students between 1996 and 2000, and who subsequently left the state to pursue higher education out of State were the least likely to come back to participate in the workforce. While non-degree holding students who attended higher education institutions out of Connecticut were more likely to come back and participate in workforce compared to degree-holding counterparts, their participation rates were still lower than the participation rates of students who stayed in Connecticut for higher education.

The table above summarizes three important points for various stakeholders in Connecticut's schools and labor market. First of all, public high school students pursuing higher education in Connecticut are more likely to participate in Connecticut's work force than public high school students who leave Connecticut for higher education. Secondly, among these students, students who attended public segment of higher education in Connecticut are more likely to continue participating in the work-force compared to students who attended private segment of higher education. Degree-holding also appears to be an important factor. Students who attended public segment of higher education are found more likely to stay in Connecticut and work for remuneration by the end of the study period, 2006.4, if they completed their studies with a degree.

While determining who will continue to participate in the workforce is an important issue for policy makers, what is equally important is providing information to high school students and their parents as they consider their options for higher education and the returns to their investment in schooling. Degree-holding students, compared to their non-degree holding counterparts, tend to participate in the workforce more often. Students who attended the CSU system without obtaining a degree participated in the workforce 87% of the time, which is lower than the percentage for students who finished their post-secondary education in the CSU system with a degree. As Table 27 shows, the students completing their higher education in Connecticut with a degree command higher earnings than their counterparts who left the State for higher education and those students who completed their higher education without a degree. Students completing higher-education studies with a degree on the average commanded higher earnings in the labor market, than students who attended the same institutions but dropped out. Note that, in addition to contribution of having a college degree to an individual's earning potential, this result may reflect another factor: Higher earning students with degrees may be more motivated, carrying their motivation to their endeavors in the labor market, compared to their non-degree holding counterparts. Employment by industry also shows differences by degree-holding status. Retail industry absorbs the majority of non-degree holding higher-education students, whereas degree-holding students are more likely to work in industries requiring professional credentials, such as health care and education. Indeed Person and Rosenbaum (2005) report in occupational 2 year colleges, the school-industry collaboration in job placement services increases the likelihood of timely degree attainment and post-degree employment probability.

Table 27: Labor Market Outcomes by Post-secondary Activity including Detailed College of Attendance

		Without Post-Secondary Degree					With Post-Secondary Degree				
	Activity post high school	Traced in CT WF following schooling	% Periods Participated in CT WF	Average Earnings Per Quarter (current $)	Most Frequent Industry at entry	% Working in Most Frequent Industry	Traced in CT WF following schooling	% Periods Participated in CT WF	Average Earnings Per Quarter (current $)	Most Frequent Industry at entry	% Working in Most Frequent Industry
CT Colleges	No College without SAT	27,106	0.75	3069	Retail	37.04	NA	NA	NA	NA	NA
	CT C&TC System	20,624	0.87	4887	Retail	27.15	2,685	0.92	5736	Health Care	23.85
	CT State Univ. System	6,434	0.88	5288	Retail	28.05	6,295	0.93	6691	Education	21.35
	Univ of Connecticut	1,913	0.83	5007	Retail	25.36	5,895	0.89	7074	Professional/Scientific; Education; Health Care	14.11; 13.20;
	CT 2 Year Priv	597	0.89	5154	Retail; Health Care	22.93; 22.73	504	0.90	6449	Health Care; Education	28.1; 25.22
	CT Selective Private Colleges	1,005	0.88	6354	Retail	19.86	2,036	0.90	7091	Health Care; Education	16.19; 15.11
	CT Highly Selective Private Colleges	19	0.73	3110	Education; Arts	17; 17	285	0.82	6956	Education	29.03
Non-CT Colleges	MA & RI Public and Private	1,616	0.81	5221	Retail	22.03	3,475	0.82	5904	Education; Retail Trade	15.65; 12.91
	NT Public and Private	687	0.81	4954	Retail	20.96	989	0.81	5118	Education; Health Care	13.98; 13.80
	NY, NJ & PA Public and Private	1,243	0.78	4994	Retail	23.48	3,097	0.81	5965	Education	16.27
	Rest of Country Public and Private	1,778	0.75	4498	Retail	22.82	2,168	0.78	5127	Education	15.38

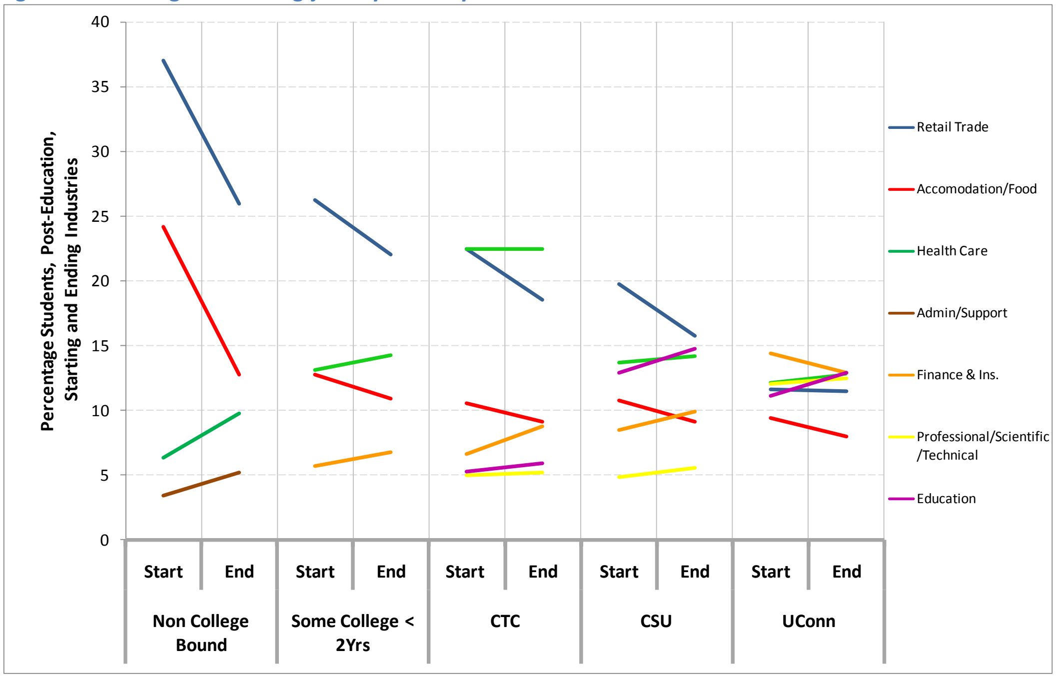
There are also significant differences in earnings depending on the geography of the last higher-education institution attended. Connecticut's public high school students who selected to attend higher education institutions in Connecticut command higher earnings in the labor market compared with the students who completed higher education out of State. This trend applies to both degree and non-degree status students.

B. Participation in the Connecticut Workforce by Industry

Tables reported in the previous section summarize the nexus of the relationship between higher education institutions and firms operating in Connecticut. High school students destined for higher education in Connecticut appear more likely to be among the many working for Connecticut's firms if they attended public higher education and if they hold a degree. Therefore, increasing support from the business community to the public segment of higher education to retain the high school graduates helps in preparing the future workforce in Connecticut. For public higher education, which supplies a significant share of the State's workforce from students who attended public high schools in Connecticut, bolstering the rate of degree holding benefits not only the industries seeking specialized workers, but also the earnings status of students.

Figure 31 depicts the differences in the Industry of employment, comparing non-college bound students with students who finished their higher-education with a degree in public higher education. We have to remark that while employment by industry is informative, it falls short of capturing full-utilization of individuals' skills in the labor market via matching their college majors with occupations. In the future, a dataset including occupational choices of individuals should expand on this shortcoming. The retail industry absorbs the majority of non-college bound students at the beginning of their

Figure 31: Starting- and Ending-jobs by Industry and Educational Attainment



work careers. In time, the share of retail industry employment drops, but still a significant number of non–college bound students are locked into jobs in the retail industry. As the years of schooling increases, industry composition also changes. Compared to non-college bound students, fewer students with some college education enter the retail industry, and most diversified distribution of employment across industries is observed among UConn graduates. Furthermore students who completed higher education with a degree are unlikely of being locked into a particular industry. The industrial distribution of employment suggests that higher education provides students with more flexible options in the State's workforce.

C. Education and Workforce Empowerment

Starting wages, i.e. the earnings for the first stable job of students who attended public higher education institutions, are grouped by the students' gender, ethno-racial background and by family poverty and are summarized in Figure 32. The first panel of the figure compares the averages by the degree-holding status of female and male students. With or without degree, female students, on average, start their early work career with lower earnings than their male counterparts, and this holds for all public segments of higher education in Connecticut (for similar conclusions from nationally representative samples, see Bobitt-Zeher (2007) on US graduates and Frenette and Coulombe (2007) on Canadian graduates). The differences with respect to degree-holding status for minority students and for poor students are shown in the second and third panels. Unlike what the data reveal for gender earning differentials, for minority students degree-holding has a premium in the labor market. Minority students who become college drop-outs are more likely to be penalized in the labor market compared to white students with similar credentials, however, the trend is reversed for the group of degree-holding students. A similar pattern is also observed for poor students; students from less well-off families tend to earn more if they hold a degree compared to non-poor students in Connecticut.

While this earnings premium to minority and poor students in the labor market is heartening, a myriad of explanations for this trend, other than degree holding status of the individuals, is possible and thus our result warrants further sensitivity analysis. What might be alternative explanations? Consider how female graduates, notoriously known for their shorter work hours due to family obligations, earn less than their male counterparts. Degree holding students from disadvantaged backgrounds, in comparison, may work for longer hours, thus earn more in total earnings, than their counterparts. To the extent that this explanation is true, working longer hours may depress the individuals' hourly wages, the customary measure of labor market success. Simply put, while higher total earnings are suggestive of importance of returns to education for students with disadvantaged backgrounds, without data on hours worked, the result obtained here is in fact inconclusive.

Note also that in this exercise we neither controlled for occupation/industry of the individuals nor their college majors, , a proxy measure of their skills. Minority students and students from poor families may opt to gravitate toward certain occupations with skill shortages. Dale and Krueger (2002), using the College and Beyond dataset, report that students from low income families earn more if they attend highly selective colleges. The relationship between choice of major and earnings is another factor that should be considered, as reported by Loury and Garman (1995). Secondly, the industry and occupational choices are not controlled for in this exercise. If students from disadvantaged backgrounds are more likely to choose employment in industries with skills shortage, such as health care and education, then an earnings premium at the beginning of work careers is expected. Thirdly, group-level averages are only helpful to explain individual outcomes to a certain degree. The literature has discussed many other individual traits as important determinants of earnings (Bowles, Gintis and Osborne 2001).

We discussed in the previous sections that minority students and students in supported lunch programs are found less likely to attend college and, if they do, are less likely to graduate. It is indeed plausible that these degree holding minority and poor students are more motivated than any other group in our study, and in fact represent a select group of individuals. Murnane et al (2001) as an example report academic, psychological and skills relating to mental accuracy are all statistically significant in predicting subsequent wages. Lastly, as much as the first stable job-earnings is a crucial indicator, for policy purposes, a comparison of earnings at individual level for a longer time period is also needed in order to assess the individual returns to education in a robust way. We discuss a basic model for average work life earnings in Appendix A.15.

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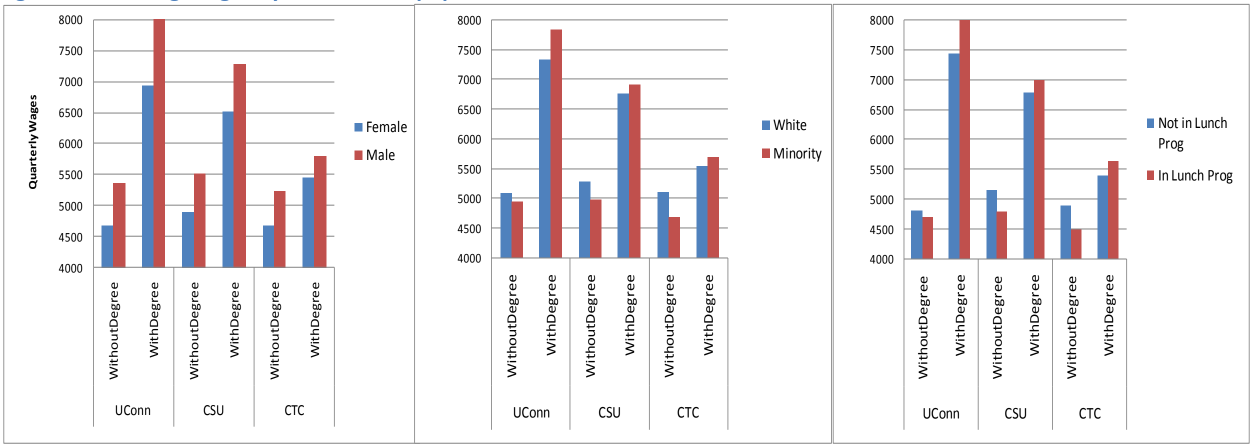
Figure 32: Starting Wages by Student Sub-populations



D. More on the Connecticut Brain Drain—Employment in Connecticut of Those First Starting Work in Connecticut beyond Completion of Highest Level of Attainment

We have talked about brain-drains that occur as Connecticut public high school cohorts of 1998 – 2002 make certain key educational decisions, including:

1. some of the high achieving students choosing not to go to college at all after high school,
2. some other students beginning college out-of-State, and
3. yet other students making college decisions to transfer out-of-State than returning to the Sate.

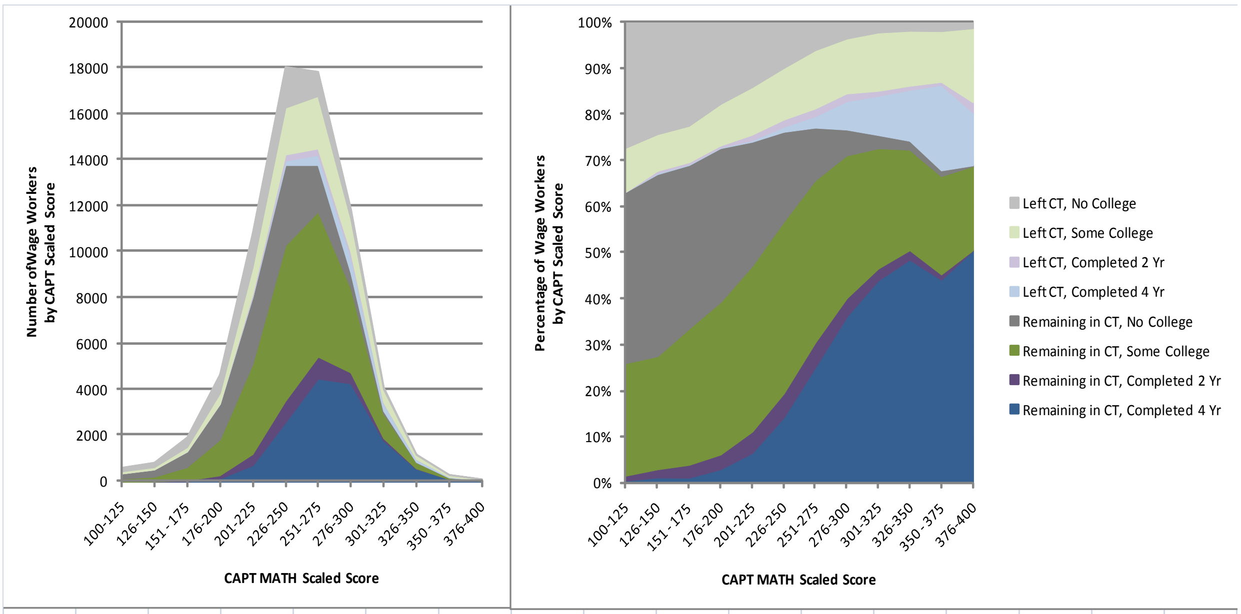
These represent independent decisions by students which together represent three forms of brain-drain. The additive effect of these three brain-drains described in the previous section is enough to alert Connecticut of not having sufficient numbers of qualified workers to continue to appropriately fuel the economy. Now, finally in this section, emanating from our focus on education's role in these brain-drains but having worked with the Connecticut Department of Labor UI wage record database, we press into evaluating a fourth brain-drain: how large a proportion of the public high school students, employed in Connecticut after completion of all of their academic work (with or without degrees, but no longer attending school), remain in Connecticut at the end of the study period, 4th quarter 2006?

If persons employed in Connecticut after college or high school are not employed at the latest period through which we could possibly track them, these persons represent a brain-drain to the Connecticut workforce. This is true, even if individuals are temporarily out-of work because of unemployment, voluntarily not working for wages (e.g., to raise a family), in the armed services, imprisoned, or out-of-State working elsewhere. The only cases in which persons are not fully part of the brain-drain is when they do not show in Connecticut's workforce data because they are employed Federally or they are self-employed or deceased.

Figure 33 depicts the proportion of the initial population cohort, employed at some time in Connecticut after finishing their last academic experience (i.e., no longer enrolled in school or college). This Figure shows how many of the limited, working cohort:

1. left Connecticut employment (whether or not they had left Connecticut itself)—shaded in black and white, or
2. remained at 2006.4 in Connecticut employment—shade in full color.

Figure 33: Connecticut Employment in 4th Quarter 2006 by Educational Attainment--Connecticut Public High School Graduating Cohorts from 1998 to 2002 Beginning Work in Connecticut post-Completion of Highest Level of Education



For each group, Figure 33 shows additionally what the sub-group's educational attainment was: no college, some college, a 2-year degree, or a 4-year degree. Across all groups, we plot the number and percentage of students against Connecticut's scaled CAPT test scores and highest educational attainment.

Such non-retention of human potential employed, post-completion of education, in Connecticut's labor market seems not a responsibility to be laid on the educational system—the secondary schools, colleges and central educational policy makers. This factor must primarily be addressed by government and the business community.

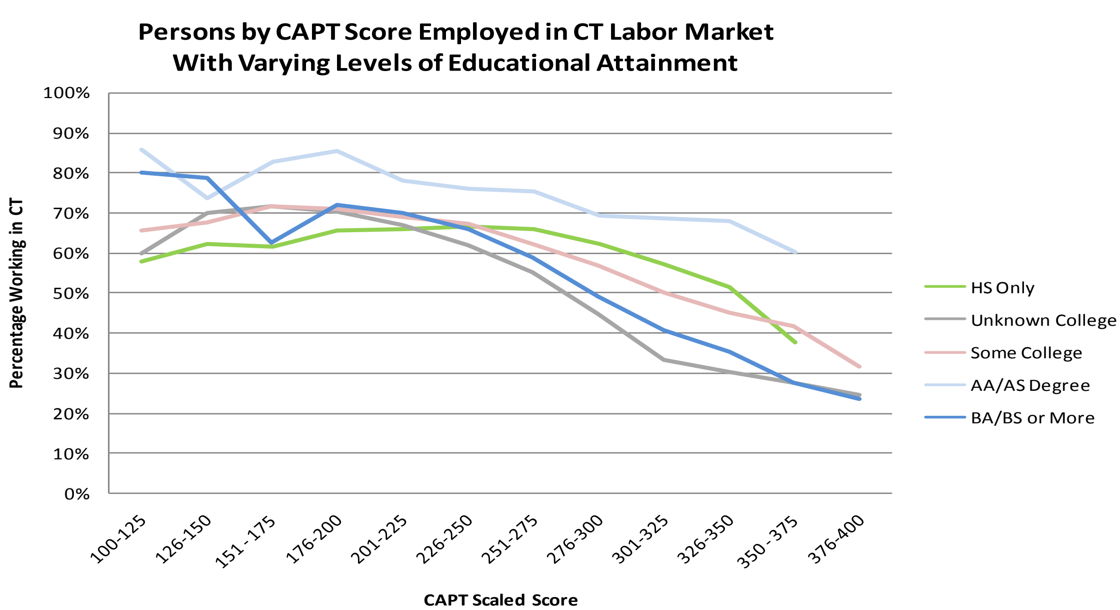
Looking at the loss identified in Figure 33, almost equal percentages of workers across all levels of CAPT scoring. The solid colored lines go pretty smoothly across the graph in the right panel, across higher (and lower end CAPT scorers), implying that about 70% of those who started in Connecticut after school stay employed through the study period, regardless of CAPT scoring level. This, 70%, is a higher percentage of the relevant population to be left with than the enrollment losses associated with brain-drain II and III. But a 30% loss is actually very large, given the rather short period of time many education completers have been in the labor market. We would have to ask the question: if we look five years from now, what will be the proportion remaining in Connecticut? The issue here is that these students, post-completion of their education, have been in the labor market and out-of-education, maximally for only 4 - 8 years (for those not going on to college, depending on their graduation cohort), 2 – 6 years for associate degree holders, and 0-4 years for baccalaureate holders. Clearly this is too short of a time to have had the 30% attrition rate already seen from this workforce.

E. The Conclusion from Connecticut Brain-drains I - IV—Employment in Connecticut of the Public High School Cohorts of 1998 - 2002

In the end, we can put all the work on brain-drain losses together to look at the full, initial cohort, the entire group of 170,064 CAPT takers from Connecticut public high schools. When we check whether this group is still employed in 2006.4, we find the results shown in Figure 34 on retention of persons by level of educational attainment and in Figure 35 on whether the group is or is not still in state by earned educational attainment.

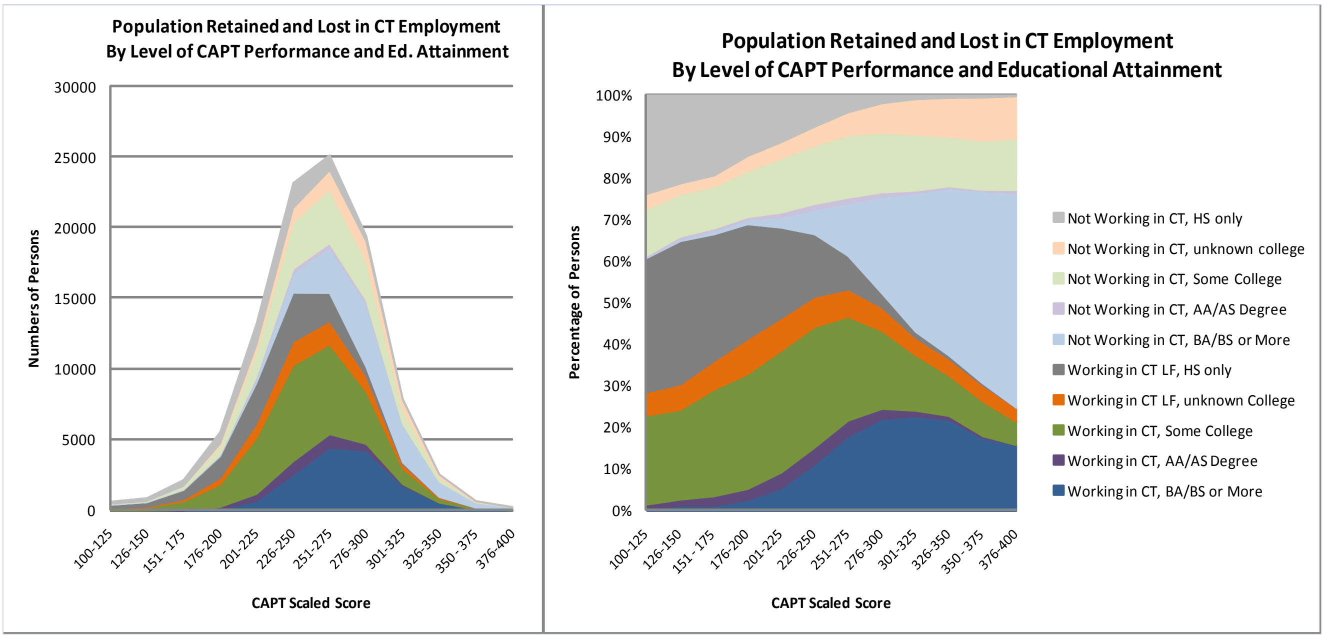
We see in Figure 34, that retention in in-State employment falls off for persons with higher levels of CAPT MATH skills, ranging from retention of approximately 60 – 80% of the lowest scoring CAPT takers to 25 – 35% of the highest taking CAPT takers. BA/BS holders fare worse than any other group than those with unknown colleges, and we know from institutions that supply data to NSC, that these are most likely to be persons with BA/BS's or some college, working toward BA/BS's. Those with AA/AS degrees are the most likely to be employed in Connecticut. The observed mobility of high scoring public high school students suggest that the employment prospects in Connecticut may be failing to capture the talent of sons and daughters of Connecticut tax payers.

Figure 34: Percentage of Persons Working in Connecticut by Educational Attainment, 4th Quarter, 2006



The observed out-of-State employment shift of CT's highly talented public high school students suggest that employment prospects in CT may fail to capture the utilization of talent mobility. Thus, the Figure suggests that it is worth investigating to determine whether job conditions and market opportunities in-State are better for AA/AS degree holders than for BA/BS holders.

Figure 35: Connecticut Employment in 4th Quarter 2006 by Educational Attainment--All in Connecticut Public High School Graduating Cohorts from 1998 to 2002



The right panel of Figure 35 shows the distribution of persons by education level available as a talent pool to the State. The effects of all brain-drain losses on this distribution can be observed. Those with talent enough to go onto college but who don't, get trapped as part of the areas represented either in green or shaded with black and white horizontal lines, depending on whether they went out-of-State. Through losses of persons starting out-of-State or transferring out-of-State and not coming back, we find that the shaded areas representing losses of persons from the State are large, especially on the right side of the CAPT score distribution. And the losses of persons starting work in Connecticut, but quite quickly shifting out-of-State are also represented in the shaded areas. There is no wonder therefore, why only about 20% of the top CAPT scorers remain in Connecticut, remedies for which will require a dialog among the business, education and government sectors.

Note however, our results are open to debate. The figure shows only gross out-of-State migration. It is quite possible that talented students from other States and abroad choosing CT for their higher education studies may opt to stay in CT post completion of their studies. To what extent the "net" flow of high achieving individual measures vis-a-vis the reported "gross" out migration in CT's workforce is not within the capability of the dataset allowed in this project, as the population includes only public high school students of the State. Yet, it should be noted that this discrepancy between "net" vs "gross" out migration does not prevent the implications of Figure 35 for public policy, such as State and local tax revenue prospects. It is well known that highly educated persons do not only earn higher wages but also pay higher taxes. Therefore, the extent to which high achieving public high school students with college degrees prefer to stay in or move out of CT for work has bearings on the tax revenue prospects of the State, local communities and school districts, which supported education of highly talented students by local taxes.

XI. Policy Conclusions and Study Recommendations

A. List of Conclusions

Before moving on to the policy recommendations of Next Steps, we recapitulate the major findings of the study.

1. The 46.8% of Hispanic, 41.3% of Other, and 37.7% of Black high school students who do not continue on to college, shown in Table 5, Section V are significant relative to the 18.5% of Asian and 21.9% of White students who do not continue on to college. Given the steady increases in the population proportion coming from minority groups with high rates of non-continuation, the State goal must be to reduce minority non-continuation to White and Asian rates. This will take counseling and support activities in the high schools, financial assistance, and particular attention to those who are high performing on high school tests but who still seem not to continue schooling.

2. CAPT scores effectively predict educational and labor market successes, leaving no question that CAPT is an effective test (Sections VII.A, VIII.D, IX.A) We find strong associations between a student's performance in CAPT exams and subsequent success measures in higher education, including all measures of attending college, credits earned over the semesters and graduation probability. Within the non-college bound student population, high achieving CAPT takers realize higher earnings than their less successful counterparts. The current study spends less time in presenting the relevant evidence on SAT versus CAPT tests, but there is also little doubt that the SAT is similarly also a very good test (Section VIII.C, Appendix).

3. Plenty of evidence exists that the CAPT and SAT tests are not fully aligned, each measuring a variety of student capabilities at different grades and at different times in students' high school careers (Section VI.B, VIII.A) At various, different mean SAT test scores, the overlap of CAPT score achievement bands is remarkable. Yet, there are further differences in predictive power of these tests: SAT test scores predict remedial course taking in college better than CAPT exam scores, and SAT Verbal and CAPT LIT exams predict time to start college in opposite directions—while higher CAPT LIT scores are associated with earlier enrollment dates, higher SAT Verbal scores are associated with delays in enrollment. In the case of both exams, the effect of test

scores on time to begin college is marginal, compared to other factors, such as gender, participation in supported lunch programs.

4. Institutions should use both exams to understand the full scale of student capabilities because each exam appears to measure some but not all of student capabilities; the exams are far from perfectly correlated. While colleges are not using CAPT scores in making admission decisions, the data suggest that the CAPT exam has utility for such decisions (Section VI.C).

5. CAPT gives a robust indicator of the likelihood that a student will go on to college at high school's completion, the probability of going to college rising from just under 25% for low scoring students (considering CAPT LIT and at lower probabilities for low CAPT MATH scorers) to probabilities of over 90% for high scoring CAPT takers. The probabilities of college attendance seem to be affected by variations in income levels as much as by race and ethnicity, gaps that quite possibly could be eliminated by an incisive financial aid programs (Section VII.B).

6. We have retested and confirmed in this study the critical finding from **Connecticut First Steps** that too many of the brightest Connecticut public high school students fail to go on to college at all. While the percentage of goal achieving CAPT MATH students who did not go to college fell from nearly 10% in the class of 1998 to stabilize at just over 8% for the class of 2002, the ratio is still too high a percentage to accept. (Section V) While many of those who fail to go on to college are the white student majority (because the numbers in this population group are large), there are higher proportions of goal-achieving Hispanic and African American students who fail to go on to college.

7. We found from earlier studies (**New England 2020** and **Connecticut First Steps**) that Connecticut is confronted by student out-migration for college that absorbs many of Connecticut's brightest high school graduates (Section VIII. B.3). For this reason alone, Connecticut is likely to have a significant problem in keeping an adequately prepared labor force. The current study reinforces and extends this conclusion with far more detailed findings that show the result repeated over multiple years. This loss, at the stage of student college choice, is the first major source of "brain-drain" identified in this study. Such brain-drains are sources of workforce development losses that the State might choose to plug.

8. UConn has played a major role in improving the State's ability to keep the brightest in-State, increasing the University's draw of top CAPT MATH students from just over 10% of the class of 1998 to approximately 33% of the same level students in the class of 2002. In this respect, the competitiveness of CT's public flagship institution vis-à-vis out of State higher education institutions improved significantly over the course of study period (Section VIII.B.3, Figures 11 and 12) .

9. By carefully analyzing the transfer patterns of students among colleges, the current study shows that a second major "brain-drain" occurs as Connecticut colleges lose more students starting

college in Connecticut to out-of-state transfers than they gain from the reciprocal into-state student transfers (Section VIII.B.4). “Net out-migration” through transfer happens in both private and public segments of higher education—but, relatively, such net out-migration occurs more in the private than in the public higher education sector; among the public segments, it also happens significantly at UConn negating some of the gains ascribed to UConn in conclusion 7. CSU is the only segment with a positive net in-migration through transfer. Overall, the State loses 20.2% of students who start college in-State to out-of-State colleges. It gains back only 15.9% of those initially starting out-of-State for in-State college enrollments. There are, however, undoubted large variations within campuses of each individual public higher educational institution which have not yet been analyzed and which require further analysis.

10. Higher CAPT scores (and SAT scores) are associated with students going to schools with higher selectivity (Section VIII.B.4, Table 16). But, it is instructive that the ranges in student CAPT scores overlap significantly among the types of public higher education institutions in the State, leading us to conclude that State campaigns encouraging and empowering students, emphasizing the role of higher education wherever they go are appropriate (Section IV.B, Figure 5).

11. The comprehensive evaluation of students' starting and finishing institution shows greater institutional interchange of students among the various segments of higher education than might have been anticipated (Section VIII.B). With such student mobility, a globally competitive workforce calls for placing high focus on developing State-level pre-K through 16 educational-demographic objectives, involving players simultaneously from education, government and the private sector; and developing specific demographic-economic policies.

    The Next Steps study confirms that institutions matter a great deal, but a focus on what strength each institution can bring is clearly important. Many components of the higher education system, public and private, fuel Connecticut's workforce:

    a. Much of the role of educating Connecticut public high school graduates falls on public in-State colleges (59.2% of Connecticut public high school graduates start and 56.3% finish their higher educational programs in Connecticut public higher educational institutions while only 5.3% start and 6.2% finish in Connecticut private educational institutions),
    b. Significant percentages of Connecticut high school graduates go out-of-State to college (35.5% of starting and 37.6% of finishing students),
    c. Generally, the highest percentages of students starting and finishing in the same segment is a characteristic of the private institutions—especially the Connecticut highly selective private institutions (of students who started in this segment, 81.59% finished therein). This high percentage is next followed by the Connecticut selective private institutions (at 71.88%). But, the public Connecticut segments rank not far behind—a surprise, given the usual assumption that public institutions have more mobile student populations. It is remarkable that the Connecticut Community Colleges have the

highest finishing post secondary education rate for students starting in the Connecticut public segments—71.5% of students starting in the Community College system end their post-secondary education in the segment in which they started. This deserves further evaluation; as the lower bound graduation statistics indicate only 15% of those who finish obtain degrees. Community colleges are complex institutions, with multiple missions and outputs. Some of the discrepancy between these two statistics, 72% finish vis-à-vis 15% degree holding is accounted for by the specialization of student programs in the Community College system that end without degress, but for many, we must ask whether those deciding that college is not for them have sampled broadly and late enough in their lives to make such a pivotal decision. In any case, the high community college rate of completion without transfer is followed by CSU at 67.0% and then by UConn at 66.5%.

   d. The Connecticut highly selective institutional segments generally take more students (i.e., they are net gainers) from other types of institutions than they give up to those other segments. Within the Connecticut public higher education institutions, CSU is most like this example set by the highly selective privates.

12. Once enrolled in college, CAPT (as well as SAT) acts as an indicator of potential student performance. Higher CAPT scores, in MATH or LIT, are associated with steadier and stronger progress in earning credits. At the end of eight semesters, for example, CAPT MATH goal-achieving students on average have earned almost 40 credit hours more than CAPT MATH deficient students. Differences in credits earned (a bit greater than 20 credits) at the end of eight semesters are not as great for CAPT LIT goal-achieving and CAPT LIT deficient students (Section VIII.D) .

13. Remediation, across all of the public campuses, is highly related to CAPT LIT and CAPT MATH scores. The probability of taking remediation is close to 100% for low scoring CAPT students and falls nearly to negligible levels for high performing CAPT students. The probability of association is somewhat different for CAPT LIT than for CAPT MATH. Such a relationship between CAPT and remediation in college is expected and occurs in each of the public segments. The results are indicative that college bound students with relatively low CAPT scores at tenth grade may benefit from remedial work while still in high school.(Sections VIII.C.1 to VIII.C.3)

14. Post-secondary remediation in Connecticut public colleges has achieved payoffs across all segments. For those classified as CAPT MATH deficient, remediation produces similar GPA levels to those of students without remediation (Section VIII.F, Figure 24).

15. Because of the high degree of institutional connectivity in student careers, student degree earning is not well shown in the usual “6-year institutional graduation rates.” While only 15% of students graduate when they start and stop with their work in the Community and Technical College system, we observe that this alone is a wild understatement of community college effectiveness. For those transferring from community colleges to CSU, 51% complete with at

least one degree, nearly as good as those who start and stop directly in the CSU system. 68% who go on from a beginning in Connecticut community colleges to end at UConn complete their studies with at least one degree. It is further remarkable that those starting in the community college system, as compared to those in the CSU system and the UConn system graduate from Connecticut's highly selective colleges at 89%, 84% and 94%, respectively—not quite as good as the 97% graduation rate of those who start and stop in the Highly Selective system directly, but very close (Section IX).

16. We conclude that there are significant returns to higher education in the labor market with higher initial starting salaries and higher growth in such salaries over time for persons completing college as compared to just high school (Section X, Figure 32). Within the college bound student population, degree-holding appears to be important in leveling the starting wages of students who are otherwise disadvantaged because of race/ethnicity or family poverty. Compared to minority students who finished their college education without a degree, degree-holding minority students start their early career with wages at or above those of white students. The limitations in our data set require further sensitivity analysis of this result, however. Similar effects hold for college graduates who were in free or reduced price lunch programs during their high school years. Early career wage differences in gender, however, are not attenuated with degree holding. Female students, with or without a degree, consistently earn less than their male counterparts. If female students opt to work for shorter hours, thus earning lower , the necessity of sensitivity analysis because of lack of hours data becomes all the more important.

17. College has a profound effect not only on students' income, but also on the industries in which they work. College-going students at more selective institutions face a much wider diversity in employment by industry in first jobs than do less selective college-going and non-college-going students. The latter are more likely than the former to begin their work life in the retail industry. Percentages of college educated students beginning in retail activities drop with increases in students' educational attainment. Among the segments of public higher-educational institutions, UConn students appear to be employed in the most diverse set of industries. To what extent occupations of the students tracked in our study match with their college majors is another point not addressed in our study (Section X, Figure 31).

18. Our final empirical conclusion deals with another identifiable source of Connecticut "brain-drain"—the loss of workers who, regardless of college attendance, began but decided not to continue their work careers in Connecticut. Although causes of such losses are beyond the scope of the current study, it is plausible that such decisions may depend on several factors:
    a. tightening working conditions,
    b. other location costs (housing, commutation time, etc.) associated with Connecticut, or
    c. constrained future opportunities in the Connecticut Labor Market.

    However, it is clear that a *smaller* proportion of Connecticut's brightest (i.e., highest scoring CAPT takers) stay in-State while, at the other extreme, *larger* proportions of lower scoring CAPT takers continue to participate in the State's work force. The mobility of talented students in their labor market choices should be noted with care. Furthermore, high achieving CAPT students with AA/AS degrees are more likely to stay in the State's work force than their high scoring counterparts with BA/BS degrees .

By the fourth quarter of 2006, only 25% of the highest scoring CAPT MATH students graduating from Connecticut public high schools from 1998 to 2002 remained in-State working for Connecticut employers. It is of little consolation that far more than half of that 25% who remained had completed BA/BS degrees because of the 75% of those brightest who left, even larger proportions had attained BA/BS degrees. Further analysis will be necessary to determine whether there are gains in Connecticut's work force from other States that compensate sufficiently the brain-drain losses in the workforce of Connecticut's high school graduating classes (Section X, Figures 33-35).

19. We must conclude however by reiterating the limitations of Next Steps. Many factors, all potentially important in explaining student success outcomes, were not observed in our dataset; therefore, omitted factors must be taken at least conceptually into account. The population of Next Steps includes only public high school students taking CAPT exams between 1996 and 2000. Thus results reported herein apply only to the outcomes of these students, analyzing their institutional based matriculation, graduation, degree holding records. Note also that our work in **Next Step**s did group different campuses of the same institution into a single group, thereby potential variations across campuses warrant further scrutiny. While the outcomes on labor market success are suggestive, and to some extent replicates the trends observed in national averages, the fact remains that what people may bring to the labor market as their skills set can still be measured much better than we have here.

    Lastly, but not least, the Next Steps study database is built on administrative records, and suffers the biases inherent in such observational datasets. The rigor in our results should be interpreted at most as "associations" and "correlations". Let us remind that claiming an "association" between A and B is distinct from claiming that A "causes" B. Thus, an analysis of "causal" relationships, e.g., whether high school student exams "causes" college attendance or higher earnings in the labor market, necessitates additional requirements that the current database does not yet provide. Rest assured, however, the policy conclusions and the recommendations of Next Steps study is built on associations and tracking the individuals over a long time span and serves well the public policy discussions to which our study aims to contribute.

B. Moving to Change the Future: Recommendations and Policy Considerations

In the **Connecticut Next Steps** study, we have identified several weaknesses in Connecticut's human resources development that must be changed if Connecticut is to continue fueling its highest-in-the-nation levels of income. These weaknesses consist of:

1. Too many highly qualified high school students do not go on to college at all
2. Too many high school students fail to apply to in-State colleges or are not accepted in the in-State college of their choice; leaving the State, they then fail too often to return to work in Connecticut's workforce post completion of college
3. Too many additional students transfer from in-State to 0ut-of-State colleges during their college careers; these—in great numbers, as above, fail to return for work in Connecticut post college
4. Too many students, wherever trained, after starting in the Connecticut labor market fail to stay in Connecticut employment for very long.
5. Too many, starting college, fail to complete college, making college an expensive and uncertain proposition; improving completion rates of students would promote greater efficiency in the use of student and State resources.

Next Steps has evaluated many pieces of information leading to the aforementioned conclusions—most are results obtained directly from the empirical results and careful data analysis in **Next Steps**. For many of these issues we still need more data and information to fully address the policy questions; and consequently, policy recommendations here can, at best, be only tentative until we complete collection of such information. At a minimum, information is needed to answer the following five questions:

1. How much of the loss of 65 – 70% of the Connecticut, post-education starting workers already in the employ of Connecticut firms is due to limitations and deficiencies of new employee skills, how much is due to limits of employer needs, and how much is due to the stronger pull of employment opportunities outside of Connecticut? That is, does demand outstrip supply, vice-versa—supply outstrip demand, or to what extent does potential worker quality play a critical role? We believe the State and its business community must talk seriously about what is necessary to do business in Connecticut. But believing that it is most likely that some industries suffer labor shortages, while others have excess supply, it becomes important to know in which industries the various conditions apply..
2. Are the many educated either in Connecticut private institutions or at UConn who come in from outside Connecticut of an appropriate size and skill to compensate for the heavy losses of students native to Connecticut during their college years?
3. Are there ways to evaluate the size and quality of potential replacements educated in high school or in college but outside of Connecticut—these, employees who come after completion of high school and college elsewhere to work in the State?

4. Are the main sources (importing into College and then the workforce, or just taking workers post-College into the workforce) equally good for getting long-term resident workers? This is the same question as asking whether the costs are the same for hiring two equally qualified workers (one growing up, being educated, and likely having family and familial assets in Connecticut; the other growing up and being educated out-of-Connecticut) the same?
5. How will continual globalized competition stress Connecticut's need for workforce development? In what ways will increasingly fierce competition affect which industries and occupations need support to grow in Connecticut?

As a result of the **Next Steps** study, we recommend a wide variety of integrated policy considerations, including shifts in A.) parameters of college financing, B.) counseling and student support programs, C.) education-business outreach programs in both directions, D.) heavy involvement of government in supporting business-education entrepreneurship, E.) implementation of a State based student loan program, and more. Each individual recommendation can be positively tied to detailed findings of the Study, Next Steps Connecticut (even though, here, not for brevity's sake). Some of these, include:

1. Evaluation of where is the greater effectiveness of remedial work currently deemed necessary for large numbers of the high school completing population choosing to go to colleges. Such remediation can be carried out at either of two distinctive places and times:
    a. at the time that deficiencies are first noticed while the student is still in high school, or
    b. As now, during college and closer to periods when the student is older and more mature and when remediation is more proximally necessary for adequate completion of advanced academic work.

    Wherever done, if effective, such remediation should have the effect of reducing time spent in college, improving the likelihood that students will end with degrees and prepared for workforce participation. A carefully considered study can put this ages-old debate concerning where remediation is more effective to rest forever. Without a study, no one will know the appropriate time effectiveness of remediation.

2. Three components should be implemented to help remedy the low rate of college going in highly achieving CAPT students:
    a. For the many highly qualified students who do not see college options available to them, SAT and college prep courses, like those given by companies like the Princeton Review and others should be offered by persons hired by the district at State expense to help prepare those students most at risk, thosewho might be the first within a family to college and those with low income,
    b. Districts should be held responsible for achieving the goal that every high achieving CAPT taker would be helped in preparing at least one college application with an expectation on the supporting school district that at least one of the applications be sent to a Connecticut college, and
    c. The State should continue to monitor, consistent with the current study what the rate of college going among the goal achieving students are by district. Districts with improving

performance in encouraging college-going rates should be rewarded with additional State funding. Districts with declining rates should be penalized.

3. The differentials between in-State and out-of-State student tuition levels should be scrutinized. On the one hand, low in-State tuition represents the State helping those residents in the State. But on the other hand, low in-State tuition encourages institutional preference for admission of out-of-State students less likely to stay in-State after college. From an institution's perspective, low in-State relative to out-of-State tuition, coupled with institutional tuition retention and no out-of-State enrollment percentage limitations, leads colleges to prefer out-of-State students as they make admission decisions for two valid reasons:
    a. Out-of-State students are preferred to in-State students on the basis that they add greater diversity to a college and
    b. Out-of-State students return much larger volumes of dollars to an institution since tuition is held on campus rather than returned, as in some other States, to central treasury holdings[33].

    Elimination of differentials in tuition levels, however, leaves the State devoid of a visible role with regard to education and certainly does not satisfy the natural interest in making tuition lower for State residents than out-of-State residents. A strong and appropriate position will be required for a State that advertises, and gives off expectations of its high quality labor supply.

    Choosing a position with regard to tuition policy is central to workforce policy. We think this tuition policy decision must be tailored to each of the public institutions, CTC, CSU, and UConn. Whatever changes Connecticut decides to make with regard to tuition, it can balance its educational revenues with in-state students paying substantially less than comparable states charge their native students, but also with significantly less differential between in- and out-of-State tuition rates. Rates can be adjusted so as to leave surplus funds to increase spending on education: including need based aid to residents, loan programs (recommended separately below), and many other areas referenced in the remainder of this set of recommendations.

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[33] In- and out-of-State tuition and other costs for Connecticut public colleges looked as follows for :

College	Campus	Out-of-State	In-State
UConn	Tuition	$20,760	$6,816
	Storrs—Tuition, R&B, & Fees	$31636	$17,692
	Regl Campuses, "	$21,280	$7,336
CSU	Tuition	$10,831	$3,346
	Central—Tuition, R&B & Fees		$10,080
	Eastern— "		$10,307
	Southern— "		$9,964
	Western— "		$9,965
Community Colleges	Tuition	$8,444	$2,828
	Tuition, R&B & Fees	$10,344	$3,428

4. To the extent that additional funds can be raised from changes in tuition, funding increases should apply to components which address the speed of students going through programs of higher education, retention of students in a single college, and programs that encourage business-campus entrepreneurial interactions:
    a. Paying additional reimbursement to campuses with students who complete "4-year" programs in four or five years as opposed to five or six years, significantly reduces the college cost incurred by the students and tax payers. To the extent that social costs can be reduced, this savings should be returned to campuses so that the campus can build support and pedagogical programs encouraging students to more quickly progress through college.
    b. Paying additional reimbursement to colleges that encourage students to have better student retention (measured by numbers of students starting and finishing in a given college), reducing the length of time a student remains in college and increasing the proportion of successful college outcomes.
    c. Establishing faculty time and student resources in outreach programs designed to encourage: business visits on campuses, entrepreneurial programs producing solutions to specific, articulated business needs, and increasing rates of absorption of college students into the Connecticut workforce. Colleges should adopt specific niches: technological, engineering, bio-medical, social and behavioral[34], and other academic branches.

5. Now as loan programs fail wildly across the US, Connecticut should enter into its own, new loan program so as to build program flexibility that bends to the State's, not merely the national loan organization's, agenda. This program should be eligible to all high school graduates whether students continue on to college in-State or out-of-State. It should also apply to students originally from out-of-State who choose to go to school in Connecticut. Such programs establish a policy lever to "incentivize" student behavior in critical ways (implementing significant differences in loan repayment interest rates) for those who:
    a. Live post college completion in-State rather than out-of-State,
    b. Complete programs quickly rather than slowly,
    c. Start a college-borne and faculty-nurtured entrepreneurial business assisting other in-State companies, and
    d. Get employer contribution to their loan-payback because they are working in demonstrably high demand fields.

[34] One example of a social-behavioral program is work long associated with one of this report's authors in producing detailed international market information on size, growth and competition (market penetration rates) in specific foreign commodity markets, improving individual company absorption of what would be otherwise expensive information on the nuances of international markets. This can be expanded by a wide variety of individuals on Connecticut college campuses, and through them, out to the business community, but the fact that campuses have abundant international language and cultural resources to accommodate economic and social expertise make such a natural exercise for campuses.

6. With the change in enrollment patterns likely to follow any movement toward equalization of in- and out-of-State tuition, even higher quality students are likely to come into Connecticut for study. Connecticut should make every effort to bring the best of these into State and once they are in-State, to keep them just as it should not forego efforts to increase retention of those who grew up in Connecticut but who leave for college. College age is the great age of geographic relocation. Connecticut must step in to absorb
The best of the best students for its workforce.
To facilitate increased retention, the State should more fully differentiate individual segments of higher education. This, if not establishing a “capital” university system such as that used earlier in Pennsylvania and at the Pennsylvania State University system, would integrate the higher education system in a way in which:
    a. UConn, as the public flagship university, would strengthen its research orientation and graduate studies that can drive new business formation in the State;
    b. CSU, as the Freshman-to-Senior institutions, would build their focus on high quality liberal arts and science education, in the best tradition of the private institutions and New College of Florida, University of Minnesota-Morris, St. Mary’s College of Maryland, Richard Saxton College of New Jersey, and SUNY Binghamton in New York in the public sector; and
    c. the CTC system’s role would be to maintain and build distinctive terminal and extension activities in certificate and non-certificate programs, integrating much more of its programs to support upper level institutions (both UConn and CSU as well as private sector colleges) to which student’s might aspire.

   This differentiation of opportunities available to students where the public sector is so crucial would give increased choice and depth for preparation for the workforce following their degrees.

7. If high property taxes and living costs raise real impediments to Connecticut residence post-graduation, the State can offer a tax incentive to CT's public high school students following completion of their higher education studies (with degree) for the first three years, such that the tax break would be gradually paid back at the end of three years to the State with interest. Such a repayment mechanism has the potential to prevent injustices that may arise between different generations of workers. At the same time, policy change will not force a tax revenue loss on the State.

   Considering that jobs are increasingly migrating to overseas and that US workers—including CT's— face competition from workers abroad as companies move operations overseas to cut costs in face of global competition, the State should take an active and collaborative policy with public higher education institutions such that:

   (i) the State particularly supports the degree programs in higher education institutions which would be difficult to move overseas. Application of such a scheme, taking dentistry as an example industry unlikely to relocate out-of-country, might favor all segments of public higher education institutions including student swho are receiving degrees in CTC system as a dentist assistants, and students who receive degrees in dentistry from UConn School of Dental Medicine.

(ii) For students whose skills face competition from abroad, one incentive mechanism to be offered to students in their post-graduate work time is to offer 'microcredits' if the student decides to stay in CT and establish a business but can't access credit because of early work life, thereby lack of credit history. Availability and payment conditions for microcredits can be contingent upon many factors, but should be offered to students who start businesses and help the productivity of the CT economy, subsidized to some extent by the State. The State's may also take an active role in policies of subsidizing companies (with loans being offered to 10 years of repayment schedule) contingent upon creating of jobs for students whose skills face competition.

C. Maintenance of the Next Steps Database for Future Use

1. Information in Connecticut on individuals engaged in education and the workforce is held only by agencies and institutions entrusted to provide such services to the public. The relevant agencies use the data to assess means of making their services more focused and efficient and to monitor and report on system-wide education and workforce outcomes. To carry out a project called the Connecticut Next Steps project evaluating how the current system of education creates future workforce preparedness, informing both those individuals in the workforce pipeline, State educational institutions, and the overlying Connecticut business community, selected components of the individual education and workforce databases were recently put together by an independent contractor acting on behalf of each of the individual educational and workforce organizations and agencies.

   The combination of data from the different agencies extended only so far as required for evaluation of the outcomes determined to be necessary by the agencies and the independent study group to look at labor force creation, including such elements as the performance of persons in the labor force *by* their levels of educational attainment. Combinations of data were limited to achieve just only those overarching elements identified by the individual agencies and agreed to by the full set of participating agencies at the beginning of work. This work was specified in the Connecticut Next Steps contract(s) between the project contractor and the individual participating Connecticut agencies.

   The privacy and confidentiality of individuals included in the sample frame on which data used in this project was collected has been paramount. Data files were maintained in two non-computer-network-accessible external hard-drives (one primarily on educational outcomes in a secured room at the University of Connecticut and the other in storage at the Connecticut

Department of Labor (CT DOL). These data were constantly locked away from non-project personnel in highly secure places. Names and identifying information were stripped from all records used in any of the analytical aspects of work on the project. Results identified as destined potentially for public release in reports from the work were reviewed by representatives of all supervising agencies, the Connecticut State Department of Education, the Connecticut Department of Higher Education (acting on behalf of the Connecticut public institutions of Higher Education), the Connecticut Department of Labor and the College Board. All results reported to the public were expressed solely in the aggregate so as to avoid <u>any</u> instance of disclosure of individuals. At no time, has one participating agency's or institution's data been made available, through the action of the contractor, to a second agency participating in the study, thus maintaining the focus of each individual agency and institution on only those issues for which they hold fiduciary responsibility for monitoring.

Subsequent to completion of work on the project, the data bases have been consolidated into a single hard drive, demonstrated as to their completeness to CT DOL and CT DHE personnel, and left under locked storage at CT DOL. The independent contractor completing this project no longer has any individual records secured for purposes of the current project. The contractor has maintained only aggregate records approved by the participating agencies as to not contain any private or confidential material that could identify any student or employer.

2. The data and information associated with Connecticut Next Steps yields significant potential policy gains in understanding how Connecticut may improve its performance on behalf of its citizenry. Therefore, if the participating agencies desire to preserve and maintain the data to validate work already completed, to perpetuate study of education and labor market achievement, and to construct and monitor new policy designed to improve such performance, the following should be the guiding principles of work designed to maintain and perpetuate the database:

    a. Data in the database initially obtained from various original sources (e.g., CMT and CAPT data from the Connecticut State Department of Education—CSDE; semesters enrolled, grade point average, and required remediation data from Institutions of Higher Education under the oversight of the Connecticut Department of Higher Education—CDHE: the University of Connecticut—UConn, the Connecticut State University—CSU, and the Connecticut Community and Technical Colleges—CTC; SAT data from the College Board; time of enrollment data and degrees obtained data from the National Student Clearinghouse; and employment in Connecticut from the Connecticut Department of Labor—CDOL). Such data was associated with the name, social security number (ssn), or both, of individuals, herein referred to as *individual identifiers*. The State administrative units from whom such data was obtained are called herein as the *participating agencies* and the data obtained from the agencies are called the *original data* because they contain individual identifiers of name and ssn. Original data obtained from the participating agencies has been transferred and stored in secure files (as described in 2.d.) as originally obtained to facilitate repetition and future maintenance of the database, as necessary. Such data shall not be used further without approval of the *database advisory committee*.

b. The original data will not be available to anyone other than a member of an independent and contractually restricted *data handling team.* Such a data handling team will act only under contract with the participating agencies. Data will be combined only to achieve analysis of policy questions unanswerable except with data from more than one participating agency, such analyses called herein *higher order goal analysis*. In so combining data, the independent data handling *team* must be under specific authority from the agencies simultaneously interested in accomplishing the higher order goal.

c. The original data will be used to produce a second *derivative data* set from which names and social security numbers will be removed and replaced with *pseudo-id* codes allowing the data to be matched internally by the independent data handing team. The pseudo-id thus will act as a record identifier. The pseudo-id is non-duplicated across all individual records, but does not directly identify any individual person.

d. The original and derivative data sets will be kept for a period of one year (or until an agreement among the participating agencies can be arranged to supplant the agreements under which **Next Steps** was done extends this date) in a secure, non-network accessible storage device at the State of Connecticut's Department of Labor. Such storage will be maintained so as to allow limited future use to address policy questions to which the data are relevant.

e. A participating agency may make a request for analyses to evaluate a specifically defined higher order question requiring use of the database. The higher order question must be policy relevant to the participating agency's mission, the relevance of which must be approved by the database advisory committee. Upon approval, the analyses may be conducted by the data handling team, by an agency employee assigned by the participating agency, or by both jointly.

   Another State agency not contributing data to the database may make a request for analyses to evaluate specifically defined higher order questions relevant to Connecticut policy formulation appropriate to the agency's statutory function. The higher order question must be approved by the database advisory committee. Upon approval, analyses of said policy questions may be conducted by the data handling team, by a participating agency employee assigned by the participating agency head, or by both jointly.

f. Maintenance and use of the database shall be overseen by a database advisory committee consisting of three representatives appointed by the Commissioners of the Connecticut State Department of Education, the Connecticut Department of Higher Education, and the Connecticut Department of Labor. The database advisory committee will convene meetings as necessary to address issues related to maintenance of the database and requests for analyses using the database. This committee shall review all requests for use of the data and must approve a request before any access to the data is given.

g. College Board, as a contributor of data to the database, may make a request for analyses like other participating agencies. Its requests must be reviewed by the database advisory committee and, if approved, must be processed by the data handling team.

Definitions

individual identifiers are components of records (e.g., social security number—ssn, name, or other administrative identifiers) that directly identify individual persons or entities.

participating agencies are the Connecticut agencies which have contributed data to the project (the Connecticut State Department of Education—CSDE; Connecticut public Institutions of Higher Education (the University of Connecticut—UConn, the Connecticut State University—CSU, and the Connecticut Community Colleges—CCC) and the Connecticut Department of Higher Education—CDHE; the Connecticut Department of Labor—CDOL; and the College Board.

original data are data in education or employment records, including individual identifiers, that are provided by the participating agencies.

data handling team are the persons responsible for adding new data to the database as time passes, maintaining existing records, and producing additional analyses as required by participating or non-participating agencies.

Database advisory committee are representatives of the Commissioners of the Connecticut State Department of Education, the Connecticut Department of Higher Education (acting on behalf of itself and the public segments of Higher Education), and the Connecticut Department of Labor.

higher order goal analysis is an analysis that requires data elements from more than one participating agency in order to address question raised in the analyses.

derivative data are data from the participating agencies that have had the direct individual identifiers removed, structured to quickly yield results to analyses, and that, without the original data, cannot produce results which will identify individual persons within the relevant databases.

pseudo-id is a code used in derivative databases to identify a record as belonging to a specific, but unidentified, person. There must be one unique pseudo-id for each record in the database.

D. Recommendations for Further Study

There are several elements in the Scope of work associated with the follow-on to the Connecticut Next Steps Project:

1. Two components, best discussed together that follow-on from the now completed CT Next Steps project, include:
    a. Negotiation with the agencies that participated in Next Steps (the CSDE; the CT public colleges of higher education—Connecticut Community and Technical Colleges, the Connecticut State University System, and the University of Connecticut, all reporting through the CT DHE; the Connecticut Department of Labor; data contributing national organizations—the National Student Clearinghouse and the College Board; and the Nellie Mae Education Foundation) about the terms of use, inclusion, and contents of a database that will remain in place for various reasons following completion of the current on-going study, CT Next Steps; and
    b. Further preparation of data already in storage at CT DOL, compliant with the negotiated agreement, to be included in an archive of information for development of future policy regarding Connecticut education and workforce development.

    Such a data archive would include the primary data used in preparing the initial Next Steps report for the state of Connecticut, assuming other participating agencies desire to follow-on with work on the project. This would give database sufficient flexibility to allow for additions of new data in future years, allowing the archive to grow over time to accommodate more complex policy issues to be researched. Data included in this archive must include unit record information because such records are so much more powerful than aggregate unit records in identifying and estimating policy parameters on a host of policy research questions. Many of the future policy parameters are not yet known at this time and so the flexibility of the database must be great. This implies that a contractor doing such work will consider the variety of analyses that will be desired by the various participating agencies and will form a subset of data, eliminating elements which might identify individual businesses or individuals, leaving appropriate samples which will form the basis of future analyses. The pre-conditions going into such work is that no data from any of the agencies will be included if either the agency responsible for its initial collection is uncomfortable with its inclusion or elements in it cannot be removed so as to permanently conceal individual businesses and persons who might be identified in future work. This implies that the comprehensiveness of the full database cannot be determined until all decisions of all contributing agencies are made.

2. Data needs to be prepared for return to Connecticut public school districts at district aggregated level on student performance, post completion of high school. This task too must be carefully negotiated to be sure that what will be returned is acceptable with regard to issues of privacy and confidentiality before any work with the data is undertaken. But given that much work of a similar nature is going on in other parts of the country, it seems as though Connecticut with the opportunity now before it should follow through. Districts need information about how well they are doing in getting students prepared for college and work beyond high school. The fact that the Next Steps project has bought the NSC data on behalf of being allowed to return data to individual high schools and that the single purchase will allow schools to use NSC as a single clearinghouse for employers wanting to check on high school graduation, implies that there will be a need to work with each of the individual school systems.

3. Next Steps has now developed clear and effective mechanisms for evaluating labor market histories. While that knowledge remains clear in the minds of key personnel, a follow-on should complete an evaluation of teacher attrition and the lure of Connecticut's non-teaching labor market on attrition by areas of teacher preparation and specialization. Such a study could focus on attrition over a substantial history, roughly cotemporaneous with teacher workforce history, 1994-2006. Such a study would need approval from CT Department of Labor to secure their permission to use Labor data; but presumably such a study could match teachers in CT public high schools with labor market wage record data. The result would indicate the extent to which teachers at various ages and stages of their careers need to work in the labor market outside of teaching. It would pay special attention to data on teachers for whom CSDE records show attrition from public teaching to see if teaching was replaced by work outside of teaching, and whether attrition had antecedents of teachers working in the non-teaching Connecticut labor market. The result might give clues to policy solutions to issues of teacher attrition if necessary.

Finally, follow-on work from CT Next Steps will develop a plan to use all data as described in other tasks to produce estimation algorithms that will keep the CSDE data as current as possible. If true student outcomes data provides a better method for evaluating teacher quality and of test quality, then estimation techniques need to be developed in which a partial history of student outcomes can be used to impute a more complete history of outcomes, allowing evaluation of teacher quality and how it has changed over time, and of successfulness of test construction in measuring student performance. This will in turn allow much more accurate evaluations of teacher and test outcomes than a system in which one needs to wait until students are fully out of school for seven or eight years (as in the current study).

XII. Appendices

A.1. Ethno-racial profile of the students

One of the main indicators driving the study was the students' ethno-racial profiles. While the CAPT and CMT data, provided by the CT Department of Education, included race and ethnicity profile of the students, the datasets were available were not always overlapping. Students who took SAT exams also had the option to reveal their ethno-racial background, and for students who took both CAPT and SAT, again, race and ethnicity of the student did not always match in the datasets. During the data matching process, we followed the race-ethnicity profile of the students as revealed in the CAPT cohorts, since this dataset determined the population included in the study, however, for the cases in which the answer was "Omitted" in CAPT, the answer was replaced by the student's answer in either CMT or in College Board dataset, provided the student revealed a ethno-racial background category.

Table 28: Ethno-Racial Profile of Students Across the Databases

		CAPT Race - Ethnicity								
		Black	Hispanic	White	Asian	American	Other	Multiple	Omitted	Total
CMT - Race Ethnicity	Black	48.7	0.2	0.0	8.3	0.3	5.1	6.5	10.0	5.6
	Hispanic	0.3	47.6	0.2	2.2	0.2	0.5	4.1	7.2	4.8
	White	0.5	1.9	61.5	20.9	2.5	27.1	30.8	20.6	45.3
	Asian	3.0	0.8	0.7	17.4	15.4	5.6	2.4	9.0	2.1
	Native American	0.0	0.0	0.0	1.7	36.3	0.0	0.6	0.7	1.0
	Other	0.3	0.1	0.1	0.4	0.0	17.0	0.2	1.2	0.2
	Multiple	0.9	0.7	1.2	1.8	1.7	0.9	2.5	1.7	1.2
	Omitted	0.6	0.5	0.1	1.1	0.1	1.6	0.4	7.4	0.3
	Missing	45.7	48.1	36.3	46.3	43.5	42.4	52.6	42.2	39.5
College Board - SDQ Race-Ethnicity	No Response	5.9	5.1	3.9	4.9	3.2	3.4	5.7	6.3	4.3
	American	0.2	0.0	0.3	0.4	0.1	17.5	0.2	1.8	0.3
	Asian	0.2	0.0	0.1	5.0	59.6	0.2	1.4	1.3	1.7
	Black	34.7	0.5	0.0	8.9	0.2	3.4	4.2	10.1	4.2
	Hispanic	0.2	28.2	0.4	2.7	0.3	0.6	2.6	5.7	3.1
	White	0.2	0.4	57.7	12.9	0.9	10.4	25.5	11.4	41.8
	Other	1.5	0.4	0.9	15.7	2.6	2.6	2.5	6.8	1.7
	Missing	57.1	65.3	36.7	49.5	33.2	62.0	57.9	56.6	42.8

A.2. Students Not Reported in the NSC Database Attending Connecticut Public Institutions

Approximately 2.6% of CTC system students did not appear under NSC database, the figures are lower for CSU and UConn student profiles. Since the first and last attendance dates, which we used in our calculations for tracking labor market outcomes, are based on the NSC data, for these students, our analysis could not provide labor market outcomes.

Table 29: Enrollment Data by Institutions and National Student Clearing House

		NSC Data
Institutional Data	% of Students	Number of Institutions Attended = 0
	CTC	2.56
	CSU	1.18
	UConn	0.82

A.3. Group-level Performance Comparisons of Non-college Attending ”No NSC - No SAT” Students with the Students with Known-college Attendance “No NSC/with SAT or both NSC/SAT known”

The degree to which we can be certain that students with no enrollment records in the National Student Clearing House database but with a SAT exam score in College Board database are college-bound albeit possibly in institutions not captured in our database can be further illustrated by comparing the group-averages of CAPT exam scores. Within the college bound student category for which we have college enrollment records, the average LIT and MATH exam scores are 79.7 and 264.3, respectively. In comparison, among the group of students with no enrollment record but with SAT exam score, the averages are 76.7 and 256.4 for CAPT LIT and MATH scores. The similarity in group averages becomes more obvious if we compare the CAPT exam score averages of non college bound students, 64.4 for CAPT LIT, and 228.3 for CAPT MATH. Of students not going on to college, only 12% are goal achieving. In contrast, 48% of those with an enrollment record in National Student Clearing House and with SAT record are goal achieving. For those lacking NSC records (but with SAT records), a condition preventing us from knowing which institution they attend, 41% are goal achieving. The proximity of this percentage and 48% of those with known college attendance records gives confidence that the first group of students, too, is college bound.

Table 30: Percentage of Cohort Found in Defining NSC and SAT Record Databases- Complete Data

	Non College Bound	College Bound		
			Known College	
	No College	Unknown College	Attended	Still Attending
CAPT Cohort	No NSC - No SAT	No NSC/SAT Known	Prior, but no current NSC	Current NSC records
1996	29.1	8.5	58.1	4.3
1997	27.2	7.9	59.9	5.0
1998	26.6	8.4	58.6	6.4
1999	26.5	8.2	57.3	8.0
2000	26.9	7.9	50.7	14.5
Total	27.2	8.2	56.8	7.8

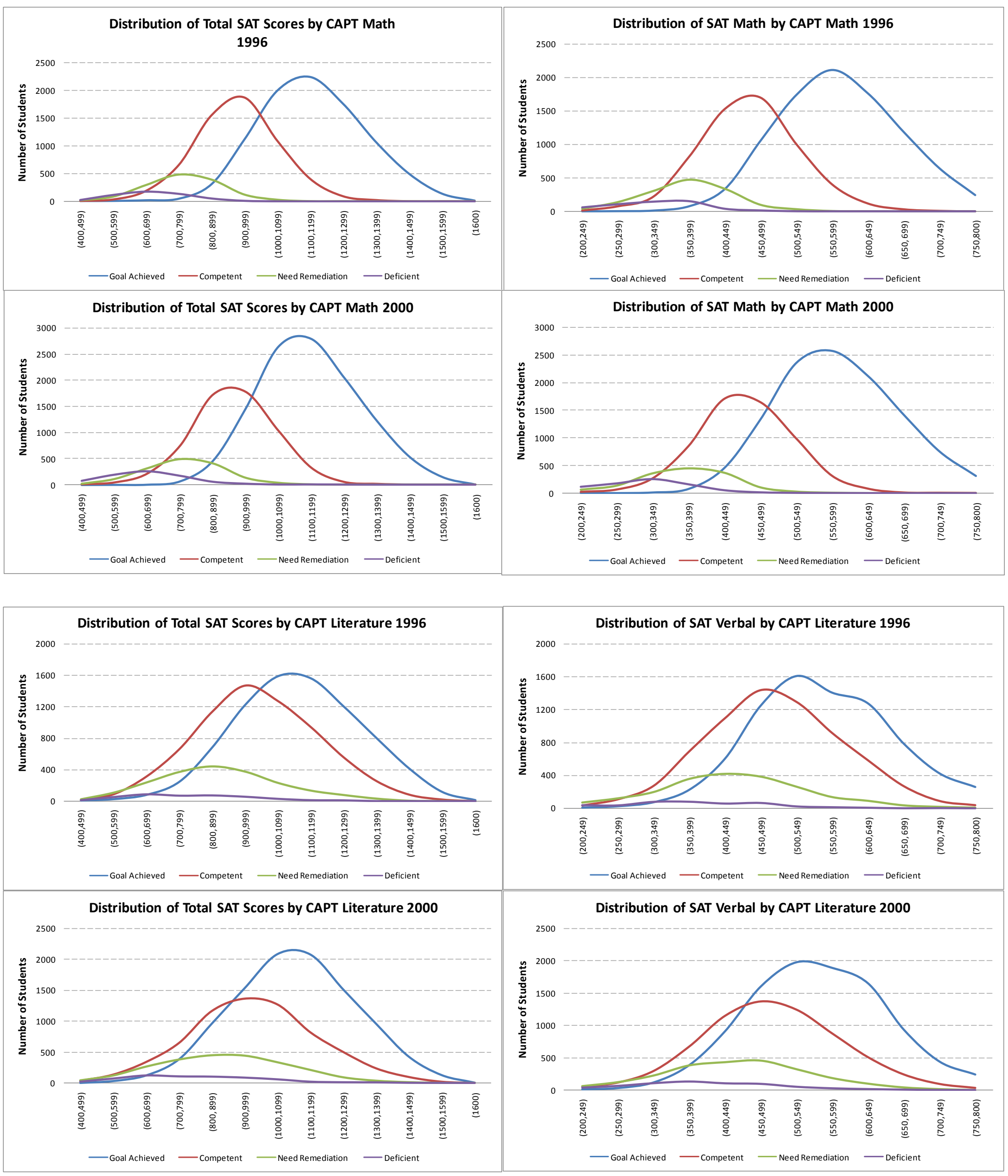
Table 31: Average CAPT scores by SAT and Enrollment Information

	CAPT SCORES		CAPT TOP CATEGORY	
	Avg. CAPT LIT Score	Avg. CAPT Math Score	% LIT Goal Achieved	% Math Goal Achieved
No NSC - No SAT	64.39	228.30	0.10	0.12
No NSC/with SAT	76.76	256.43	0.36	0.41
NSC/SAT known	79.74	264.39	0.43	0.48

A.4. Modeling the Probability of SAT Exam-taking, by CAPT Performance Levels

In this section, we will discuss a model of the probability of taking SAT exam, conditioned on 10th grade CAPT Literature and Math exam scores, in addition to other student related characteristics. Our discussion will begin with a comparison of the dissimilarities of the two tests for 1996 and 2000 CAPT Cohorts.

Figure 36: Overlaps and Dissimilarities Between CAPT and SAT in MATH and LIT 1996 and 2000 CAPT Cohorts



Today there is a vast literature on measuring success outcomes of students with the assumption that students from the same class or school are more likely to have similar outcomes, compared to two random students in the population. The empirical strategy in these models is to employ multi-level modeling, where each strata, such as class and/or school, constitutes a level and the unobserved variations in each level is taken into account. While this is certainly a preferable empirical strategy, in our case, with more than 150 thousand observations, it became computationally expensive. For this reason, we will present a probability model, and try to assure the unobserved variation across the levels by district level controls. Measuring probability is performed by non-linear functions, in each model, first the coefficients, then the marginal effects, i.e., the change in probability with each unit increase in the covariate, is shown. Consider the first model below which shows that higher scores of CAPT Lit exam is associated with higher probability of taking SAT exam, as the coefficient , 0.029, is positive and statistically significant. In this form however, we can’t assess the change in probability with each unit increase in the exam score, as the functional form driving this result is non-linear. Thus, the relationship between probability and unit changes in each covariate is summarized under the columns with title “Marginal Effects”. For instance, with each score increase in CAPT Literature exam, the probability of taking SAT exam increases by 0.01 points. Compare this effect with the model summarizing the probability of taking SAT exam, conditioned on CAPT Math exam scores. The “marginal effects” column in CAPT MATH model shows that the probability of taking SAT exam increases by 0.004 points with each unit increase in CAPT Math exam scores, which is lower than the effect of unit increase in CAPT Lit on the probability. The last column predicts the probability of SAT exam taking, conditioned on both CAPT exams. A comparison of the marginal effects associated with CAPT Lit and CAPT Math exam scores shows that a unit increase in CAPT Lit exam score, all else equal, increases the probability by 0.007 points; an effect higher than the unit increase in CAPT MATH exam score, 0.003.

The model also summarizes the effect of student background on probability of taking SAT exam. All else equal, an average male student is less likely to take the SAT exam than an average female student. While the base model depicted in the text grouped all minority students together, here we also present probability differences by race/ethnicity. The control group, i.e., the base category, in the model is white female students who are not in reduced/free lunch programs. A comparison of the coefficients and marginal effects show that a white male student similarly not in reduced/free lunch program, all else equal, is .10 points less likely to attend college than a female student in the base group. The difference between Asian and white students is not statistically significant, however, a Hispanic male in reduced/free lunch program is .17 points less likely than a student in the base category at the same test scores.

Table 32: Probability of Taking SAT Exam, 1996 - 2000 CAPT Cohorts

Dependent Variable: Probability of Taking SAT						
	CAPT LIT	Marginal Effects	CAPT MATH	Marginal Effects	CAPT MATH&LIT	Marginal Effects
CAPT LIT Scaled Score	0.029	0.010			0.019	0.007
	(0.000)***	(0.000)***			(0.000)***	(0.000)***
CAPT MATH Scale Score			0.012	0.004	0.009	0.003
			(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender(=1 M)	-0.124	-0.044	-0.428	-0.152	-0.268	-0.095
	(0.008)***	(0.003)***	(0.008)***	(0.003)***	(0.008)***	(0.003)***
Race/Eth(=Black)	-0.066	-0.024	0.143	0.050	0.156	0.054
	(0.016)***	(0.006)***	(0.016)***	(0.005)***	(0.016)***	(0.005)***
Race/Eth(=Hispanic)	-0.219	-0.082	-0.079	-0.029	-0.062	-0.022
	(0.016)***	(0.006)***	(0.016)***	(0.006)***	(0.017)***	(0.006)***
Race/Eth(=Asian)	0.029	0.010	0.017	0.006	-0.008	-0.003
	(0.025)	(0.009)	(0.025)	(0.009)	(0.026)	(0.009)
RF Lunch(=1)	-0.188	-0.069	-0.160	-0.059	-0.138	-0.050
	(0.014)***	(0.005)***	(0.014)***	(0.005)***	(0.014)***	(0.005)***
Num Taken CAPT	-0.765	-0.274	-0.759	-0.271	-0.667	-0.238
	(0.038)***	(0.014)***	(0.039)***	(0.014)***	(0.039)***	(0.014)***
% Minority Students by District – Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.816		-1.714		-2.548	
	(0.050)***		(0.054)***		(0.056)***	
Model χ-square	26142.93	26142.93	28148.02	28148.02	31803.32	31803.32
Log likelihood	-73581.06	-73581.06	-72578.51	-72578.51	-70750.86	-70750.86
Pseudo R2	0.15	0.15	0.16	0.16	0.18	0.18
N of observations	135069	135069	135069	135069	135069	135069

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

A.5. Modeling the Probability of College Attendance

Before discussing our results, a reminder on the analytical rigor of the model, omitted factors in our analysis, is warranted. Consider the following scenario: High motivation, which is unobservable to us, researchers in the dataset, is expected to be one of the driving forces behind the decision to attend college. It is, therefore, plausible to hypothesize that students who attend college are highly motivated, and actually are "self-selected", i.e., we observe college attendance because of high motivation of these students, in addition to the factors included in the dataset, such as CAPT score. Consider further that high motivation not only affects college attendance decision but also the CAPT scores of the student. In this case, high motivation, an omitted factor in the analyses, affects not only observed college attendance decision, but also observed control variables, such as test scores. In this case, the results are expected to suffer from a bias caused by this elusive factor, high motivation. Such "self-selection" issues can be solved in a variety of ways, however the current dataset offers no options for handling this issue.

The model presented in the text on college bound students remarked that the differences by reduced free lunch program participation appear to be a stronger factor in determining college attendance than the ethno-racial background of the student. Here a model, treating each ethno-racial group as a separate category, is shown. Indeed, the model incorporating both CAPT LIT and CAPT MATH test scores indicated that minority students, especially Asian-American students, are slightly more likely to attend college than white students. But before discussing group-level differences, we should remark that the predictive power of CAPT test scores for college attendance is weaker than that of for SAT exam taking. A unit increase in CAPT MATH test score increases the probability of college attendance by .002 points, which is lower than the increase in probability of SAT exam taking by a unit increase in CAPT MATH score, .003. Regarding the ethno-racial differences in college attendance, indeed, the marginal effects for the model in which both CAPT Lit and CAPT Math tests are used as independent variables, the results suggest that minority students are more likely to attend college, however, this effect is tuned with the negative coefficient of participation in reduced/free lunch programs. Considering the significant overlap in minority and reduced and free lunch status, our results are possibly picking up both effects.

Table 33: Probability of Attending College, 1996 - 2000 CAPT Cohorts

Dependent Variable: Probability of Attending College						
	CAPT LIT	Marginal Effects	CAPT MATH	Marginal Effects	CAPT LIT and MATH	Marginal Effects
CAPT LIT Scaled Score	0.028	0.007			0.019	0.004
	(0.000)***	(0.000)***			(0.000)***	(0.000)***
CAPT MATH Scale Score			0.012	0.003	0.009	0.002
			(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender(=1, Male)	-0.132	-0.033	-0.432	-0.106	-0.266	-0.064
	(0.009)***	(0.002)***	(0.009)***	(0.002)***	(0.009)***	(0.002)***
Race/Eth(=Black)	0.008	0.002	0.207	0.046	0.213	0.046
	(0.017)	(0.004)	(0.017)***	(0.004)***	(0.017)***	(0.003)***
Race/Eth(=Hispanic)	-0.155	-0.041	-0.017	-0.004	-0.005	-0.001
	(0.017)***	(0.005)***	(0.017)	(0.004)	(0.017)	(0.004)
Race/Eth(=Asian)	0.061	0.015	0.057	0.014	0.030	0.007
	(0.030)**	(0.007)**	(0.030)*	(0.007)**	(0.030)	(0.007)
RF Lunch(=1)	-0.217	-0.058	-0.200	-0.053	-0.178	-0.046
	(0.015)***	(0.004)***	(0.015)***	(0.004)***	(0.015)***	(0.004)***
Num Taken CAPT	-0.565	-0.140	-0.562	-0.137	-0.475	-0.113
	(0.034)***	(0.008)***	(0.034)***	(0.008)***	(0.035)***	(0.008)***
% Minority Students by District – Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.442		-1.205		-2.012	
	(0.050)***		(0.054)***		(0.056)***	
Model χ-square	22918.28	22918.28	23918.98	23918.98	26986.27	26986.27
Log likelihood	-56287.73	-56287.73	-55787.38	-55787.38	-54253.73	-54253.73
Pseudo R2	0.17	0.17	0.18	0.18	0.20	0.20
N of observations	135069	135069	135069	135069	135069	135069

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

A.6. Time to Start college, post expected High School graduation

The time between expected high school graduation and the first time the student enrolled in a higher education institution depends on many factors, in addition to the test scores. Here we expand the dataset by self-reported answers to the Student Demographic Questionnaire of the College Board, in addition to the variables on test scores, and student background. The dependent variable is the time between the quarter of expected high school graduation and the quarter of enrollment to college. Because the precise time of high school graduation was not available to us, we decided to synchronize the time difference between expected high school graduation and the first enrollment date using "quarters" as unit of analysis. The variables selected are the number of years the student attended English and Calculus classes in high school and whether the student was an honors student. High School cumulative GPA and whether the student considered applying for financial aid for college are also incorporated into the model. Except for CAPT LIT, the results for the SAT Verbal and CAPT and SAT Math exam scores continue to exert a positive and statistically significant effect on the time of first enrollment. Female students are more likely to begin their higher education careers earlier than male students and compared to White students, Black and Hispanic students delay their enrollment, while Asian students are slightly more likely to enroll earlier, although the difference in first enrollment timing between White and Asian students is not statistically significant. Students who select their first college in Connecticut are more likely to begin higher education earlier than the students leaving the state and students who decide to attend public institutions do so later than their counterparts attending private institutions. Increases in number of English and Calculus years are associated with earlier enrollment, whereas students who revealed that they would apply for financial aid delay their enrollment. Our results associating higher CAPT LIT scores with earlier enrollment of students, however, are contradicted by results focusing on SAT verbal scores. Higher SAT scores in both verbal and math, and higher CAPT MATH scores, *marginally* postpone student enrollment. The marginality of this is that each 100 point increase in SAT Verbal scores is associated with only 0.17 semesters, a significant, but very small, delay in time-to-college following expected high school graduation.

Table 34: Average Time to Start College, Post expected High School Graduation

Dependent Variable: Semester to Start College, post expected High School graduation				
	CAPT LIT&SAT Verbal	CAPT LIT&SAT Verbal	CAPT MATH&SAT MATH	CAPT MATH&SAT MATH
CAPT LIT-Scaled	-0.001	-0.001		
	(0.000)***	(0.000)***		
SAT Verbal	0.001	0.001		
	(0.000)***	(0.000)***		
CAPT MATH-Scaled			0.001	0.001
			(0.000)***	(0.000)***
SAT MATH			0.000	0.000
			(0.000)***	(0.000)***
Gender(=1 Male)	-0.008	-0.007	-0.018	-0.021
	(0.006)	(0.006)	(0.006)***	(0.006)***
Race/Eth(=Black)	0.126	0.128	0.137	0.136
	(0.012)***	(0.012)***	(0.012)***	(0.012)***
Race/Eth(=Hispanic)	0.044	0.047	0.041	0.042
	(0.014)***	(0.014)***	(0.014)***	(0.014)***
Race/Eth(=Asian)	-0.013	-0.014	-0.029	-0.031
	(0.019)	(0.019)	(0.019)	(0.019)
RF Lunch(=1)	0.065	0.068	0.055	0.057
	(0.013)***	(0.013)***	(0.013)***	(0.013)***
First Enroll2yr(=1)	0.731	0.731	0.730	0.728
	(0.008)***	(0.008)***	(0.008)***	(0.008)***
In CT (=1)	-0.087	-0.083	-0.090	-0.086
	(0.008)***	(0.008)***	(0.008)***	(0.008)***
Public Inst. (=1)	0.014	0.017	0.009	0.013
	(0.008)*	(0.008)**	(0.008)	(0.008)
HS Cumulative GPA	0.007	0.006	0.008	0.007
	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Consider Fin. Aid(=1)		-0.081		-0.080
		(0.011)***		(0.011)***
HS Engl. No.Yrs		-0.003		
		(0.002)*		
HS Engl. Honors(=1)		0.034		
		(0.008)***		
HS Calculus No.Yrs				-0.003
				(0.001)***
HS Calculus Honors(=1)				0.044
				(0.011)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes
Constant	0.590	0.707	0.505	0.608
	(0.029)***	(0.034)***	(0.031)***	(0.033)***
Model χ-square	12028.53	12101.44	11724.52	11816.30
Log likelihood	-131361.23	-131324.77	-131513.23	-131467.34
Pseudo R2	0.04	0.04	0.04	0.04
N of observations	47415	47415	47415	47415

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

A.7 The Full "From/To" Table, Representing Connecticut Public High School Graduates Choices of Starting and Ending Segments of Colleges, 1998 - 2002

Connecticut students make choices in attending college as wide as the institutions available to them. The table in this Appendix gives starting and ending segments for all students going on to post-secondary education following high school. Ending segment should not be interpreted as the segment granting a degree since the table does not purport to show degrees earned. Ending segment simply means that the indicated segment was the last segment the student was enrolled in before ceasing to not longer enroll. In other words, the ending segment may be the segment from which a student either dropped out or received the terminal degree.

This table shows transfers among institutions from, at the leftmost column margin—the institution in which students started college; to, at the topmost row margin, the institution in which students finish college. A color legend is used in making the table clearer to understand:

6. pink cells at the right and bottom margins highlight whether the number of students starting (rightmost column, when colored pink) or ending (bottom row, when colored pink) at an institution is greater.
7. green cells highlight transfer flows in which the sending institution (in the left column) sends more to a receiving partner institution than it receives from the finishing institution (in the top row).
8. yellow cells along the diagonal show numbers of students who start and end in the same institutional segment.

For each institution first attended, the number in the top row of a cell group is the number of students starting in the institution indicated in the left margin and finishing in the institution at the top row. The second row is the proportion of starting students ending in specific institutions, all such numbers adding across a row to 100% and showing where all students starting in an institution end by the time they are no longer enrolled. The third row is the proportion of students in the ending institution originating from specific institutions, adding down each column to 100% and showing from where all students in the cohort ending in a specific institution come.

Number of Connecticut High School Students by First and Last College Segment Attendance

Entering College Segment		Last Attending College Segment															
		Connecticut Public			Connecticut Private			MA & RI		Northern Tier		NY, NJ & PA		Rest of US		No	Total
		C&TC	CSU	Uconn	2 Yr.	Selective	H Selective	Public	Private	Public	Private	Public	Private	Public	Private	Record	
Connecticut Public	C&TC	24,566	3,319	1,286	413	544	40	359	954	207	155	305	595	790	842	0	34,375
		71.5	9.7	3.7	1.2	1.6	0.1	1.0	2.8	0.6	0.5	0.9	1.7	2.3	2.5	0	100
		78.9	18.1	10.5	25.0	12.3	5.9	17.0	10.3	9.9	9.2	11.1	7.1	10.5	11.4	0	20.2
	CSU	2,874	11,646	641	143	258	21	98	304	82	48	178	274	438	385	0	17,390
		16.5	67.0	3.7	0.8	1.5	0.1	0.6	1.8	0.5	0.3	1.0	1.6	2.5	2.2	0	100
		9.2	63.6	5.2	8.7	5.8	3.1	4.6	3.3	3.9	2.9	6.5	3.3	5.8	5.2	0	10.2
	UConn	1,030	1,001	8,735	80	266	56	69	477	74	60	147	435	346	352	0	13,128
		7.9	7.6	66.5	0.6	2.0	0.4	0.5	3.6	0.6	0.5	1.1	3.3	2.6	2.7	0	100
		3.3	5.5	71.4	4.8	6.0	8.3	3.3	5.1	3.6	3.6	5.3	5.2	4.6	4.8	0	7.7
Connecticut Private	2 Yr.	292	112	30	867	35	3	5	16	4	6	6	16	25	30	0	1,447
		20.2	7.7	2.1	59.9	2.4	0.2	0.4	1.1	0.3	0.4	0.4	1.1	1.7	2.1	0	100
		0.9	0.6	0.3	52.5	0.8	0.5	0.2	0.2	0.2	0.4	0.2	0.2	0.3	0.4	0	0.9
	Selective	331	270	115	27	2,704	8	20	63	8	7	27	55	63	64	0	3,762
		8.8	7.2	3.1	0.7	71.9	0.2	0.5	1.7	0.2	0.2	0.7	1.5	1.7	1.7	0	100
		1.1	1.5	0.9	1.6	61.2	1.2	1.0	0.7	0.4	0.4	1.0	0.7	0.8	0.9	0	2.2
	H Selective	8	9	12	7	10	492	0	16	0	1	6	10	18	14	0	603
		1.3	1.5	2.0	1.2	1.7	81.6	0.0	2.7	0.0	0.2	1.0	1.7	3.0	2.3	0	100
		0.0	0.1	0.1	0.4	0.2	73.0	0.0	0.2	0.0	0.1	0.2	0.1	0.2	0.2	0	0.4
MA & RI	Public	185	179	89	5	31	0	1,284	56	13	9	21	30	64	29	0	1,995
		9.3	9.0	4.5	0.3	1.6	0.0	64.4	2.8	0.7	0.5	1.1	1.5	3.2	1.5	0	100
		0.6	1.0	0.7	0.3	0.7	0.0	60.8	0.6	0.6	0.5	0.8	0.4	0.9	0.4	0	1.2
	Private	491	467	342	35	161	17	123	6,892	34	26	75	152	158	175	0	9,148
		5.4	5.1	3.7	0.4	1.8	0.2	1.3	75.3	0.4	0.3	0.8	1.7	1.7	1.9	0	100
		1.6	2.6	2.8	2.1	3.6	2.5	5.8	74.3	1.6	1.6	2.7	1.8	2.1	2.4	0	5.4
Northern Tier	Public	221	285	119	11	52	0	25	42	1,552	41	28	35	80	47	0	2,538
		8.7	11.2	4.7	0.4	2.1	0.0	1.0	1.7	61.2	1.6	1.1	1.4	3.2	1.9	0	100
		0.7	1.6	1.0	0.7	1.2	0.0	1.2	0.5	74.4	2.4	1.0	0.4	1.1	0.6	0	1.5
	Private	134	129	61	9	36	3	16	55	30	1,279	18	23	51	40	0	1,884
		7.1	6.9	3.2	0.5	1.9	0.2	0.9	2.9	1.6	67.9	1.0	1.2	2.7	2.1	0	100
		0.4	0.7	0.5	0.5	0.8	0.5	0.8	0.6	1.4	76.1	0.7	0.3	0.7	0.5	0	1.1
NY, NJ & PA	Public	149	114	82	5	30	1	12	39	11	6	1,634	131	90	55	0	2,359
		6.3	4.8	3.5	0.2	1.3	0.0	0.5	1.7	0.5	0.3	69.3	5.6	3.8	2.3	0	100
		0.5	0.6	0.7	0.3	0.7	0.2	0.6	0.4	0.5	0.4	59.2	1.6	1.2	0.7	0	1.4
	Private	323	341	319	23	161	18	29	172	23	14	200	6,440	192	165	0	8,420
		3.8	4.1	3.8	0.3	1.9	0.2	0.3	2.0	0.3	0.2	2.4	76.5	2.3	2.0	0	100
		1.0	1.9	2.6	1.4	3.6	2.7	1.4	1.9	1.1	0.8	7.3	76.7	2.6	2.2	0	5.0
Rest of the US	Public	294	230	234	12	60	10	38	85	28	11	57	81	4,736	397	0	6,273
		4.7	3.7	3.7	0.2	1.0	0.2	0.6	1.4	0.5	0.2	0.9	1.3	75.5	6.3	0	100
		0.9	1.3	1.9	0.7	1.4	1.5	1.8	0.9	1.3	0.7	2.1	1.0	63.0	5.4	0	3.7
	Private	256	207	172	15	70	5	33	101	19	17	57	119	462	4,799	0	6,332
		4.0	3.3	2.7	0.2	1.1	0.1	0.5	1.6	0.3	0.3	0.9	1.9	7.3	75.8	0	100
		0.8	1.1	1.4	0.9	1.6	0.7	1.6	1.1	0.9	1.0	2.1	1.4	6.2	64.9	0	3.7
No Record	with SAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,933	13,933
	without SAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46,477	46,477
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	35.5
Total		31,154	18,309	12,237	1,652	4,418	674	2,111	9,272	2,085	1,680	2,759	8,396	7,513	7,394	60,410	170,064
		18.3	10.8	7.2	1.0	2.6	0.4	1.2	5.5	1.2	1.0	1.6	4.9	4.4	4.4	35.52	100
		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

A.8 First and Last Institutions by SAT Score

Table 35: Average SAT Verbal Score by First and Last Institution of Student Attendance

First Attending Segment		Last Attending College Segment													
		Connecticut Public			Connecticut Private			MA & RI		Northern Tier		NY, NJ & PA		Rest of US	
		C&TC	CSU	Uconn	2 Yr.	Selective	H Selective	Public	Private	Public	Private	Public	Private	Public	Private
CT Public	C&TC	412	454	516	430	485	662	489	508	506	486	505	533	485	477
	CSU	458	477	511	492	490	629	498	539	504	549	528	557	503	523
	Uconn	511	526	548	573	547	666	569	601	576	625	577	601	574	578
CT Private	2 Yr.	400	451	513	448	475	663	480	506	403	602	610	424	459	455
	Selective	460	500	529	492	511	601	516	568	548	561	502	573	527	520
	H Selective	600	552	643	670	618	661		675		640	638	668	685	653
MA & RI	Public	486	507	538	460	542		510	505	563	514	529	538	522	495
	Private	455	501	545	553	528	623	488	555	544	555	555	585	558	574
N. Tier	Public	498	497	533	478	511		508	513	514	514	523	537	521	523
	Private	478	495	554	501	506	590	472	565	519	558	592	560	537	563
NY, NJ & PA	Public	479	522	563	488	554	730	533	541	587	510	551	561	556	565
	Private	500	530	565	527	544	614	547	578	545	523	561	575	568	573
Rest of US	Public	465	514	558	511	543	645	487	571	505	550	542	577	547	533
	Private	477	515	584	511	560	545	532	592	545	589	580	596	542	569

Table 36: Average SAT Math Score by First and Last Institution of Student Attendance

First Attending Segment		Last Attending College Segment													
		Connecticut Public			Connecticut Private			MA & RI		Northern Tier		NY, NJ & PA		Rest of US	
		C&TC	CSU	Uconn	2 Yr.	Selective	H Selective	Public	Private	Public	Private	Public	Private	Public	Private
CT Public	C&TC	404	449	523	424	483	620	485	504	504	479	489	533	489	469
	CSU	451	473	520	478	479	654	494	539	507	525	522	558	515	518
	Uconn	522	531	559	571	550	646	564	602	570	630	581	604	574	582
CT Private	2 Yr.	389	426	523	432	467	620	523	514	463	542	576	394	433	424
	Selective	454	497	541	506	517	611	506	577	538	540	499	573	532	529
	H Selective	596	533	648	687	599	656		659		650	596	662	673	659
MA & RI	Public	495	510	546	464	525		515	498	558	470	528	572	523	506
	Private	457	499	546	534	544	639	486	559	536	567	555	570	564	573
N. Tier	Public	487	493	530	501	506		479	495	518	515	511	533	523	526
	Private	463	480	555	477	472	593	458	560	505	556	583	547	536	556
NY, NJ & PA	Public	470	514	555	530	553	640	515	541	560	410	555	563	564	563
	Private	503	520	574	500	536	613	540	577	559	536	546	579	563	574
Rest of US	Public	458	521	573	522	539	687	520	578	548	547	534	573	557	534
	Private	473	506	579	511	549	578	512	582	526	585	550	581	535	569

A.9. Probability of Taking Remedial Course

The model presented in the section on remediation provided the estimates of the base line models. Here we expand our model with students' self-reported answers to SDQ of the College Board, in addition to estimating the probability of taking English remediation course within the CTC system for different ethno-racial groups. The results suggest that Asian and Black students attending CTC system have lower probability of taking English remediation, while Hispanic students, all else equal, have higher probability, compared to white students. As expected, higher self-reported High School GPAs are associated with lower probability of taking English remediation, an effect similar to that of students who reported to be in English Honors class during High school.

Table 37: Probability of Taking English Remedial Coursework CTC system

Dependent Variable: Probability of Taking English Remedial Course – C&TC system						
	CAPT LIT	Marginal Effects	SAT Verbal	Marginal Effects	CAPT LIT & SAT Verbal	Marginal Effects
CAPT LIT – Scaled	-0.020	-0.008			-0.012	-0.005
	(0.001)***	(0.000)***			(0.001)***	(0.000)***
SAT Verbal			-0.003	-0.001	-0.002	-0.001
			(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender(=1 Male)	0.080	0.032	0.236	0.094	0.106	0.042
	(0.018)***	(0.007)***	(0.018)***	(0.007)***	(0.018)***	(0.007)***
Race/Eth(=Black)	0.018	0.007	-0.063	-0.025	-0.109	-0.043
	(0.031)	(0.012)	(0.032)**	(0.012)**	(0.032)***	(0.012)***
Race/Eth(=Hispanic)	0.305	0.121	0.211	0.084	0.194	0.077
	(0.036)***	(0.014)***	(0.037)***	(0.015)***	(0.037)***	(0.015)***
Race/Eth(=Asian)	-0.235	-0.091	-0.311	-0.119	-0.228	-0.088
	(0.055)***	(0.021)***	(0.055)***	(0.020)***	(0.056)***	(0.021)***
RF Lunch(=1)	0.149	0.059	0.082	0.032	0.077	0.030
	(0.033)***	(0.013)***	(0.033)**	(0.013)**	(0.033)**	(0.013)**
Special Ed in HS (=1)	0.214	0.085	0.188	0.075	0.103	0.041
	(0.041)***	(0.016)***	(0.041)***	(0.016)***	(0.042)**	(0.017)**
HS Cumulative GPA					-0.047	-0.018
					(0.004)***	(0.002)***
HS Engl. No. Yrs					-0.024	-0.009
					(0.004)***	(0.002)***
HS Engl. Honors(=1)					-0.449	-0.171
					(0.027)***	(0.010)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.651		0.522		1.477	
	(0.079)***		(0.071)***		(0.095)***	
Model chi-square	2343.97	2343.97	2708.59	2708.59	3590.07	3590.07
Log likelihood	-14788.45	-14788.45	-14606.14	-14606.14	-14165.40	-14165.40
Pseudo R2	0.07	0.07	0.08	0.08	0.11	0.11
N of observations	23165	23165	23165	23165	23165	23165

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

An expanded model with self-reported SDQ variables for modeling probability of taking math remediation class reveals similar results to English remediation model presented above. Compared to white students, Hispanic students have higher probability of taking Math remediation during their studies in CTC system, and male students have higher probability than female students. Students who reported to be in math honors class in high school, similarly have a lower probability of taking math remediation, however, a comparison of marginal effects of English and Math remediation classes indicates that the effect of attending Math honors class during high school on probability of taking remediation class is lower than the effect of English honors class.

Table 38: Probability of Taking Math Remedial Coursework - CTC system

Dependent Variable: Probability of Taking Remedial Math Class – C&TC system						
	CAPT MATH	Marginal Effects	SAT Math	Marginal Effects	CAPT MATH & SAT Math	Marginal Effects
CAPT MATH	-0.011	-0.004			-0.003	-0.001
	(0.000)***	(0.000)***			(0.000)***	(0.000)***
SAT Math			-0.004	-0.002	-0.003	-0.001
			(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender(=1 Male)	0.291	0.115	0.324	0.127	0.292	0.115
	(0.018)***	(0.007)***	(0.018)***	(0.007)***	(0.019)***	(0.007)***
Race/Eth(=Black)	-0.229	-0.091	-0.215	-0.086	-0.247	-0.098
	(0.033)***	(0.013)***	(0.032)***	(0.013)***	(0.034)***	(0.013)***
Race/Eth(=Hispanic)	0.142	0.056	0.110	0.043	0.106	0.042
	(0.038)***	(0.015)***	(0.038)***	(0.015)***	(0.039)***	(0.015)***
Race/Eth(=Asian)	-0.314	-0.125	-0.250	-0.099	-0.207	-0.083
	(0.054)***	(0.021)***	(0.055)***	(0.022)***	(0.056)***	(0.022)***
RF Lunch(=1)	0.118	0.046	0.105	0.041	0.094	0.037
	(0.035)***	(0.014)***	(0.034)***	(0.013)***	(0.035)***	(0.014)***
Special Ed in HS (=1)	0.158	0.062	0.154	0.060	0.123	0.048
	(0.043)***	(0.017)***	(0.043)***	(0.016)***	(0.044)***	(0.017)***
HS Cumulative GPA					-0.061	-0.024
					(0.004)***	(0.002)***
HS Math Yrs.					-0.034	-0.013
					(0.004)***	(0.002)***
HS Math Honors (=1)					-0.299	-0.119
					(0.030)***	(0.012)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.164		1.358		2.085	
	(0.093)***		(0.070)***		(0.105)***	
Model chi-square	2618.21	2618.21	3305.55	3305.55	3713.42	3713.42
Log likelihood	-14376.59	-14376.59	-14331.86	-14331.86	-13828.99	-13828.99
Pseudo R2	0.08	0.08	0.10	0.10	0.12	0.12
N of observations	22716	22716	23165	23165	22716	22716

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

Probability of taking math remediation classes within the CSU system results with similar coefficients for CAPT and SAT math exam scores we obtained for the CTC system. The ethno-racial background of the student has somewhat different influence however. While the coefficients for Hispanic and Asian students are negative, these effects are not statistically significant. Therefore, we cannot say that, unlike the case for CTC system, white students are more likely to attend math remediation classes than Hispanic and Asian students. Similarly, family background, captured by the reduced/free lunch status of the student has a statistically insignificant effect on probability of remediation for the students who attended CSU system.

Table 39: Probability of Taking Math Remedial Coursework - CSU system

Dependent Variable: Probability of Taking Remedial Math Class – CSU system						
	CAPT MATH	Marginal Effects	SAT Math	Marginal Effects	CAPT Math & SAT Math	Marginal Effects
CAPT MATH	-0.015	-0.005			-0.005	-0.002
	(0.000)***	(0.000)***			(0.001)***	(0.000)***
SAT Math			-0.006	-0.002	-0.004	-0.001
			(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender(=1 Male)	0.054	0.017	0.102	0.031	0.082	0.024
	(0.025)**	(0.008)**	(0.026)***	(0.008)***	(0.026)***	(0.008)***
Race/Eth(=Black)	-0.110	-0.032	-0.107	-0.031	-0.176	-0.049
	(0.051)**	(0.015)**	(0.051)**	(0.014)**	(0.052)***	(0.013)***
Race/Eth(=Hispanic)	-0.037	-0.011	-0.030	-0.009	-0.064	-0.018
	(0.061)	(0.018)	(0.061)	(0.018)	(0.062)	(0.017)
Race/Eth(=Asian)	-0.210	-0.060	-0.147	-0.042	-0.143	-0.040
	(0.092)**	(0.024)**	(0.094)	(0.025)*	(0.095)	(0.025)
RF Lunch(=1)	0.039	0.012	0.010	0.003	0.021	0.006
	(0.055)	(0.017)	(0.055)	(0.017)	(0.056)	(0.017)
Special Ed in HS (=1)	0.110	0.035	0.097	0.030	0.058	0.018
	(0.067)	(0.022)	(0.068)	(0.022)	(0.068)	(0.021)
HS Cumulative GPA					-0.026	-0.008
					(0.007)***	(0.002)***
HS Math Yrs.					-0.026	-0.008
					(0.006)***	(0.002)***
HS Math Honors (=1)					-0.457	-0.117
					(0.053)***	(0.011)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.570		1.627		2.456	
	(0.152)***		(0.121)***		(0.169)***	
Model chi-square	1937.53	1937.53	2294.68	2294.68	2518.23	2518.23
Log likelihood	-6960.65	-6960.65	-6782.07	-6782.07	-6670.30	-6670.30
Pseudo R2	0.12	0.12	0.14	0.14	0.16	0.16
N of observations	13747	13747	13747	13747	13747	13747

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

Unlike CTC and CSU systems, all else equal, within UConn the probability of attending math remediation for Hispanic and Black students is not statistically different than that of white students. Asian students, however, have a lower probability of taking math remediation. While attending a math honors class during high school lowers the probability of taking math remediation, the lower marginal effect shows that being a math honors class during high school has lesser predictive power in math remediation for UConn students.

Table 40: Probability of Taking Math Remedial Coursework - UConn

Dependent Variable: Probability of Taking Remedial Math Class – UConn						
	CAPT MATH	Marginal Effects	SAT Math	Marginal Effects	CAPT Math & SAT Math	Marginal Effects
CAPT MATH	-0.018	-0.004			-0.004	-0.001
	(0.001)***	(0.000)***			(0.001)***	(0.000)***
SAT Math			-0.008	-0.001	-0.006	-0.001
			(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender(=1 Male)	-0.130	-0.027	-0.054	-0.010	-0.083	-0.015
	(0.032)***	(0.007)***	(0.033)	(0.006)*	(0.034)**	(0.006)**
Race/Eth(=Black)	0.094	0.021	0.069	0.014	0.032	0.006
	(0.070)	(0.016)	(0.072)	(0.015)	(0.073)	(0.014)
Race/Eth(=Hispanic)	0.196	0.045	0.123	0.025	0.105	0.020
	(0.069)***	(0.017)***	(0.071)*	(0.015)	(0.072)	(0.014)
Race/Eth(=Asian)	-0.541	-0.084	-0.456	-0.067	-0.467	-0.063
	(0.083)***	(0.009)***	(0.086)***	(0.009)***	(0.088)***	(0.009)***
RF Lunch(=1)	0.189	0.043	0.167	0.035	0.139	0.027
	(0.074)**	(0.018)**	(0.076)**	(0.017)**	(0.077)*	(0.016)*
Special Ed in HS (=1)	-0.013	-0.003	-0.257	-0.042	-0.284	-0.042
	(0.128)	(0.026)	(0.134)*	(0.018)**	(0.134)**	(0.016)***
HS Cumulative GPA					-0.044	-0.008
					(0.010)***	(0.002)***
HS Math Yrs.					-0.026	-0.005
					(0.007)***	(0.001)***
HS Math Honors (=1)					-0.479	-0.078
					(0.045)***	(0.006)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.056		3.302		3.968	
	(0.195)***		(0.147)***		(0.228)***	
Model chi-square	1477.99	1477.99	2053.79	2053.79	2253.42	2253.42
Log likelihood	-4320.65	-4320.65	-4032.74	-4032.74	-3932.93	-3932.93
Pseudo R2	0.15	0.15	0.20	0.20	0.22	0.22
N of observations	11235	11235	11235	11235	11235	11235

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

A.10. Institutions Attended and Average Number of Semesters by First and Last College

Table 41: Average Number of Institutions Attended by Institution of Students' First and Last Attendance

First Attending Segment		Last Attending College Segment													
		Connecticut Public			Connecticut Private			MA & RI		Northern Tier		NY, NJ & PA		Rest of US	
		C&TC	CSU	Uconn	2 Yr.	Selective	H Selective	Public	Private	Public	Private	Public	Private	Public	Private
CT Public	C&TC	1.22	2.31	2.36	2.35	2.50	2.72	2.47	2.44	2.39	2.41	2.58	2.45	2.64	2.49
	CSU	2.23	1.20	2.34	2.43	2.41	2.48	2.52	2.44	2.35	2.48	2.53	2.40	2.55	2.57
	Uconn	2.33	2.35	1.23	2.22	2.33	2.38	2.48	2.31	2.30	2.32	2.40	2.34	2.57	2.45
CT Private	2 Yr.	2.30	2.44	2.33	1.19	2.46	2.67	3.00	2.25	2.00	2.67	2.83	2.50	2.92	2.70
	Selective	2.34	2.32	2.34	2.22	1.22	2.63	2.80	2.49	2.75	2.71	2.78	2.44	2.56	2.52
	H Selective	2.50	2.44	2.33	1.43	2.20	1.44		2.44		2.00	2.67	2.40	2.72	2.21
MA & RI	Public	2.34	2.50	2.44	2.40	2.58		1.28	2.32	2.54	2.78	2.38	2.40	2.66	2.66
	Private	2.39	2.41	2.42	2.69	2.45	2.65	2.33	1.34	2.47	2.31	2.47	2.38	2.53	2.54
N. Tier	Public	2.51	2.32	2.42	2.27	2.58		2.68	2.50	1.32	2.34	2.43	2.49	2.66	2.62
	Private	2.34	2.38	2.38	2.33	2.61	3.00	2.56	2.60	2.33	1.37	2.28	2.39	2.57	2.47
NY, NJ & PA	Public	2.36	2.54	2.43	3.60	2.73	2.00	2.75	2.44	2.55	2.67	1.37	2.31	2.60	2.58
	Private	2.51	2.49	2.36	2.61	2.45	2.50	2.76	2.53	2.78	3.14	2.50	1.38	2.59	2.68
Rest of US	Public	2.41	2.53	2.52	3.42	3.00	2.50	2.61	2.45	2.32	2.64	2.75	2.40	1.41	2.46
	Private	2.44	2.49	2.44	2.80	2.30	2.60	2.70	2.45	2.58	2.59	2.56	2.32	2.49	1.37

Table 42: Average number of Semesters Attended by Institution of Students' First and Last Attendance

First Attending Segment		Last Attending College Segment													
		Connecticut Public			Connecticut Private			MA & RI		Northern Tier		NY, NJ & PA		Rest of US	
		C&TC	CSU	Uconn	2 Yr.	Selective	H Selective	Public	Private	Public	Private	Public	Private	Public	Private
CT Public	C&TC	4.63	10.10	10.76	9.12	9.70	11.60	8.59	10.29	9.60	9.19	9.11	10.38	8.94	8.98
	CSU	7.47	8.02	10.93	9.63	10.62	11.57	9.27	10.43	9.80	10.48	10.62	10.47	10.10	10.09
	Uconn	8.46	10.61	9.70	8.44	10.97	9.89	9.36	9.87	10.23	10.73	10.33	10.22	10.66	10.47
CT Private	2 Yr.	6.82	10.35	10.67	6.34	10.23	10.33	8.20	9.88	6.25	12.83	10.17	10.00	8.36	10.07
	Selective	7.03	9.19	9.91	8.11	7.90	12.50	8.90	10.43	12.13	9.71	9.96	10.56	9.56	11.33
	H Selective	6.75	10.56	11.42	6.14	11.20	9.84		12.38		16.00	13.67	11.60	14.06	11.86
MA & RI	Public	6.94	10.38	10.36	14.80	10.26		8.31	8.00	9.23	11.89	10.43	10.00	10.41	9.69
	Private	7.05	9.89	10.96	10.97	10.77	11.06	9.23	9.03	10.24	10.69	9.71	10.51	10.66	11.42
N. Tier	Public	7.71	10.17	10.51	11.27	10.63		9.92	10.81	8.86	9.02	10.43	10.29	10.52	11.04
	Private	6.90	9.81	11.30	10.89	10.81	10.67	9.63	11.25	8.27	8.84	9.72	11.26	10.94	11.68
NY, NJ & PA	Public	6.83	10.16	10.49	15.20	11.20	7.00	10.75	11.10	8.00	10.00	8.41	9.74	9.98	10.53
	Private	8.31	10.31	10.96	10.78	10.72	12.11	10.66	11.31	10.91	11.07	10.76	9.35	11.30	12.11
Rest of US	Public	6.87	9.77	11.42	12.17	10.80	12.80	9.95	10.04	10.14	10.36	10.74	10.35	8.54	9.53
	Private	7.46	9.73	10.84	9.13	10.39	12.80	9.52	10.51	10.11	9.18	10.42	10.03	10.50	8.40

A.11. Percentage Courses Passed

Table 43: CAPT and Percent Courses Passed in Public Segment of Higher Education

Dependent Variable: Percent Courses Passed				
	CAPT LIT&MATH	SAT Verbal&Math	SAT Verbal&Math	CAPT & SAT
CAPT LIT – Scaled	0.121			0.098
	(0.007)***			(0.007)***
CAPT MATH	0.053			0.013
	(0.003)***			(0.004)***
SAT Verbal		0.006	0.004	-0.000
		(0.001)***	(0.001)***	(0.001)
SAT Math		0.020	0.017	0.012
		(0.001)***	(0.001)***	(0.001)***
Gender(=1 Male)	-3.879	-4.852	-4.218	-3.728
	(0.172)***	(0.166)***	(0.168)***	(0.174)***
Race/Eth(=Black)	-3.302	-3.708	-3.686	-3.206
	(0.335)***	(0.332)***	(0.333)***	(0.334)***
Race/Eth(=Hispanic)	-2.260	-2.262	-2.505	-2.210
	(0.371)***	(0.372)***	(0.372)***	(0.370)***
Race/Eth(=Asian)	-0.875	-1.174	-1.514	-1.487
	(0.476)*	(0.478)**	(0.479)***	(0.475)***
RF Lunch(=1)	-0.756	-0.638	-0.753	-0.685
	(0.347)**	(0.348)*	(0.348)**	(0.345)**
Transfer(=1)	-1.669	-1.700	-3.354	-1.634
	(0.262)***	(0.263)***	(0.263)***	(0.260)***
HS Cumulative GPA			0.745	0.679
			(0.040)***	(0.040)***
HS Math Hnrs (=1)			0.410	0.235
			(0.270)	(0.268)
HS Engl. Hnrs (=1)			1.943	1.435
			(0.248)***	(0.247)***
Ending Segment (=CSU)	5.003	5.049	3.465	4.867
	(0.194)***	(0.194)***	(0.194)***	(0.193)***
Ending Seg.(=UConn)	5.668	5.625	3.325	4.604
	(0.215)***	(0.217)***	(0.221)***	(0.219)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes
Constant	65.869	76.746	75.216	67.229
	(0.917)***	(0.668)***	(0.715)***	(0.970)***
Adj R2	0.10	0.10	0.10	0.11
F-stat	176.18	170.44	152.09	167.33
N of observations	39781	39781	39781	39781

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

A.12. Exit GPAs

Table 44: CAPT and Exit GPAs in Public Segment of Higher Education

Dependent Variable: LOG(EXIT GPA)				
	CAPT LIT&MATH	SAT Verbal&Math	CAPT&SAT	CAPT&SAT
LOG (CAPT LIT)	0.185		0.153	0.147
	(0.010)***		(0.010)***	(0.011)***
LOG (CAPT MATH)	0.369		0.125	0.107
	(0.014)***		(0.019)***	(0.020)***
LOG (SAT Verbal)		0.220	0.180	0.186
		(0.010)***	(0.011)***	(0.011)***
LOG (SAT Math)		0.175	0.114	0.104
		(0.011)***	(0.013)***	(0.013)***
Gender (=1 M)	-0.081	-0.099	-0.086	-0.082
	(0.003)***	(0.003)***	(0.003)***	(0.004)***
Race/Eth(=1 Black)	-0.062	-0.064	-0.056	-0.056
	(0.007)***	(0.006)***	(0.007)***	(0.007)***
Race/Eth(=1 Hispanic)	-0.016	-0.009	-0.005	-0.004
	(0.007)**	(0.007)	(0.007)	(0.008)
Race/Eth(=1 Asian)	-0.021	-0.015	-0.017	-0.018
	(0.010)**	(0.010)	(0.010)*	(0.010)*
RF Lunch (=1)	-0.008	-0.001	0.003	0.004
	(0.007)	(0.006)	(0.007)	(0.007)
Transfer(=1)	-0.027	-0.025	-0.026	-0.026
	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Remedial Course(=1)	-0.323	-0.324	-0.310	-0.309
	(0.008)***	(0.008)***	(0.009)***	(0.009)***
Rem *(%)Passing Rem Course	0.292	0.301	0.292	0.293
	(0.008)***	(0.008)***	(0.008)***	(0.009)***
Num. Sem. Attended	0.057	0.057	0.056	0.055
	(0.001)***	(0.001)***	(0.001)***	(0.001)***
NumSemAttended-sq	-0.002	-0.002	-0.002	-0.002
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
HS GPA	0.018	0.017	0.017	0.020
	(0.001)***	(0.001)***	(0.001)***	(0.001)***
HS Engl. No. Yrs				0.003
				(0.001)***
HS Math No. Yrs				0.002
				(0.001)**
Ending Segment (=CSU)	-0.124	-0.123	-0.125	-0.125
	(0.004)***	(0.004)***	(0.004)***	(0.004)***
Ending Seg.(=UConn)	-0.105	-0.112	-0.120	-0.123
	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes
Constant	-2.238	-1.814	-2.555	-2.452
	(0.080)***	(0.061)***	(0.082)***	(0.085)***
Adj R2	0.25	0.25	0.26	0.26
F-stat	446.92	467.90	433.42	388.16
N of observations	42374	42374	42374	42374

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

A.13A. Probability of Graduation, All Sample

Here a model hypothesizing the graduation probability dependent on a number of factors, such as number of years the student attended English and Math courses during high school, in addition to student background, type of first choice of college is presented. In order to do so, we expand our data using the self-reported variables obtained from the SDQ of the College Board.

The discussion on graduation probability in the text noted that minority students and students from poorer families are less likely to graduate, compared to white student and students from affluent families. A comparison of different ethno-racial groups with the white students reveals however that not all minority students are less likely to graduate than white students. The difference in graduation probability between white and Asian students is statistically insignificant. All else equal, however, a Hispanic student is .8 points less likely to graduate, and once combined with the gender effect, compared to a white female student, the graduation probability of a Hispanic male student is .15 points lower. Number of semesters attended increases the probability of graduation, with each additional semester attended, the graduation probability increases by .18 points. This effect however is not linear as suggested by the statistically significant effect of the square of semesters attended, after approximately 15 semesters, the probability of graduation starts to decrease. A one grade increase in High School GPA is associated with .03 points increase in the probability of graduation, and high school preparation for college effects is also statistically significant as indicated by high school English and math course grades. That these variables are statistically significant, even with the incorporation of CAPT and SAT test scores suggest that, high school course work preparation has a statistically significant association with the college graduation probability beyond the effects of CAPT and SAT test scores.

Table 45: Probability of Graduation, 1996 - 2000 CAPT College Bound Cohorts

Dependent Variable: Probability of Graduation with a Degree – ALL SAMPLE								
	CAPT	Marg.Eff.	SAT	Marg.Effects	CAPT&SAT	Marg.Effects	CAPT&SAT	Marg.Effects
CAPT LIT Scaled Score	0.009	0.003			0.008	0.003	0.007	0.003
	(0.001)***	(0.000)***			(0.001)***	(0.000)***	(0.001)***	(0.000)***
CAPT Math Scale Score	0.005	0.002			0.000	0.000	0.000	0.000
	(0.000)***	(0.000)***			(0.000)	(0.000)	(0.000)	(0.000)*
SAT Verbal			0.001	0.000	0.000	0.000	0.000	0.000
			(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)**
SAT Math			0.002	0.001	0.002	0.001	0.002	0.001
			(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender (=1 M)	-0.200	-0.073	-0.282	-0.103	-0.233	-0.085	-0.225	-0.077
	(0.014)***	(0.005)***	(0.013)***	(0.005)***	(0.014)***	(0.005)***	(0.014)***	(0.005)***
Race/Eth(=Black)	-0.158	-0.059	-0.166	-0.062	-0.146	-0.054	-0.148	-0.057
	(0.030)***	(0.011)***	(0.029)***	(0.011)***	(0.030)***	(0.011)***	(0.030)***	(0.011)***
Race/Eth (=Hispanic)	-0.254	-0.096	-0.250	-0.095	-0.235	-0.089	-0.235	-0.081
	(0.034)***	(0.013)***	(0.034)***	(0.013)***	(0.034)***	(0.013)***	(0.035)***	(0.013)***
Race/Eth (=Asian)	-0.014	-0.005	-0.054	-0.020	-0.052	-0.019	-0.054	-0.024
	(0.040)	(0.015)	(0.040)	(0.015)	(0.040)	(0.015)	(0.040)	(0.015)
RF Lunch(=1)	-0.135	-0.050	-0.117	-0.043	-0.116	-0.043	-0.114	-0.037
	(0.033)***	(0.012)***	(0.033)***	(0.012)***	(0.033)***	(0.012)***	(0.033)***	(0.012)***
No. Semester	0.488	0.178	0.489	0.178	0.486	0.177	0.485	0.175
	(0.005)***	(0.002)***	(0.005)***	(0.002)***	(0.005)***	(0.002)***	(0.005)***	(0.002)***
No. Semester square	-0.013	-0.005	-0.013	-0.005	-0.013	-0.005	-0.013	-0.005
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
HS GPA	0.084	0.030	0.077	0.028	0.071	0.026	0.070	0.026
	(0.004)***	(0.001)***	(0.004)***	(0.001)***	(0.004)***	(0.001)***	(0.004)***	(0.001)***
Public Inst (=1)	-0.193	-0.069	-0.187	-0.067	-0.183	-0.066	-0.180	-0.083
	(0.017)***	(0.006)***	(0.017)***	(0.006)***	(0.017)***	(0.006)***	(0.017)***	(0.006)***
In CT (=1)	0.119	0.044	0.136	0.050	0.141	0.052	0.142	0.033
	(0.017)***	(0.006)***	(0.017)***	(0.006)***	(0.017)***	(0.006)***	(0.017)***	(0.006)***
Transfer(=1)	-0.656	-0.247	-0.660	-0.248	-0.661	-0.249	-0.660	-0.248
	(0.014)***	(0.005)***	(0.014)***	(0.005)***	(0.014)***	(0.005)***	(0.014)***	(0.005)***
HS Engl. Yrs							-0.005	-0.001
							(0.004)	(0.002)
HS Engl. Grade							0.057	0.021
							(0.010)***	(0.003)***
HS Math Yrs.							0.027	0.010
							(0.004)***	(0.002)***
HS Math. Grade							-0.031	-0.011
							(0.009)***	(0.003)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.757		-4.045		-4.549		-4.701	
	(0.076)***		(0.058)***		(0.077)***		(0.082)***	
Model chi-square	34683.67	34683.67	34830.97	34830.97	35018.56	35018.56	35109.43	32860.55
Log likelihood	-24659.65	-24659.65	-24586.00	-24586.00	-24492.20	-24492.20	-24446.77	-25571.21
Pseudo R2	0.41	0.41	0.41	0.41	0.42	0.42	0.42	0.39
N of observations	64296	64296	64296	64296	64296	64296	64296	64296

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

A.13B. Probability of Graduation, Connecticut Public Higher Education Segment

In this model we also exploit the remediation course work of the student, in addition to the English and Mathematics courses attended during high school. Note however that in this analysis we did not control for variations across college campuses, therefore our results may vary at campus level. Furthermore, note that the sampled student population represents only a portion of total student population in these institutions. Thus, the analysis is expected to differ from the institution based graduation records. In addition to the variables obtained from the SDQ of the College Board, we also utilize the transcript data from the public higher education segment of CT. Attending remediation classes during college lowers the graduation probability of an average student by .37 points. Reporting simply this effect would be misleading however, as whether or not the student succeed the remediation course work is also crucial. Once the percentage of remediation classes passed is interacted with the remediation course work indicator, the model indicates that the probability of graduation of an average student who passed the remediation course work is .08 points lower than a similar student who did not attend remediation course work. All else equal, a student who fails remediation course work, on the other hand, is .66 points less likely than a student who did not attend remediation courses during college.

Table 46: Probability of Graduation in Public Segment of Higher Education, 1996 - 2000 CAPT Cohorts

Dependent Variable: Probability of Graduation with a Degree – CT Public Higher Education						
	CAPT	Marg.Effects	SAT	Marg.Effects	CAPT&SAT	Marg.Effects
CAPT LIT Scaled Score	0.007	0.003			0.006	0.002
	(0.001)***	(0.000)***			(0.001)***	(0.000)***
CAPT Math Scale Score	0.002	0.001			0.000	0.000
	(0.000)***	(0.000)***			(0.000)	(0.000)
SAT Verbal			0.000	0.000	-0.000	-0.000
			(0.000)**	(0.000)**	(0.000)	(0.000)
SAT Math			0.001	0.000	0.001	0.000
			(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender (=1 M)	-0.228	-0.090	-0.288	-0.114	-0.222	-0.087
	(0.019)***	(0.007)***	(0.018)***	(0.007)***	(0.020)***	(0.008)***
Race/Eth(=Black)	-0.256	-0.102	-0.277	-0.110	-0.244	-0.096
	(0.037)***	(0.015)***	(0.036)***	(0.014)***	(0.039)***	(0.016)***
Race/Eth (=Hispanic)	-0.213	-0.084	-0.225	-0.089	-0.204	-0.081
	(0.041)***	(0.016)***	(0.040)***	(0.016)***	(0.044)***	(0.017)***
Race/Eth (=Asian)	-0.101	-0.040	-0.150	-0.060	-0.127	-0.049
	(0.053)*	(0.021)*	(0.051)***	(0.021)***	(0.054)**	(0.022)**
RF Lunch(=1)	-0.097	-0.039	-0.083	-0.033	-0.084	-0.031
	(0.039)**	(0.016)**	(0.038)**	(0.015)**	(0.042)**	(0.016)*
No. Semester	0.549	0.216	0.551	0.218	0.544	0.212
	(0.009)***	(0.004)***	(0.009)***	(0.003)***	(0.009)***	(0.004)***
No. Semester square	-0.015	-0.006	-0.015	-0.006	-0.015	-0.006
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Remedial(=1)	-0.970	-0.372	-0.957	-0.367	-0.953	-0.366
	(0.052)***	(0.019)***	(0.052)***	(0.018)***	(0.055)***	(0.020)***
Rem*Prct pass Rem	0.723	0.285	0.711	0.281	0.735	0.287
	(0.052)***	(0.021)***	(0.052)***	(0.020)***	(0.055)***	(0.022)***
HS GPA	0.057	0.022	0.057	0.022	0.063	0.023
	(0.004)***	(0.002)***	(0.004)***	(0.002)***	(0.005)***	(0.002)***
Public 2 Yr(=1)	-0.223	-0.088	-0.228	-0.090	-0.215	-0.084
	(0.019)***	(0.008)***	(0.019)***	(0.008)***	(0.020)***	(0.008)***
HS Engl. Yrs					0.114	0.044
					(0.028)***	(0.011)***
HS Engl. Grade					0.009	0.015
					(0.005)**	(0.005)***
HS Math Yrs.					0.082	0.036
					(0.031)***	(0.012)***
HS Math. Grade					-0.005	-0.013
					(0.010)	(0.004)***
Controls for CAPT Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.610		-4.033		-4.314	
	(0.117)***		(0.091)***		(0.132)***	
Model chi-square	20185.96	20185.96	20438.56	20438.56	18509.97	18514.85
Log likelihood	-13264.39	-13264.39	-13550.32	-13550.32	-12374.42	-12371.98
Pseudo R2	0.43	0.43	0.43	0.43	0.43	0.43
N of observations	34380	34380	34380	34380	34380	34380

A.14: SAT and Participation in Connecticut Work Force

Although main emphasis in Next Steps has been on 10th grade CAPT exams, all of our results are replicated by utilizing SAT exam as the benchmark. The table below for instance replicates the outcomes of students whose records were traced in College Board dataset, including the special group of students whose choice of higher education institution was not available in the dataset. The first point to be read from the Table is the variations in the distribution of students across SAT score bands and degree status. Note, for instance, only 40% of students with a four-year degree scoring higher than 1200 in SAT Verbal and Math exams opted to stay and participate in CT's workforce, compared to 72% of students with similar higher education credentials, but with less than 800 total SAT score. This trend strongly supports the results obtained for CAPT scores. Note also that by the end of study period, the percentage of participants in CT's workforce dropped to 31% and 69%, respectively, a drop much sharper for the high scoring individuals. Considering the differentials in participating CT's workforce by SAT score bands, the average earnings of individuals in these score bands should be interpreted with care. That average earnings of group consisting individuals, with a four year degree scoring more than 1200 SAT score, represents only the earnings of the less than half of group, as more than 50% of the students in this group has left the State for opportunities elsewhere.

Table 47: Labor Market Outcomes by SAT Score Range and Educational Attainment

Sum Tot SAT Scores, Math and Verbal		No of Students	Worked in CT WF, following schooling	% Worked in CT WF, following school	Still in CT WF in 2006.4	% Still in CT WF in 2006.4	% Periods Participated in CT WF, following schooling	Average Earnings Per Quarter
Sum > 1200	No NSC with SAT	1,915	NA	NA	NA	NA	NA	NA
	Some College, incl. Certificates	2,985	1,907	0.64	1,176	0.39	0.81	5048
	Completed 2-Yr Degree	142	75	0.53	90	0.63	0.9	5277
	Completed 4-Yr Degree	8,386	3,361	0.40	2,632	0.31	0.84	6465
1000<Sum<1200	No NSC with SAT	3,332	NA	NA	NA	NA	NA	NA
	Some College, incl. Certificates	8,165	6,326	0.77	4,534	0.56	0.86	5344
	Completed 2-Yr Degree	774	465	0.60	521	0.67	0.9	5814
	Completed 4-Yr Degree	11,290	6,725	0.60	5,892	0.52	0.88	6298
800<Sum<1000	No NSC with SAT	4,008	NA	NA	NA	NA	NA	NA
	Some College, incl. Certificates	10,701	9,033	0.84	6,857	0.64	0.87	5347
	Completed 2-Yr Degree	1,460	907	0.62	1,078	0.74	0.91	5766
	Completed 4-Yr Degree	6,871	4,745	0.69	4,523	0.66	0.91	6471
Sum < 800	No NSC with SAT	3,203	NA	NA	NA	NA	NA	NA
	Some College, incl. Certificates	6,681	5,962	0.89	4,718	0.71	0.87	4841
	Completed 2-Yr Degree	954	650	0.68	749	0.79	0.92	5403
	Completed 4-Yr Degree	1,363	988	0.72	938	0.69	0.89	6194

* excluding still attending, **excluding Masters or higher degrees

A.15: Returns to Education

One of the reasons individuals may decide to pursue higher education is if they believe the present value benefits of such education, most often realized as earnings in the labor market, exceed its costs such as foregone earnings during schooling, tuition and associated costs of schooling. Here we define the average early work career earnings of individuals as the returns to education. Labor experience of persons who were traced in the Unemployment and Insurance database represents their true experiences in the labor market, as we were able to observe each quarter they worked. This point is particularly relevant for women whose labor market experiences are more likely to be interrupted by marriage and child-bearing decisions (Bacolod and Hotz 2007).

Although the logic inherent in pursuing higher education is simple, measuring the relationship between education and earnings requires thinking outside of the box. Consider the following scenario: If a person calculates the benefit and cost of pursuing higher education, the implied assumption is that this person has information on two states: what would the earnings be (i) with and (ii) without a college degree. Yet, the observation is only for one of the states, individuals either pursue higher education or not. Calculating returns to education for each individual requires that the analysis tease out these two states. When this is not possible, the analysis in fact is a comparison of the earnings of two "similar" individuals who differ by their college credential. Satisfying this assumption is quite arduous, however. Consider two individuals of similar in observed backgrounds, similar test scores, similar parental income, yet, the parents of the first student is more involved in the student's schooling, and this information is not available to the researcher. This being the case, the assumptions required for an unbiased analysis of an earnings comparison of two similar individuals, is very difficult to satisfy. The technically well versed readers will understand the nature of these difficulties.

Yet, let us run the analysis as a simple exercise, as we will see even with fragile assumptions, the results are suggestive for our purposes, explaining the returns to earnings for minority and poor students. The formulation of model reflects the responsiveness of earnings to percentage increases in 10th grade test scores. For instance, Basic Model, which includes only demographic variables explaining the student's background and gender, labor experience of the student post completion of highest education attainment and CAPT exam scores, reveals that for each one percent increase in CAPT MATH and LIT scores of the student, the average earnings of the student increases by 62% percent and 34% percent, respectively. Average earnings of male students are higher than female students, approximately 8.3%, and African-American students earn less than white students in their early work careers, approximately 11%. More experience in the labor market is rewarded, one additional quarter in the labor market increases average earnings by 0.1 percent, however, this effect is not linear, the positive increase of additional experience in the labor market declines in time, approximately 6 years later, the positive effect of experience in earnings begins to decline.

In the second column, Model (I) we add the higher education credentials of the persons included in our study, in addition to CAPT exam scores and other variables of interest, such as gender and ethno-racial background. Once higher education credentials are included, the effect of 10th grade CAPT MATH exam score is halved into two, dropping from 62% to 31%. The drop in the effect of CAPT Lit exam is much sharper, from 34% to 10%. Without any labor market related information, Model (I) reports compared to a non-college bound student, all else equal, a student with some college background will earn approximately 46% more, while a 4 year degree holding student will earn 76% more.

The last column, Model (III) reports the full model, after incorporating industry of employment to the model. In its final form, a one percentage increase in CAPT Math score is associated with 31% increases in average earnings, students who hold a 4 year degree earn, on average, 45% more than students with no higher education degrees. Gender gap in earnings widens, as males earn 13% more than females, all else equal. The earnings returns to experience also decreases, each additional employed quarter increases earnings by 7.6%, however, as experience level increases, the returns to earnings increase less and less. After including higher education credentials and industry of employment, the returns to experience begins to decline after approximately 10 years. The fact that returns to degree holdings exceed the ethno-racial earnings gap point to positive effects of educational attainment for each ethno-racial group in the sample (Gonzales and Hilmer 2007). Note however, that the returns of education for Hispanic and Black students change in sign and size with the inclusion of industry of the occupation. The simple interpretation of this result is that these students have difficulty in securing jobs with lucrative earnings prospects. Our results thus suggest that group-level averages reported in Figure 32 represent a very broad categorization of the earnings potential of the individuals. In future, with a better dataset, and presumably using hourly wages as the outcome, the returns to earnings of students from disadvantaged backgrounds can be analyzed with more precision.

Table 48: Returns to Education in Labor Market- Connecticut

Dependent Variable: Ln(Wages)				
	Basic	Model(I)	Model (II)	Model (III)
Ln(CAPT MATH)	0.618	0.314	0.343	0.306
	(0.022)***	(0.021)***	(0.021)***	(0.018)***
Ln(CAPT LIT)	0.338	0.096	0.105	0.09
	(0.016)***	(0.016)***	(0.016)***	(0.014)***
Gender(=1 M)	0.083	0.137	0.14	0.132
	(0.006)***	(0.006)***	(0.006)***	(0.006)***
Race/Eth(=Black)	-0.107	-0.125	-0.118	-0.12
	(0.012)***	(0.011)***	(0.011)***	(0.010)***
Race/Eth(=Hispanic)	0.008	0.008	0.005	-0.007
	(0.012)	(0.012)	(0.012)	-0.01
Race/Eth(=Asian)	0.074	0.04	0.028	0.035
	(0.022)***	(0.022)*	-0.022	(0.019)*
RF Lunch(=1)	-0.089	-0.051	-0.052	-0.041
	(0.011)***	(0.011)***	(0.011)***	(0.009)***
Experience	0.094	0.099	0.096	0.076
	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Experience ^sq	-0.002	-0.002	-0.002	-0.001
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Degree(=Some College)		0.459	0.113	0.177
		(0.009)***	(0.020)***	(0.018)***
Degree(=2 Yr)		0.658	0.304	0.285
		(0.015)***	(0.023)***	(0.021)***
Degree(=4 Yr)		0.761	0.437	0.452
		(0.011)***	(0.020)***	(0.018)***
Graduate In CT (=1)			0.187	0.076
			(0.011)***	(0.010)***
Graduation Public Inst.(=1)			-0.006	0.004
			-0.011	-0.01
Controls for CAPT Cohort	Yes	Yes	Yes	Yes
Controls for CAPT ERG	Yes	Yes	Yes	Yes
Controls for Industry				Yes
Constant	2.821	4.827	4.889	5.349
	(0.113)***	(0.113)***	(0.113)***	(0.112)***
Adj R2	0.16	0.21	0.22	0.31
F-stat	493.32	649.9	627.63	460.24
N of observations	66759	66759	66759	66759

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

BIBLIOGRAPHY

Alfonso, M. (2006) “The Impact of Community College Attendance on Baccalaureate Attainment” *Research in Higher Education*, Vol. 47, No. 8, pp. 873 – 903

Alon, S. (2008) “"Overlapping Disadvantages and Racial and Ethnic Disparities in College Graduation" forthcoming in *Social Science Research*

Angrist, J. , Lang, D. and Oreopoulos, P. (2007) “Incentives and Services for College Achievement: Evidence from a Randomized Trial” *IZA Discussion Paper* No. 3134

Bacolod, M. and Hotz, J. (2006) "Cohort Changes in the Transition from School to Work: Evidence from Three NLS Surveys." *Economics of Education Review* ,Vol.25, pp. 351 - 373

Beattie, I.R. (2002) “Are All "Adolescent Econometricians" Created Equal? Racial, Class, and Gender Differences in College Enrollment” *Sociology of Education*, Vol. 75, No. 1, pp. 19-43

Bishop, J. (1989) "Is the Test Score Decline Responsible for the Productivity Growth Decline?" *American Economic Review,* Vol. 79, No. 1, pp. 178 – 197

Blinder, A. (2006) “Preparing America’s Workforce: Are We Looking in the Rear-View Mirror? “ *CEPS Working Paper No. 135*

Blinder, A. (2007) “How Many U.S. Jobs Might Be Offshorable?” *CEPS Working Paper No. 142*

Bobitt-Zeher, D. (2007) “The Gender Income Gap and the Role of Education” *Sociology of Education*, Vol. 80, pp. 1–22

Bowles, S., Gintis, H. and Osborne, M. (2001) “The Determinants of Earnings: A Behavioral Approach” *Journal of Economic Literature*, Vol. 39, No.4, pp. 1137-1176

Charles, C.Z., Roscigno, V. J.and Torres, K.C. (2007) “Racial Inequality and College Attendance: The Mediating Role of Parental Investments” *Social Science Research*, Vol. 36, pp. 329–352

Cho, D. (2007) “The Role of High School Performance in Explaining Women’s Rising College Enrollment” *Economics of Education Review,* Vol. 26, pp. 450–462

Dale, S.B. and Krueger, A.B. (2002) “Estimating the Payoff to Attending A More Selective College: An Application of Selection on Observables and Unobservables” *Quarterly Journal of Economics*, Vol. 107, No. 4, pp. 1491-1527

Dee,T.S. (2004) “Are There Civic Returns to Education?” *Journal of Public Economics*, Vol. 88, pp. 1697–1720

Ehrenberg, R.S. and Smith, C. L. (2004) “Analyzing the Success of Student Transitions from 2- to 4-year Institutions within a State” *Economics of Education Review*, Vol. 23, pp. 11–28

Frenette, M. and Coulombe, S. (2007) "Has Higher Education among Young Women Substantially Reduced the Gender Gap in Employment and Earnings?" *Statistics Canada Research Paper, 11F0019 No. 301*

Gonzales, A. and Hilmer, M.J (2006) "The Role of 2-year Colleges in the Improving Situation of Hispanic Postsecondary Education" *Economics of Education Review,* Vol. 25, pp. 249–257

Grubb, W.N. (2002) "Learning and Earning in the middle, part II: State and Local studies of Pre-baccalaureate Education" *Economics of Education Review*, Vol. 21, pp. 401–414

Hanushek, E.A. and Raymond, M.E. (2004) "The Effect of School Accountability Systems on the Level and Distribution of Student Achievement" *Journal of the European Economic Association*, Vol. 2, No. 2-3, pp. 406-415

Hanushek, E. A. and Wößmann, L. (2007) "The Role of Education Quality in Economic Growth" *World Bank Policy Research Working Paper 4122*

Jacob, B. A. (2005) "Accountability, Incentives and Behavior: the Impact of High-stakes Testing in the Chicago Public Schools" *Journal of Public Economics*, Vol. 89, pp. 761–796

Kane, T. J. and Staiger, D. (2002) **"**Volatility in School Test Scores: Implications for Test-Based Accountability Systems" *Brookings Papers on Education Policy*, pp. 235-283

Kane, T.J. and Rouse, C.E. (1995) "Labor-Market Returns to Two- and Four-Year College" *The American Economic Review*, Vol. 85, No. 3, pp. 600-614

Katz, L.F. and Murphy, K.M. (1992) "Changes in Relative Wages, 1963-1987: Supply and Demand Factors**"** *The Quarterly Journal of Economics*, Vol. 107, No. 1, pp. 35 – 78

Leigh, D.E. and Gill, A.M. (2004) "The effect of community colleges on changing students' educational aspirations" *Economics of Education Review*, Vol. 23, pp. 95–102

Lofstrom, M. (2007) "Why Are Hispanic and African-American Dropout Rates So High?" *IZA Discussion Paper No. 3265*

Long, J.S. and Freese, J. (2003) Regression Models for Categorical Dependent Variables Using Stata, Stata Press, College Station TX

Loury, L.D. and Garman, D. (1995) "College Selectivity and Earnings" *Journal of Labor Economics*, Vol. 13, No.2, pp. 289 - 308

Murnane, R.J. , Willett, J.B. and Levy, F. (1995) "The Growing Importance of Cognitive Skills in Wage Determination" *The Review of Economics and Statistics*, Vol. 77, No. 2, pp. 251-266

Murnane, R.J., Willett, J.B. , Braatz, M.J. and Duhaldeborde, Y. (2001) "Do different dimensions of male high school students' skills predict labor market success a decade later? Evidence from the NLSY" *Economics of Education Review*, Vol. 20, pp. 311–320

Pennington, H. (2003) "Accelerating Advancement in School and Work" *Brookings Papers on Education Policy*, pp. 339 – 363

Person, A.E. and Rosenbaum, J.E. (2006) "Educational outcomes of labor-market linking and job placement for students at public and private 2-year colleges" *Economics of Education Review*, Vol. 25, pp. 412–429

Prescott, B. et al (2008) "Knocking at the College Door: Projections of High School Graduates by State and Race/Ethnicity 1992 – 2022" Western Interstate Commission for Higher Education.

Roderick, M. and Engel, M. (2001) "The Grasshopper and the Ant: Motivational Responses of Low-Achieving Students to High-Stakes Testing" Educational Evaluation and Policy Analysis, Vol. 23, No. 3, pp. 197-227

Rose, H. (2006) "Do Gains in Test Scores Explain Labor Market Outcomes?" *Economics of Education Review*, Vol. 25, pp. 430–446

Stratton, L.S. and O'Toole, D.M. and Wetzel, D.N. (2005) "A Multinomial Logit Model of College Stopout and Dropout Behavior" *IZA Discussion Paper No. 1634*

Taber, C.R. (2001) "The Rising College Premium in the Eighties: Return to College or Return to Unobserved Ability?" *Review of Economic Studies*, Vol. 68, No. 3 , pp. 665-691